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GETTING BETTER WITH AGE

Military Service and Men's Health Trajectories in Later Life

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Objectives. This study examines differences in the relationship between veteran status and men's trajectories of health conditions, activities of daily living limitations, and self-rated health.

Methods. We use data on 12,631 men drawn from the 1992–2006 waves of the Health and Retirement Study to estimate growth curve models that examine differences in health trajectories between nonveterans and veterans, veterans with and without wartime service, and war service veterans who served during World War II, Korea, Vietnam, and multiple wars.

Results. The results indicate that veterans have better health at the mean age of 66.2 years, but experience greater age-related changes in health than nonveterans. Similarly, men who served during wartime have better health at the mean age, but more age-related changes in health than men who did not serve during wartime. Among war veterans, Vietnam veterans are in poorer health at the mean age, but they experience less substantial age-related health changes than men who served during previous wars.

Discussion. Although veterans experience better health relative to nonveterans around retirement age, they have poorer health than nonveterans among the oldest old. These findings inform our understanding of the veteran–nonveteran health-mortality paradox found in previous research and suggest a health crossover among veterans and nonveterans in later life.

Key Words: Growth curve models—Health—Military service—Veterans.

PARTICIPATION in the military is an often overlooked early-adulthood experience that has the potential to shape a range of later-life health and health-related outcomes (Elder, 1986, 1987; London & Wilmoth, 2006). During the past 25 years, a growing body of research has demonstrated that the U.S. military is a critical social institution that can reshape educational, occupational, income, marital/family, health, and other life course trajectories and outcomes (MacLean & Elder, 2007; Modell & Haggerty, 1991; Settersten, 2006) and that the potential of the military to transform lives varies across individual characteristics, the timing of military service in the life course, service experiences, and historical periods (Angrist, 1990; Angrist & Krueger, 1994; Teachman, 2004; Teachman & Call, 1996).

The extant literature on military service and the life course has specifically and primarily addressed the negative impact of military service during World War II (WWII) on the health of men in the general population. This literature indicates that men who entered the military late were more likely to experience health declines throughout life (Elder, Shanahan & Clipp, 1994); exposure to combat predicted physical decline and death during the 15-year post-war interval from 1945 to 1960 (Elder, Shanahan, & Clipp, 1997); overseas active duty, service in the Pacific arena, and combat exposure were related to an increased mortality risk through 2000 (Elder, Clipp, Brown, Martin & Friedman, 2009); and military service caused an increase in work-limiting disabilities for men between the ages of 40 and 60 years and raised the premature death rate between the ages of 45 and 72 years (Bedard & Deschênes, 2006). Using data from the Health and Retirement Study (HRS), London and Wilmoth (2006) report that male veterans have similar or higher mortality in later life than nonveterans, although military service offsets some of the mortality disadvantage experienced by Black men. One recent study indicates that Vietnam veterans had more activity limitations and worse self-rated health than nonveterans, and that, as they aged, functioning and health deteriorated much more rapidly among veterans than among nonveterans (Dobkin & Shabani, 2009).

There is also a substantial literature on the physical health of veterans that suggests that veterans are in poorer health and have more functional limitations and disabilities than nonveterans (Aldwin, Levenson, & Spiro, 1994; Beebe, 1975; Centers for Disease Control, 1998; Keehn, 1980; Schnurr, Spiro, & Paris, 2000). Although this literature provides important data on the health of veterans, it often does not directly examine differences between veterans and nonveterans, compare veterans with and without wartime service, or attempt to determine the extent to which service during particular wars has different effects on later-life health.

This is problematic given that a large percentage of the older male population in the United States served in the military, often during periods of war. In 2000, almost 9.5 million men aged 65 years and older were veterans, which represents nearly 65% of men in this age group (Federal Interagency Forum on Aging-Related Statistics, 2005). Given that military service is a "hidden variable" in our understanding of aging (Elder & Clipp, 1988; Settersten,

2006; Spiro, Schnurr, & Aldwin, 1994), there is a need for additional research on the effects of veteran status on later-life outcomes. In particular, health research is needed that includes cohorts who came of age during and after WWII, and makes direct comparisons between veterans and nonveterans, between veterans with and without wartime service, and between war veterans who served in different historical periods.

In this article, we address the following research questions: (a) Do veterans have different levels and trajectories of health in later life than nonveterans? (b) Among veterans, do those who served during wartime have poorer health outcomes in later life than those who did not serve during wartime? and (c) Among war service veterans, do later-life health trajectories vary across men who served during different wars? We use data from the HRS to estimate growth curve models that test for differences at the mean age of 66.2 years and differing trajectories in the number of health conditions, activities of daily living (ADL) limitations, and self-rated health among men who were born prior to 1955 and came of age from WW II through the Vietnam War. We note that our analyses do not address the experiences of younger cohorts who served after 1973, when the military became an "All-Volunteer Force" and military service became a less normative part of early adulthood.

Linkages between Military Service and Health Outcomes

Military Service and Positive Health Outcomes.—There are a number of mechanisms through which military service in early adulthood could have direct effects on later-life health outcomes. Selection into military service and some effects of military service on subsequent life course outcomes could be associated with more positive later-life health trajectories. Veterans may be in better health than nonveterans, at least in earlier periods of the life course, because of pre-induction screenings that lead to the selection of healthier persons for service (Sackett & Mayer, 2006). In times of war, active duty personnel are additionally screened for psychological and physical combat readiness, which could contribute to what has been termed a "healthy warrior" effect. The intense physical training and activity required of military personnel is likely to have health benefits and may encourage life-long participation in physical activity. In addition, military service can also be a turning point in the life course, particularly for individuals from disadvantaged socioeconomic backgrounds, because it "knifes off" prior negative influences and creates a "bridging environment" that provides access to educational, training, and health care resources (Bound & Turner, 2002; Elder, 1986, 1987; MacLean, 2005; Sampson & Laub, 1996).

The education, training, and health care resources to which veterans have access, as well as other benefits made available to them through the Veteran's Administration, can affect a range of health-related outcomes over the life course. For example, military service can improve occupational outcomes and earnings (Angrist, 1990; Angrist & Krueger, 1994; Sampson & Laub, 1996; Teachman & Tedrow, 2004; Xie, 1992) and positively affect marriage and family integration (Call & Teachman, 1996; Laub & Sampson, 2003; Pavalko & Elder, 1990). However, these relationships vary by historical period of service, pre-service characteristics, and aspects of military service itself, such as rank and exposure to combat.

Military Service and Negative Health Outcomes.—Considerable research documents that military service-related injury and exposure to conditions that threaten immediate and long-term health are likely to have substantial negative influences on health over the life course. Service-related factors that should negatively impact health outcomes include training accidents and over-training injuries, hazardous work assignments, deployment to locales with infectious disease conditions that are detrimental to health, financial strains and other stressors related to separation from family and work, the distribution of subsidized tobacco products by the military, and placement in environments that are conducive to substance use or heavy drinking (Bedard & Deschênes, 2006; Clipp & Elder, 1996; Elder & Clipp, 1988, 1989; Elder et al., 2009). In addition, wartime service often involves combat exposure, which increases the risk of short-term injury and long-term disability (Elder et al., 1997), physical and mental health problems (Elder et al., 2009; Vogt, King, King, Savarese, & Suvak, 2004), and later-life mortality (Elder et al., 2009). Thus, wartime service should have a more negative impact on later-life health than non-war service. This should be particularly true among veterans who served during the Vietnam War, which, compared with previous wars, involved more draftees, exposed service members to a range of social and environmental conditions that can undermine health, was less popular, and was more difficult in terms of post-service social reintegration (Frey-Wouters and Laufer, 1986; Kulka et al., 1990).

Hypotheses.—When trying to determine the relationship between military service and later-life health, it is essential to take into account the interplay of the historical experiences of the cohorts under investigation, the potential direct and indirect and positive and negative influences of military service on health, and both early-life circumstances and mid- to late-life characteristics. Although previous research suggests military service could be positively or negatively related to later-life health status and health trajectories, we expect that military service will be negatively related to later-life health, controlling for early-life circumstances and mid- to late-life characteristics that account for the factors that most likely contribute to the positive relationship between military service and later-life health. In part, this prediction arises from earlier findings regarding increased mortality among older veterans (London & Wilmoth, 2006). In addition,

given the heterogeneity that exists among veterans, we expect that serving during war time—particularly during the Vietnam War—will be more detrimental to later-life health than non-war service. Specifically, in the age range included in the HRS, we hypothesize:

(1) Veterans will have poorer health at the mean age and greater age-related changes in health than nonveterans.
(2) Among veterans, men who served during wartime will have poorer health at the mean age and more age-related changes in health than men who did not serve during wartime.
(3) Among veterans who served during wartime, men who served during Vietnam will have poorer health at the mean age and steeper age-related changes in health than men who served during previous wars.

METHODS

Sample

This study uses data from the 1992 to 2006 longitudinal HRS and the RAND HRS file. The analytic sample for this study includes 12,631 men who were born between 1890 and 1953. During the 14 years of the study, these men contribute 56,780 observations to the person-period file that is used to estimate the growth curve models. Only the observations from years in which the participant was an HRS age-eligible respondent (i.e., age 51 years or older) are included in the person-period file. The analysis does not include women because only 135 (<1%) of the 14,491 women in the HRS served in the military.

Measures

Dependent Variables.—We examine three health outcomes: number of health conditions, ADL limitations, and self-rated health. Each is a constructed variable in the RAND HRS file. Number of health conditions and self-rated health are available from 1992 through 2006, whereas the ADL limitation scale is based on data from 1993/1994 through 2006 due to changes in the measures between the first and subsequent waves. Respondents are asked if they ever had the following conditions: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. Responses are coded dichotomously (*yes* = 1) and summed to indicate the number of health conditions that each respondent reports, which ranges from 0 to 8. Respondents are also asked whether they had any difficulty with the following: bathing, eating, dressing, walking across a room, and getting in or out of bed. Responses are coded dichotomously (*difficulty* = 1) and summed to create an indicator of ADL limitations that ranges from 0 to 5. Self-rated health is a five-category, ordinal measure of *excellent*,

very good, *good*, *fair*, or *poor health*; we reverse-coded the scale such that higher numbers indicate better self-rated health. Although these three health measures are conceptually and statistically related to one another—Pearson's $r = 0.27$ for conditions and ADL limitations, -0.47 for conditions and self-rated health, and -0.35 for ADL limitations and self-rated health—it is beyond the scope of this article to document how the relationships between these three distinguishable domains of health varies by veteran status.

Military Service Variables.—The retrospective report of service in the military identifies men who have experienced "active military service" not including service in the military reserves. Respondents who report military service are asked follow-up questions about start and stop dates. We assumed that service was continuous and used these dates to determine service during WWII (1941–1946), Korea (1950–1955), and/or Vietnam (1964–1975). These start and stop dates for the wars are based on the years used by the Veterans Administration to determine eligibility for wartime service benefits. They include periods of combat as well as occupation. We then constructed three military service measures: veteran status (*yes* = 1), wartime service (*yes* = 1), and period of service (*WWII*, *Korea*, *Vietnam*, *multiple wars*, or *none*). Overall, in the analytic sample, 55% of men are veterans. Among veterans, 81% served during wartime. Among wartime veterans, 36% served only during WWII, 34% only during the Korean War, 24% only during the Vietnam War, and 6% served during multiple wars (the majority of whom served during all three wars).

We use the veteran status and wartime service variables to identify the appropriate subpopulations of veterans and wartime veterans for specific analyses. Our modeling approach allows us to systematically take into account the unique characteristics and experiences of veterans who served during different time periods. A simple comparison of veterans and nonveterans confounds differences among veterans that are related to wartime service; similarly a comparison of war service veterans and non-war service veterans masks differences across those who served during different wars. In addition, by focusing only on veterans in some analyses, we minimize concerns about selection into military service because everyone in these subsample analyses met the criteria for service that were in place at the time of enlistment or conscription. Similarly, restricting the period of service analysis to wartime veterans minimizes the impact of issues related to selection into wartime service and variation in the risk of surviving active duty between those who did and did not serve during war.

Control and Mediator Variables.—The analysis includes several control and mediator variables that are related to later-life health. The first set of control variables are retrospectively reported early-life characteristics that occurred

prior to military service. These measures are indicators of relative (dis)advantage: race/ethnicity, mother's education, father's education, father's occupation, family socioeconomic status (SES), and early-life health. Race/ethnicity includes *non-Hispanic White* (reference), *non-Hispanic Black*, *non-Hispanic other race*, and *Hispanic* (of any race). Mother's education and father's education were dichotomously coded (*<8 years* = 1; *≥8 years* = 0). Father's occupation (*unskilled manual* = 1, *non-manual, skilled, and professional* = 0) and family SES (*poor* = 1, *not poor* = 0) were also dichotomously coded. Persons who were missing on any of these four variables were assigned to the zero category for that variable, which is a conservative approach because that category represents greater advantage and misclassification would bias toward the null. We summed mother's education, father's education, father's occupation, and family SES, and then divided by the number of items answered to create an early-life disadvantage scale that ranges from 0 to 1, with higher values indicating more disadvantage. Given the relatively large proportion of respondents who had missing values on at least one early-life disadvantage item due to father absence or attrition prior to the 1998 survey when these questions were first asked, we include a variable in the analysis that is equal to one for all individuals for whom at least one of these variables was missing and set to zero. Additionally, the analysis includes a measure of health to age 16 that includes the following categories: *excellent*, *very good or good health* (reference category), *fair* or *poor health*, and *missing*.

The other variables, which reference mid- to late-life characteristics that may mediate the relationship between military service and later-life health, are measured many years after military service has ended. All of these mid- to late-life variables, except education, are time-varying across the 14-year study period. Marital status includes four categories: *married* (reference), *never married, divorced/separated*, and *widowed*. Education is measured at entry into the HRS and includes *high school or less* (reference), *college*, and *graduate school*. Household income is measured in dollars. Labor force status is recoded as a binary variable (*in the labor force* = 1). The models also include dichotomous measures of ever smoking (*yes* = 1) and currently drinks alcohol (yes = 1). Finally, body mass index (BMI) is used to identify men who are *underweight* (BMI < 18.5), *normal weight* (reference category, 18.5 ≤ BMI < 24.9), and *overweight* (BMI ≥ 25.0).

Sample Description

In a supplemental analysis, we examined the descriptive characteristics of the overall sample and veteran subsamples. The results (available from the first author upon request) document differences between veterans and nonveterans, veterans with and without wartime service, and wartime veterans who served during different historical periods. For example, relative to nonveterans, veterans are

more likely to be White and less likely to come from disadvantaged family backgrounds, which in part reflects the fact that a high proportion of veterans in the HRS come from older cohorts and served in historical periods in which African Americans and Latinos were less likely to be in the military (Lutz, 2008). Consistent with health selection processes for entering the military, veterans are also less likely to report poor early-life health. Compared with nonveterans, veterans are more likely to be college graduates, to be married, to have ever smoked, and to currently drink alcohol, but are less likely to be in the labor force and have slightly lower mean household incomes.

Among veterans, those who served during wartime are significantly older than those who did not serve during wartime and report better early-life health. Additionally, they are less likely to be in the labor force, to be married, to currently drink alcohol, and to be overweight or obese, but they are slightly more likely to have ever smoked. They also have lower mean household incomes. These characteristics of veterans are being driven, in large part, by the WWII veterans who represent the largest share of veterans in this sample.

Among wartime veterans, compared with those who served during the Korean and Vietnam Wars, those who served during WWII are the oldest, have lower levels of education, are more likely to have experienced early-life disadvantage, and have the lowest household incomes. They are also the most likely to be non-Hispanic White and to have ever smoked, whereas they are the least likely to be in the labor force, to be married, to currently drink alcohol, and to be overweight or obese.

Analysis Plan

The multivariate analysis takes these differences across groups into account by estimating conditional growth curve models using the PROC MIXED procedure in SAS. A person-period file is used to estimate growth curve models for the overall sample, the veteran subsample, and the war service veteran subsample. In all of these models, time is defined in terms of chronological age (as opposed to study duration) because we are interested in modeling age-related changes in health. The grand mean for all sample members, which is equal to 66.2 years, is used to center age. It is noteworthy that the grand mean, which will be used to estimate intercept effects, is close to the age of 70 years when veterans from different war periods can be directly compared at the same chronological age. This unique feature of the analysis enables us to make meaningful comparisons across veterans who served in WWII, Korea, and Vietnam. Separate models are estimated for number of conditions, ADL limitations, and self-rated health; observations with invalid responses on a particular health variable are dropped from the analysis of that dependent variable, which results in different sample sizes across the three health outcomes. All models include age and age squared to test for nonlinearities in the relationships between age and each health outcome and to

Table 1. Mean Number of Health Conditions, ADL Limitations, and Self-Rated Health by Veteran Status

	Number of conditions		ADL limitations		Self-rated health	
	Mean	Number of obs.	Mean	Number of obs.	Mean	Number of obs.
Total sample						
Nonveteran (*N* = 5,975)	1.59	25,576	0.29	23,414	3.10	25,559
Veteran (*N* = 6,650)	1.74[a]	31,204	0.23[a]	28,727	3.26[a]	31,194
Veterans only						
Non-war service (*N* = 994)	1.50	5,816	0.16	5,013	3.43	5,813
War service (*N* = 5,656)	1.80[b]	25,388	0.25[b]	23,714	3.22[b]	25,381
War service veterans only						
WWII (*N* = 2,261)	2.08[c,d]	9,139	0.35[c,d,e]	9,131	3.01[c,d,e]	9,135
Korea (*N* = 1,615)	1.77[c,f,g]	8,640	0.20[c,f]	7,531	3.26[c,f]	8,638
Vietnam (*N* = 1,452)	1.37[d,f,h]	6,034	0.15[d,f,h]	5,607	3.50[d,f,h]	6,033
Multiple wars (*N* = 328)	1.99[g,h]	1,575	0.24[e,h]	1,445	3.23[e,h]	1,575

Notes: Data are unweighted. *N* = number of participants. Number of obs. = observations in the analytic person-period file. ADL = activities of daily living.

[a] Significant difference between veterans and nonveterans, $p < .05$.

[b] Significant difference between war service veterans and non-war service veterans, $p < .05$.

[c] Significant difference between WWII and Korea veterans, $p < .05$.

[d] Significant difference between WWII and Vietnam veterans, $p < .05$.

[e] Significant difference between WWII and multiple war veterans, $p < .05$.

[f] Significant difference between Korea and Vietnam veterans, $p < .05$.

[g] Significant difference between Korea and multiple war veterans, $p < .05$.

[h] Significant difference between Vietnam and multiple war veterans, $p < .05$.

account for potential nonlinearity in the slopes that estimate age-related changes in health in relation to the military service variables. The models also control for the early-life and mid- to late-life characteristics, although the coefficients for those controls are not shown (available upon request).

We focus on interpreting the coefficients for the effect of veteran status on the levels of the number of health conditions, ADL limitations, and self-rated health dependent variables at the mean age of 66.2 years and the effect of veteran status on the change in each health outcome over time. Positive coefficients indicate that men with a given military service characteristic have a higher number of health conditions and ADL limitations and better self-rated health than those without that characteristic, whereas negative coefficients indicate the opposite.

We also present figures showing the predicted number of health conditions, ADL limitations, and self-rated health at ages 50 through 90 by veteran status for the full sample, the veteran subsample, and the war service veteran subsample, respectively. These predicted values represent men of the specified age who reported good early-life health; are non-Hispanic White, married, high school graduates, out of the labor force, nonsmokers, nondrinkers, and normal weight; and have mean early-life disadvantage scores and mean household incomes. It is important to note that these values are model-based predictions generated from sample observations that span up to 14 years of mid- to late life. In the analysis of the war service veterans, there are a limited number of observations at some ages because the group was mostly past the younger ages upon entry into the study (e.g., WWII veterans) or the group was mostly too young to have a substantial number of individuals who aged into the oldest age ranges during the period of observation (e.g., Vietnam War veterans). Given this, the figures for the war service

veteran subsample present trajectories over the age ranges that capture the majority of the observations. Five-year intervals that contain less than 5% of the observations for a given group are not included in the figures.

RESULTS

Descriptive Results

As shown in Table 1, veterans have significantly more health conditions, but fewer ADL limitations and better self-rated health, than nonveterans. Among veterans, those with war service have significantly more conditions, more ADL limitations, and lower self-rated health than those without wartime service. Among the war service veterans, those who served during Vietnam are faring the best: they have a significantly lower number of conditions, fewer ADL limitations, and better self-rated health than those who served during WWII, Korea, or multiple wars. Those who served during WWII have the poorest health, with more conditions, higher ADL limitations, and lower self-rated health than the other war veteran groups. These bivariate differences may be due to variation across the groups in age and early-life and mid- to late-life characteristics, which are taken into account in the multivariate models shown in Table 2.

Multivariate Trajectory Analysis

Table 2 presents several growth curve models predicting number of health conditions (Column 1), ADL limitations (Column 2), and self-rated health (Column 3). Separate panels are shown for the effect of veteran status in the full sample, war service among the subsample of veterans, and time period of service among the subsample of war service veterans. All models are fully specified, controlling for all

Table 2. Growth Curve Models Predicting Physical Health Trajectories

Fixed effects	Number of conditions	ADL limitations	Self-rated health
Total sample			
Intercept	1.5861*** (0.038)	0.2050*** (0.018)	3.1563*** (0.026)
Veteran	−0.0095 (0.029)	−0.0245 (0.013)	0.1362*** (0.019)
Age	0.0938*** (0.001)	0.0100*** (0.001)	−0.0164*** (0.001)
Age^2	0.0017*** (0.000)	0.0013*** (0.000)	−0.0000 (0.000)
Age × veteran	0.0088*** (0.002)	−0.0035** (0.001)	−0.0067*** (0.001)
Age^2 × veteran	0.0003** (0.000)	0.0001 (0.000)	−0.0006*** (0.000)
Goodness of fit			
Deviance	122435.9	103091.2	145827.8
AIC	122491.9	103147.2	145883.8
BIC	122700.3	103355.6	146092.3
Number of observations	56,780	52,141	56,753
Number of cases	12,625	12,625	12,625
Veterans only			
Intercept	1.9451*** (0.066)	0.2428*** (0.028)	3.2546*** (0.044)
War service	−0.5372*** (0.052)	−0.0809*** (0.020)	0.0888** (0.032)
Age	0.1213*** (0.004)	0.0075** (0.002)	−0.0197*** (0.003)
Age^2	0.0017*** (0.000)	0.0004 (0.000)	−0.0005* (0.000)
Age × war service	−0.0232*** (0.004)	−0.0001 (0.003)	−0.0052 (0.003)
Age^2 × war service	−0.0004 (0.000)	0.0011*** (0.000)	−0.0012*** (0.000)
Goodness of fit			
Deviance	66903.2	52958.1	79110.9
AIC	66959.2	53014.1	79166.9
BIC	67149.6	53204.5	79357.4
Number of observations	31,204	28,727	31,194
Number of cases	6,650	6,650	6,650
War service veterans only			
Intercept	0.5035*** (0.067)	0.2344*** (0.042)	3.5444*** (0.061)
Korea	1.1079*** (0.056)	−0.0189 (0.037)	−0.2786*** (0.054)
Vietnam	1.8470*** (0.067)	−0.0191 (0.044)	−0.4257*** (0.063)
Multiple wars	0.9724*** (0.089)	−0.0657 (0.048)	−0.1923** (0.074)
Age	0.1240*** (0.006)	−0.0232*** (0.006)	−0.0351*** (0.008)
Age^2	0.0008** (0.000)	0.0030*** (0.000)	−0.0007 (0.000)
Age × Korea	−0.0150* (0.007)	0.0306*** (0.006)	0.0107 (0.008)
Age^2 × Korea	0.0018*** (0.000)	−0.0019*** (0.000)	−0.0001 (0.001)
Age × Vietnam	−0.0032 (0.009)	0.0174* (0.008)	0.0156 (0.010)
Age^2 × Vietnam	−0.00002 (0.000)	−0.0032*** (0.000)	0.0012* (0.000)
Age × multiple wars	−0.0325*** (0.009)	0.0192* (0.008)	0.0031 (0.009)
Age^2 × multiple wars	0.0017*** (0.000)	−0.0011* (0.000)	−0.0000 (0.000)
Goodness of fit			
Deviance	54355.0	45086.1	64801.9
AIC	54423.0	45154.1	64869.9
BIC	54648.8	45379.9	65095.6
Number of observations	25,388	2,3714	25,381
Number of cases	5,656	5,656	5,656

Notes: Significance levels: *$p < .05$; **$p < .01$; ***$p < .001$. All models control for race/ethnicity, early-life socioeconomic disadvantage, early-life health, education, income, labor force participation, marital status, current alcohol consumption, smoking, and body mass index. ADL = activities of daily living.

AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

of the early-life and mid- to late-life characteristics described in the *Methods* section. In order to gauge the magnitude of the expected, non-linear age-related changes in health across these groups, we also present the predicted age-related health trajectories in Figures 1, 2, and 3.

Total Sample.—Results presented in the top panel of Table 2 indicate that veterans have the same number of health conditions, similar ADL limitations, and significantly better self-rated health than nonveterans at the mean age, but veterans acquire more health conditions and have steeper declines in self-rated health as they age. Despite this, veter-

ans appear to have slower age-related increases in ADL limitations than nonveterans.

Figure 1a, b, and c present the predicted values for veterans and nonveterans based on the model estimated with the total sample. As shown in Figure 1a, veterans and nonveterans have a similar number of conditions at age 50, but by age 90, nonveterans have slightly fewer health conditions than veterans. In contrast, Figure 1b indicates that the statistically significant differences in ADL limitations between veterans and nonveterans shown in Table 2 are substantively modest. Overall, veterans and nonveterans have very similar age-related ADL limitation trajectories. Figure 1c demonstrates that nonveterans
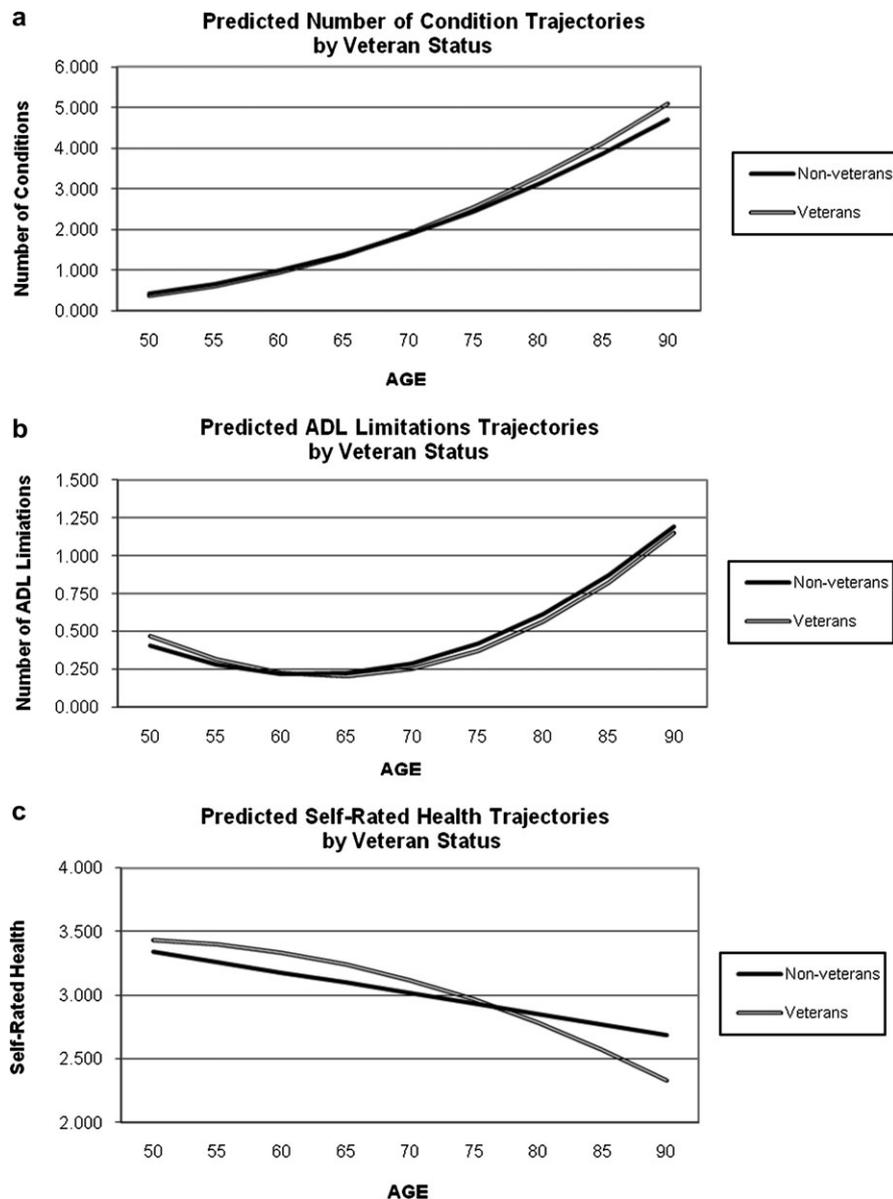
Figure 1. (a) Predicted number of condition trajectories by veteran status. (b) Predicted ADL limitations trajectories by veteran status. (c) Predicted self-rated health trajectories by veteran status. Predicted values represent men who report good early-life health; are non-Hispanic White, married, high school graduates, out of the labor force, nonsmokers, nondrinker, normal weight; and have mean early-life disadvantage scores and mean household incomes.

have worse self-rated health at age 50 than veterans, but after age 80, they have better self-rated health than veterans. Thus, in the full sample, we see modest divergence in the number of conditions reported by veterans and nonveterans, with veterans reporting more conditions at older ages, as well as a veteran–nonveteran crossover in self-rated health.

Veteran Subsample.—Among the subsample of veterans (middle panel, Table 2), compared with those without war service, those with war service have fewer health conditions, fewer ADL limitations, and better self-rated health at the mean age. With age, war service veterans have less steep increases in number of conditions, but more rapid age-related

increases in ADL limitations and greater age-related decreases in self-rated health.

Figures 2a, b, and c present the predicted values for non-war and wartime veterans. Compared with non-war veterans, wartime veterans have a similar level of health conditions, ADL limitations, and self-rated health in middle age and early later life. Although wartime veterans have slightly lower age-related increases in number of conditions (Figure 2a), they exhibit greater age-related increases in ADL limitations (Figure 2b) and more substantial age-related decreases in self-rated health than non-war veterans (Figure 2c). Consequently, among the oldest old, compared with non-war veterans, wartime veterans have a higher level
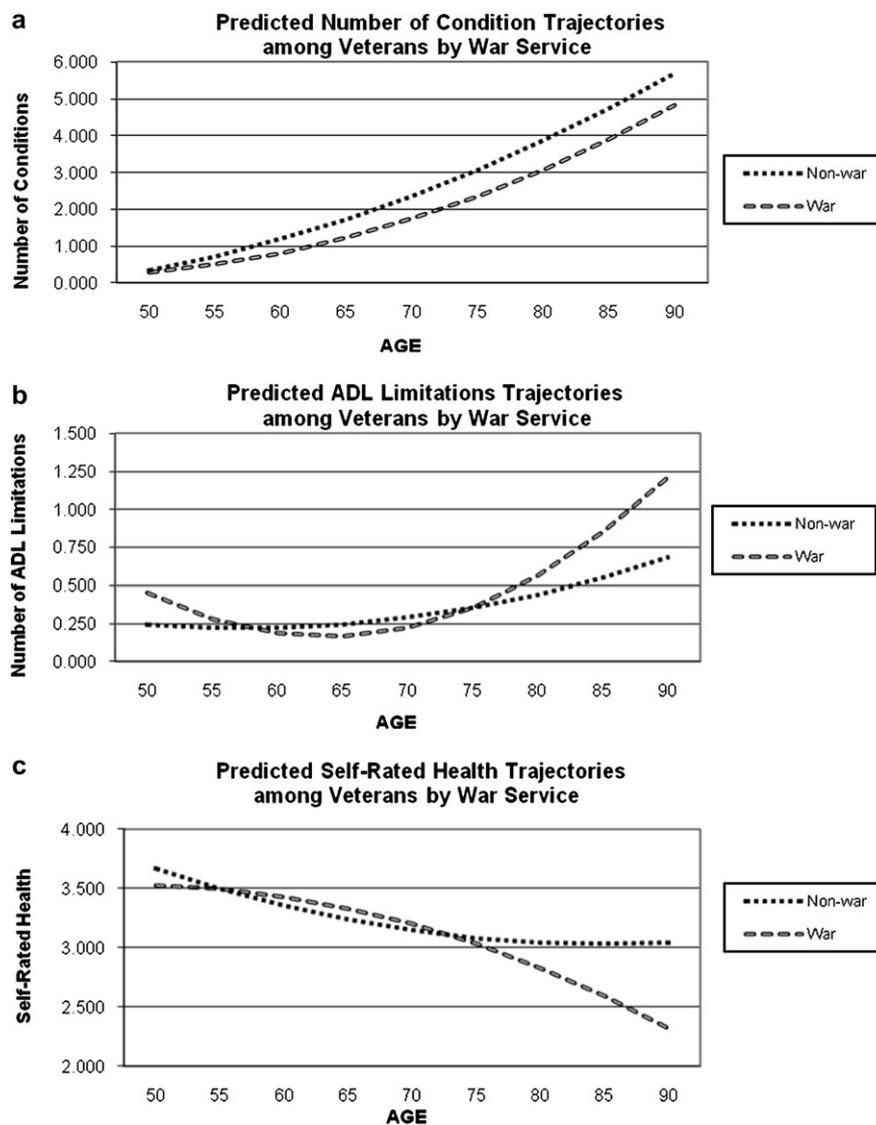
Figure 2. (a) Predicted number of condition trajectories among veterans by war service. (b) Predicted ADL limitations trajectories among veterans by war service. (c) Predicted self-rated health trajectories among veterans by war service. Predicted values represent men who report good early-life health; are non-Hispanic White, married, high school graduates, out of the labor force, nonsmokers, nondrinker, normal weight; and have mean early-life disadvantage scores and mean household incomes.

of ADL limitations and a lower level of self-rated health. This suggests that the veteran–nonveteran crossover in self-rated health observed in the full sample (Figure 1c) is being driven by more rapid declines in self-rated health among wartime veterans, who represent the majority of veterans.

War Service Veteran Subsample.—Among war service veterans (bottom panel, Table 2), compared with those who served in WWII, those who served in Korea, Vietnam, and multiple wars have more health conditions and lower self-rated health at the mean age. The age-related health trajectories are significantly different across veterans who served in different wars. Compared with WWII veterans, Korean War and multiple war veterans have a flatter slope at the mean age, but are experiencing greater age-related increases in number

of conditions. However, Korean and multiple war veterans have a steeper slope at the mean age and experience smaller age-related increases in ADL limitations than WWII veterans. Vietnam War veterans have a larger slope at the mean age, but fewer age-related increases in ADL limitations and less steep declines in self-rated health compared with WWII veterans.

Figures 3a, b, and c show the predicted values for wartime veterans who served in WWII, the Korean War, the Vietnam War, and multiple wars. Figure 3a indicates that veterans of these wars are all experiencing substantial age-related increases in the number of health conditions they report. Age-related increases in ADL limitations (Figure 3b) and decreases in self-rated health (Figure 3c) are more pronounced among veterans of WWII, Korea,

a

Predicted Number of Condition Trajectories among War Service Veterans by Time Period Served

b

Predicted ADL Limitations Trajectories among War Service Veterans by Time Period Served

c

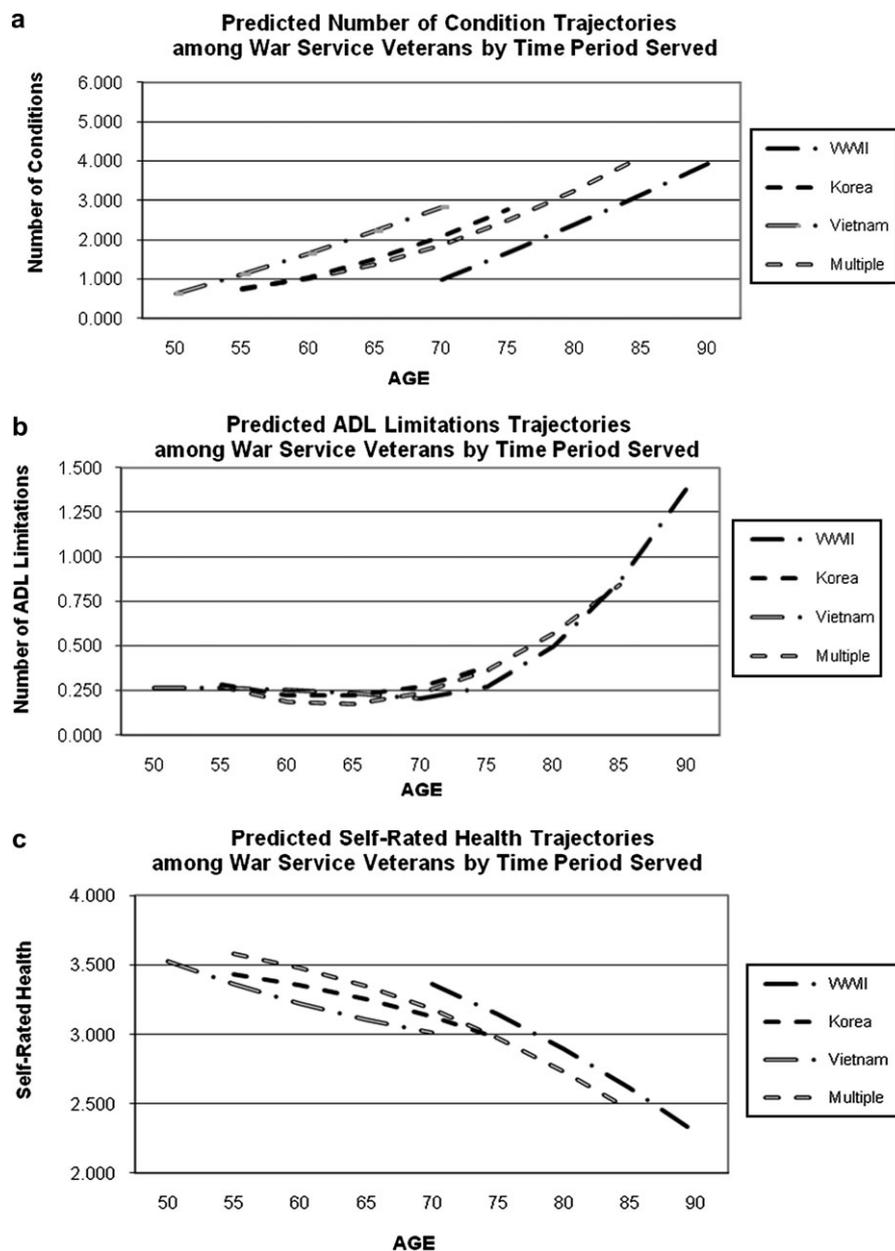### Predicted Self-Rated Health Trajectories among War Service Veterans by Time Period Served

Figure 3. (a) Predicted number of condition trajectories among war service veterans by time period served. (b) Predicted ADL trajectories among war service veterans by time period served. (c) Predicted self-rated health trajectories among war service veterans by time period served. Predicted values represent men who report good early-life health; are non-Hispanic White, married, high school graduates, out of the labor force, nonsmokers, nondrinker, normal weight; and have mean early-life disadvantage scores and mean household incomes. Percent of observations in each trajectory age range: WWII = 99%, Korea = 96%, Vietnam = 99%, multiple = 98%.

and multiple wars compared with the trajectories of Vietnam War veterans. Assuming that current, observed trajectories for the younger Vietnam War veterans continue, Vietnam War veterans can be expected to have a higher number of conditions, but a lower number of ADL limitations and better self-rated health, at very old ages compared with the current experiences of the veterans of other wars.

Covariate Effects.—Supplementary analyses indicate that the covariate effects (not shown) are consistent with the pre-

dictions of previous health research. For example, Blacks, those from disadvantaged childhood backgrounds, those with poor childhood health, those with lower education, and those who smoke have more conditions and ADL limitations and worse self-rated health. Additionally, they indicate that the veteran status coefficients do not change substantially when the early-life and mid-to-late life covariates are added to the model. There are two notable exceptions: the difference at the mean age in ADL limitations and self-rated health between veterans and nonveterans would be approximately twice as large if the early-life

factors that influence selection into military service were not taken into account. Thus, approximately half of the bivariate difference between veterans' and nonveterans' levels of ADL limitations and self-rated health at the mean age can be attributed to selection. Specifically, veterans are more likely to be White and to have good childhood health and less likely to be from disadvantaged backgrounds than nonveterans.

DISCUSSION

This research examines whether men's later-life health trajectories vary by veteran status. We consider whether observed differences in trajectories of health conditions, ADL limitations, and self-rated health vary between male veterans and nonveterans in the general population. Given that the veteran population is heterogeneous, we also examine differences in these outcomes between war service veterans and non-war service veterans, as well as across war veterans who served during WWII, the Korean War, the Vietnam War, and multiple wars.

The findings provide mixed support for the first hypothesis regarding differences between veterans and nonveterans in the general population. Contrary to our expectations, veterans had better health at the mean age of 66.2 years. However, consistent with our expectations, they did experience greater age-related changes in health than nonveterans. Similarly, in terms of the second hypothesis regarding the subsample of veterans, men who served during wartime had better health at the mean age, but more age-related changes in health, than men who did not serve during wartime. The findings also provide mixed support for the third hypothesis regarding poorer health among Vietnam War veterans. Among veterans who served during wartime, men who served during Vietnam were in poorer health at the mean age in terms of number of conditions and self-rated health, but they did not experience age-related changes in health that were steeper than men who served during previous wars. Overall, veterans seem to experience better health relative to nonveterans around retirement age, but decline more rapidly over time, such that veterans have poorer health than nonveterans among the oldest old. These trends are particularly noticeable among veterans with wartime service overall and veterans from WWII and Korea in particular.

Our findings are noteworthy given that previous research has suggested a veteran–nonveteran health-mortality paradox, in which veterans report better health, but are more likely to die over time (London & Wilmoth, 2006). This mirrors the well-documented gender health-mortality paradox (Oksuzyan, Juel, Vaupel, & Christensen, 2008) whereby men demonstrate better health and fewer disabilities than women, but are more likely than women to die over time. Our research contributes to the understanding of this veteran–nonveteran health-mortality paradox by suggesting that veterans have higher levels of health among the young–old, but experience steeper health declines and higher mortality as they age.

Furthermore, the results provide evidence of a crossover in veteran and nonveteran health trajectories, which seems to be driven by changes among wartime veterans. Overall, veterans have a lower predicted number of health conditions, and a higher predicted level of self-rated health, at age 50 than nonveterans. But, by age 75, veterans no longer have an advantage in number of conditions or self-rated health relative to nonveterans, and by age 90, the gap between veterans and nonveterans on these indicators has widened, with veterans in the disadvantaged position. While it has been suggested that a veteran–nonveteran mortality crossover exists at ages 70 and older (Liu, Engle, Kang, & Cowan, 2005), such a crossover has not been empirically demonstrated. Nonetheless, our findings related to a veteran–nonveteran health crossover are consistent with the higher mortality among veterans than nonveterans that is evident in the HRS (Liu et al., 2005; London & Wilmoth, 2006).

The steeper health declines found among veterans, which have also been reported among Vietnam-era veterans (Dobkin & Shabani, 2009), are likely to reflect real changes in the later-life health status of men who served during war. This exposure to war early in the life course is contributing to the observed higher mortality among veterans in later life. The higher mortality risk among veterans is concentrated among veterans who served in WWII and the Korean War, who represent a substantial proportion of the men who were analyzed in London and Wilmoth (2006) and, as previously noted, a large percentage of the older male population.

Although the present study is not able to fully determine the reasons for the observed health declines among wartime veterans overall, and WWII and Korean War veterans in particular, we are able to effectively control for a large range of potentially confounding variables that affect health, including early-life health and socioeconomic status and a range of mid- to late-life sociodemographic characteristics and health behaviors. The observed differences across men who served during different wars are most likely due to the complex, and often countervailing, impacts of early life military service on subsequent life course experiences. The military is an institution that has multiple domains of influence on individual lives that vary over historical time as the conditions of military service change. WWII veterans experienced a "citizen's military" in which service during early adulthood was prevalent among a broad cross-section of men. During the post-WWII period, the military retained a "citizen-solider" quality, although service became less normative. Therefore, veterans from the war and non-war eras included in this analysis experienced different induction conditions, rates of overseas deployment, exposure to combat, service-related life course disruption, and access to and use of veteran's benefits. The influences of these experiences combine in particular ways to generate variation in the effect of military service on health outcomes across veterans who served during different historical time periods.

Of the numerous differences across veterans in military service experiences, we think two are particularly salient in relation to later-life health trajectories. First, although not all wartime veterans were deployed overseas or experienced combat (e.g. 76% of those who served during WWII were deployed overseas, U.S. Census Bureau, 2004), wartime veterans are at a greater risk than non-war veterans of experiencing service-related disability, the effects of which are likely to accumulate over time and manifest most noticeably in later life. Second, the military facilitated the distribution of tobacco, particularly during WWII and the Korean War, which has been linked to poorer health and higher rates of lung cancer and heart disease among veterans (Bedard & Deschênes, 2006). Although this analysis controls for smoking, further study of veterans' smoking histories and their risk of lung cancer and heart disease might offer some additional insight into the causes of the health trajectories documented in this article. These experiences and others that vary systematically across veterans who served during different time periods should be explored in future research.

Our research, although offering new insights, is limited to some extent by the constraints of the available data, which restrict our capacity to fully examine the pathways through which military service might influence health in later life. For example, the data contain a limited number of measures of early-life circumstances that could have affected selection into the military, as well as later-life health. Also, the HRS does not contain detailed information about military service (such as exposure to combat, overseas deployment, branch of service, rank, training, and duties performed, or the use of various veteran's benefits after service was completed), which have been shown to be important in other studies of health or mortality (Elder et al., 2009). It is likely that age-related health changes among the subset of war service veterans who were deployed overseas and experienced combat are greater than those observed in this analysis, whereas service members who achieved higher ranks or spent careers in the military might have fewer changes in health relative to other veterans. In addition, the HRS does not contain a sufficient number of men or women who came of age after 1973 to allow for the examination of veterans from the "All Volunteer Force," who served during a time period when military service became a less normative part of early adulthood and career service became more common among those who did enlist. Additionally, it is important to acknowledge that part of the observed variation across men who served during different wars might be due to the age window of observation for the health trajectories in this analysis. The average age of the Vietnam War veterans is substantially lower than the WWII and Korean War veterans. It will be interesting to track these younger veterans as they age to confirm whether they are experiencing health trajectories that differ from those experienced by previous veteran cohorts. Finally, it must be acknowledged that the men in this analysis represent a select group who survived to

older ages. Thus, our findings are conditioned upon surviving to the age of inclusion in the HRS sample.

Although selective survival may be a concern in the present study, it is important to note that the potential influence of selective survival is not unique to our study. It plagues all studies that use samples like the HRS, which begin data collection in mid- to late life, to study variation in outcomes across groups with different mortality schedules. To date, this problem has been largely unaddressed due to the lack of statistical procedures for correcting the potential bias generated by this unobserved heterogeneity. Developing such procedures is an important direction for future research (Lopoo, Wing, & Wolf, forthcoming).

Despite these limitations, this article has many strengths, including its focus on multiple health outcomes; the distinctions made between veterans and nonveterans, veterans with and without wartime service, and veterans of different wars; and its use of controls for early-life characteristics and time-varying characteristics during the period of study. It provides detailed information about changes in men's health during a 14-year period in mid- to late life among individuals whose birth years span more than 70 years of American history and experiences include the three major military ventures of the mid-20th century: WWII, the Korean War, and the Vietnam War. As noted by George (2003, p. 161): "our understanding of the dynamics of social factors and health rests almost entirely on *short-term* longitudinal data . . . the number of studies (other than those examining the predictors of mortality) that include more than ten years of data are exceedingly small." Thus, by analyzing long-term longitudinal data, our findings advance scientific understandings of how early-life social and institutional factors shape health in later life, while also providing specific, new insights regarding how men's later-life health trajectories vary in relation to military service.

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