

Health, Aging, and the Post-Service Life Cycles of U.S. Veterans

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I. Introduction

Veterans constitute approximately 8 percent of the U.S. population, or roughly 23 million people (U.S. Census Bureau 2010). For the majority of these veterans, the period of military service is a relatively brief but important segment of the life course. The average length of service among respondents in the 2001 National Survey of Veterans was about 6.5 years, or a little over 10% of their roughly 61 years lived on average (MacLean and Edwards 2010). The majority of living veterans have served during periods of major warfare, while only approximately a quarter served during peacetime (U.S. Census Bureau 2010). In addition, thirty-nine percent of respondents to the 2001 National Survey of Veterans reported having served in a combat or war zone, while 36 percent reported exposure to dead, dying, or wounded people (Department of Veterans' Affairs 2002).

Exposure to the physical and psychological harms of combat is the clearest channel through which military service may harm physical and mental health. The ultimate shock to health, death itself, can occur as a result of combat or service-related accidents, and sometimes war-related deaths occur many years after the formal close of hostilities. But there are many other ways in which military service can affect health. More indirect channels include the development of healthy or unhealthy behaviors such as smoking that may arise either in response to the stresses of combat or the command structure, or more or less independently while the individual is engaged in military service. People face different risks of diseases and accidents when they are serving compared to those they face in their civilian lives. Yet the net effect of these changes in risks on health and mortality could be positive or negative depending on the level of hostilities. Military service may also affect health by independently affected by changing the life-cycle paths of earnings and wealth. Veterans' health may also be directly or indirectly

shaped by educational attainment, which is heavily subsidized for many although not all veterans. It may also affect health by means of its effects on family formation and quality. Many of these influences are likely to have lasting effects on health and well-being throughout the life cycle. But isolating the effects of military service per se on post-service health and other outcomes is, in general, a very challenging task.

According to previous research, veterans may have better or worse physical and mental health than non-veterans, as well as different rates of mortality, though these associations may stem not from service per se, but rather from selection into the armed forces and into military positions and experiences. In this chapter, we summarize and discuss the literature examining the health of aging veterans and the relationships between military service and later-life health and well-being. In section II, we outline the challenges to assessing whether and how military service affects health. In section III, we discuss some basic demographics of U.S. veterans, who are a diverse group especially along the dimension of birth year. In section IV, we discuss trends in the experiences of surviving veterans from a bird's eye perspective focusing on shifts in war and peace. Section V surveys the literature on the effects of military service on veterans' mortality and health. Section VI provides a summary, an outline for future research efforts, and some concluding remarks, and section VII provides some policy recommendations.

II. Challenges to assessing the effect of military service

In order to evaluate whether and how service affects the health of veterans, scholars and policy-makers must address the possibility that any differences we may observe in the health of veterans versus that of nonveterans could reflect other factors. If recruits have better or worse health than civilians before they serve, then the association between military service and

observed health in later life will be spurious unless we control for those preexisting conditions. Earlier researchers have argued that there is health selection into the military, leading people to enter the military at least partly on the basis of their pre-existing health. The armed forces have typically rejected recruits who have poor health, leading service-members to be more healthy than civilians.

In addition, the armed forces reject recruits who have other characteristics that are probably associated with or may be proxies for health. The services typically exclude people, for example, who are at the bottom of the distribution of what sociologists and economists call “ability,” meaning those who have the lowest cognitive test scores. People with low test scores also tend to have worse health than those with higher scores. At the top of the cognitive distribution, people have been less likely to join the military if they are more likely to go on to college. They have also been less likely to join the military if they come from families with high socioeconomic status. Research has also shown that more educated and higher status people are healthier than less educated and lower status people. Thus, the health of service-members will tend to differ systematically from the health of civilians in a manner that is totally unrelated to military service but based instead on their pre-service characteristics.

Especially today, in the context of the current all-volunteer force, untangling the causal effects of military service from selection is a daunting task. We would expect that today’s volunteer warriors are likely to be healthier than their civilian counterparts at least initially, because of entrance standards (Cawley and Maclean 2010) and the demands of basic training. Except during times of economic recession such as we are experiencing today, volunteer soldiers may also come from less advantaged backgrounds, given how military pay typically lags its civilian counterpart for a given educational background. Seeking educational subsidies is another

motivation for enlistment that is likely to reveal initial differences between veterans and nonveterans. Perceptions of and tastes for risk may be important in determining who signs up for a very risky occupation, even if it is temporary, and those preferences are probably also important for health outcomes.

Once in the military, service-members may be assigned to positions or experiences on the basis of their health or correlated characteristics. Service-members are more likely to become officers if they have college degrees than if they do not. Researchers have also discovered that the armed forces send service-members into combat if they have better health, leading to the “healthy warrior” effect (Armed Forces Health Surveillance Center 2007). Due to this effect, combat veterans may have worse health than they would have otherwise, but they still look healthier than veterans who did not see combat.

The VA takes a very time-consuming but direct approach to assessing service-related disability or health by identifying specific conditions “acquired or aggravated” by specific events occurring during service (Institute of Medicine 2007). But the disability claims process can be long and onerous, at least in part because the standard for identifying service-related disabilities is set relatively high, requiring a medical examination and service documentation. Not all disabled veterans have acquired a VA disability rating, and furthermore veterans may have conditions about which they are unaware. Finally, any protective effects of service on later-life health would never be captured by VA disability ratings.

A far broader class of health impacts than is encompassed by VA disability ratings is likely to emerge if one were able to adopt a counterfactual perspective and compare outcomes against what would have happened to individuals if they had never served. Although by no means the only relevant perspective for policy, this perspective has gained traction over the last

several decades in the social sciences. It resembles the motivation behind conducting randomized controlled trials (RCTs) to establish causality between a treatment and an outcome, holding all other relevant characteristics fixed.

In several cases, researchers have been able to exploit the usefulness of the draft during these periods as a source of plausibly exogenous assignment into treatment and control groups. In some historical periods, force strength was significantly bolstered for fighting major wars through conscription. This type of study would provide the most unbiased estimate of the total effect of military service on outcomes, and several efforts have successfully explored the reaction of earnings. But to date, this type of approach has produced ambiguous results regarding the net effects on health, possibly because there are many countervailing influences of military service on physical and mental health, on healthy behaviors, and on socioeconomic status. What is apparently needed to guide further research in this area is a careful decomposition of the array of influences running between military service and health that motivates new tests using new structural approaches. In this chapter, we aim to provide precisely that, drawing on the many observational studies that explore the relationships between military service and health in addition to examining the relatively thin body of research that is able to compare several types of outcomes among treatment and control groups.

We view identifying causal impacts of service on older-age health as an ideal that should become more attainable with a careful review of observational studies, and by no means as the only worthwhile investigation. If the association between military service and health is direct, veterans are likely to experience better or worse health than non-veterans because of experiences they have while in the armed forces. They may suffer worse health than non-veterans because they experienced more stress when they were in the armed forces than did comparable people in

civilian society. They may also experience better or worse health because the military leads them to learn healthy or unhealthy behaviors. Some researchers have shown, for example, that veterans are more likely than non-veterans to smoke. Indeed the military provided troops with cigarettes during their service in World War II (Bedard and Deschenes 2006). In addition, veterans may be affected by environmental exposures, such as those encompassed by the term, “Gulf War Syndrome” (Institute of Medicine 2006).

The benefits of a proactive, aggressive plan of research on the broader health effects of service are made clear by the ongoing conflicts overseas, which have produced more than 2 million new wartime veterans (Institute of Medicine 2010). The costs of treating even currently known conditions associated with war injuries among this cohort are likely to be large (Congressional Budget Office 2010; Stiglitz and Bilmes 2008). And comprehensive new research efforts such as the Millennium Cohort Study will reveal much about the unfolding dynamics of health and well-being among service members that we do not yet know (Ryan et al. 2007). But the immediacy and scope of the challenges motivate research-driven interventions in the near term, probably long before causality could be definitively established.

III. The social, economic, and demographic characteristics of veteran cohorts

Veterans differ from non-veterans on the basis of a number of demographic characteristics that are associated with health and mortality, particularly age, race, and gender, as well as socioeconomic background. Scholars have argued that military service represents a hidden variable in the aging of cohorts (Settersten and Patterson 2006). Historical factors have altered the experience of military service and therefore, potentially, of aging and of the relationship between military service and health. Veterans represent different shares of the

population at different ages, and these shares change over time. Today, veterans are close to a quarter of the population over the age of 65 (Wilmoth and London Forthcoming). Among people at younger ages, they constitute much smaller shares of the population. They represent slightly more than a tenth of those 45-65. Among those 25-44, only 4 percent are veterans. In the year 2030, therefore, veterans will constitute only 10 percent of those over the age of 65 (Wilmoth and London Forthcoming).

As these differences reveal, not all veterans served in the same era. In 2010, for example, about 10 percent of veterans had served in World War II, while 33 percent had served in the Vietnam war. A relatively small share, 38 percent, have served in the 38 years since the beginning of the All-Volunteer Force era (Wilmoth and London Forthcoming). Because they served in different eras, veterans have typically had very different experiences during service. Some veterans served during wartime and were therefore likely to experience combat, while other veterans served during peacetime and had little chance of fighting. More than half of World War II veterans who served saw combat, while only 15 percent of veterans who served between 1974 and 1994 saw combat (MacLean 2011). As current veterans die, and current service-members become veterans, veterans will have served in different eras and had different experiences in the military.

The types of people who serve in the military have also changed over time, meaning that veterans have different average characteristics today than they did in the past. Today, for example, women serve at greater rates than they did forty years ago (Segal and Segal 2004). In 1970, women constituted less than 5 percent of the armed forces. Today, they account for more than three times as large a share, or 15 percent (Segal and Segal 2004). Blacks were under-represented in the armed forces during the World War II and Vietnam eras. Today, they are

over-represented (MacLean and Parsons 2010). Younger veterans are therefore much more likely to be female or black than are older veterans.

Socioeconomic characteristics of veteran cohorts have varied, but two consistent patterns appear to be that military service has never drawn exclusively from the upper or lower end, and preexisting socioeconomic differences between the average service member and the average civilian tend not to be overwhelmingly large (Bachman et al. 2000; Janowitz 1960; Segal and Segal 2004). Still, there appears to be variation in patterns of selection and the effects of military service on earnings across veteran cohorts, and these have implications for relative socioeconomic well-being and thus probably also for health. Angrist and Krueger (1994) showed that veterans of World War II were a select group with consistently higher earnings relative to their nonveteran peers through the 1980s. But after controlling for the selection of higher ability individuals into military service, they discovered either a zero or small negative effect of WWII-era military service per se on earnings. Angrist (1990) revealed a similar selection dynamic but a larger negative effect of military service on the earnings of Vietnam-era veterans in the 1980s. The Vietnam era armed forces may have drawn service members from more disadvantaged strata than did those of the second World War, perhaps because the war was more unpopular. Alternatively, veterans may have been more negatively affected by serving during the Vietnam era than by serving during World War II. These findings appear to lend more support to the second hypothesis.¹ But more recent research on the members of the Vietnam cohort finds that the negative effect of service on earnings later in life, in their fifties as opposed to their thirties, seemed to have dwindled away to zero (Angrist and Chen 2007; Angrist, Chen, and Song 2011). Earnings would be negatively affected by lost labor market experience unless military service

were a perfect substitute, but other consequences of military service for earnings might also be important.

Earnings respond strongly to education, and the educational attainment of veterans is interesting for at least three reasons. First, since the Second World War, Congress has consistently offered generous educational benefits to wartime cohorts under the G.I. Bill, which raised the educational attainment of participants (Angrist 1993; Angrist and Chen 2011; Bound and Turner 2002; Stanley 2003). Second, during the Vietnam era, college deferments were a mechanism used by some to avoid the draft, raising the educational levels of those nonveterans above what they otherwise would have been (Card and Lemieux 2001). Third, a large body of literature explores the relationship between education and health, with evidence that causality runs in both directions (Elo and Preston 1996; Kitagawa and Hauser 1973; Lleras-Muney 2005). With the generous Post-9/11 G.I. Bill now in effect for the current war cohort, the impacts of additional education on earnings and later-life health outcomes are clearly of great current interest and are a promising focus for research. A current view in the literature is that the net effect of service on earnings may be zero in the long-run because of offsetting effects of missed experience (negative) and increases in education (positive). How these may translate into health impacts, if at all, is less clear.

Just as characteristics of individual veterans are interesting and likely to be important for later-life health, so too are family characteristics and social networks. A vast literature associates the strength of social networks such as families and kinship to health outcomes (Seeman 1996). Costa and Kahn (2010) demonstrate this in a plausibly causal sense by showing that greater social cohesion within units of Union Army soldiers resulted in lower later-life mortality. There have been substantial changes over the last several decades in the family structure of service

members (Segal and Segal 2004). Today's all-volunteer military consists of more careerists with families, and military policies aimed at encouraging retention have facilitated that development. Trends in the family status of veterans per se are somewhat less clear. A great unknown in the current overseas conflicts is precisely how accelerated deployment cycles and reduced dwell times have strained military families (Institute of Medicine 2010; MacDermid and Riggs 2011).

The varying demographic characteristics of veteran cohorts imply that the answer to the question of how service has impacted health will probably depend on which cohorts we are talking about, and whether we are comparing veterans to other veterans or to nonveterans. There are well-known gradients in health according to basic demographic characteristics, as well as through socioeconomic status as measured by education, income, or wealth. In general, we define health *disparities* associated with military service as those differences in health that are correlated with service but that are not explained by other well-known factors. But a complicating factor in attributing causality to military service is that service itself may well have changed many other characteristics subsequently. As we have seen, a chief candidate is education. In that case, comparing a veteran's health outcome to the clearest counterfactual will produce an estimate of the health disparity associated with service that may include any health returns to education.

The most direct influences on the health of veterans have relatively little to do with their demographic characteristics in any direct sense, however. The risk environment in which service members find themselves are highly variable and can be deadly, and even when not fatal, these characteristics are likely to have long-reaching consequences for health and well-being. Each conflict in history tends to be not only unique but also can include many unanticipated

characteristics, but aggregate casualty statistics imply some general trends in the nature of U.S. warfare and military medicine that are surely important.

IV. Warfare, technology, survival, and disability

Not all veterans serve during wartime, not all wartime veterans see combat, and not all combat veterans are injured. But there are aggregate trends in the nature of military conflict and military medicine that are important for understanding the health and well-being of veterans. We briefly explore these trends in this section.

Offensive and defensive warfare technologies and techniques have continuously evolved throughout the course of human history leading to potentially contradictory effects on veterans' health. Especially since the advent of the modern era, developments in military medicine have brought vast improvements in the probability of survival faced by wounded soldiers. The net effects of trends in these dueling technologies are roughly revealed by aggregate casualty statistics and the probabilities they indicate of being wounded if serving and of being killed if wounded.

Comparing statistics over broad stretches of time can be problematic because of changes in definitions and reporting habits, yet a basic look at aggregate casualty statistics reveals that service members may be more likely to return with serious physical wounds today than they were in the past. Proper measures of relative risk require a careful un-packing of raw manpower statistics into periods of exposure rather than simple headcounts. Table 1 is reprinted from Edwards (2010), who lists simple headcounts reported by the U.S. Department of Defense (DOD) and calculates several simple ratios. Deaths attributable to war are surely the most consistent measure provided by the DOD, but even there definitions may have changed over time

for deaths not occurring on the battlefield. The Pentagon's category of "Wounds Not Mortal" (WNM) is the most readily available category measuring the prevalence of war wounds. But as Goldberg (2010) notes, an additional 150,000 troops in Vietnam were wounded but returned to duty within 72 hours. They were not included in the WNM measure during the Vietnam conflict but would be today if they were wounded in Iraq.

[Table 1 about here.]

Based on the official WNM measure, the ratio of forces wounded to killed has climbed considerably throughout the history of the nation. Gawande (2004) cites these statistics and attributes the rapid rise in the survivability of war wounds to breakthroughs in military medicine, in particular "forward surgical teams" of physicians deployed practically to front lines. Goldberg (2010) finds that survival probabilities have indeed risen since Vietnam, although not quite as rapidly as these raw statistics suggest. He cites a survival rate of 90.4% for wounded troops in Iraq before the surge compared with 86.5% in Vietnam.

There are other interesting findings that emerge in the simple data. The shares of overall forces or survivors who were wounded display scant evidence of any trends. To the extent that overall force size might adapt to the course of conflicts, this could be evidence of Pentagon policy reactions to the course of conflicts, either through recruiting or conscription.

These two trends imply different things about the health of surviving veterans. On the one hand, the share of surviving veterans of conflicts who were officially wounded has apparently not risen or fallen in any consistent way. But on the other hand, wounded veterans of later conflicts are much more likely to have survived their wounds than wounded veterans of earlier conflicts. This probably represents a net improvement in human well-being, but it may also mean that younger cohorts of veterans who have survived their wounds may be less healthy

and more disabled than were older cohorts. As discussed by Edwards (2010), survey data on average VA disability ratings among surviving cohorts of veterans lend some support to this perspective but are far from definitive.ⁱⁱ Angrist, Chen, and Frandsen (2010) argue that increasing disability compensation claims among Vietnam veterans in the 1990s may have been driven by the work disincentives in the benefit program more than underlying disability.

V. Estimates of the effect of military service on mortality and health

Scholars have documented a number of links, primarily using observational techniques, between military service and mortality and mental health, while a smaller number of researchers have shown that military service may be linked with measures of physical health. Physical health, mental health, and mortality are all inter-related. We would typically expect to see any influences that may affect one of them also affecting the other two as well, at least in the long run. But over shorter horizons, the links between these may be considerably looser, and external events and behaviors may affect these three outcomes very differently. Several additional considerations further motivate the separate examination of these outcomes. Veterans as a group are likely to have begun their adult lives in better physical health than the average nonveteran. They may also have begun with better mental health, but in both cases, military service may have exposed them to greater stressors than those faced by nonveterans. Finally, several causes of death are of special interest here: external causes, such as accidents and suicides, and smoking-related deaths. Especially in the case of accidents, mortality outcomes may completely diverge from measurable physical and mental health outcomes.

Another motivation for a multifaceted approach is that like earnings, mortality is relatively easy to measure in large samples. At around 23 million, veterans are by no means a

small subgroup in aggregate, but particular veteran cohorts, whose characteristics can differ markedly, are smaller. Analyses may suffer from lack of power if they focus on individual veteran cohorts within national health surveys like the National Health and Nutrition Examination Survey (NHANES) or the National Health Interview Survey (NHIS), which are of smaller scale than Census or administrative data. Similar difficulties complicate analyses of veterans in detailed panel datasets like the Health and Retirement Study (HRS) or the Panel Study of Income Dynamics (PSID), which are smaller still. The VA conducts surveys of veterans with good coverage of cohorts, but such datasets typically do not include nonveterans as a comparison group. An exception is the relatively unique National Vietnam Veterans Readjustment Study (NVVRS).

A. Service and mortality

1. Excess mortality among veterans

A paramount concern about military service is that veterans may die younger than comparable non-veterans, even if they survive their wartime experiences. As we will discuss, the answer to the question of whether veterans die earlier than nonveterans appears to depend on what causes of death we are talking about, which is closely related to age, and on whether the veterans served in wartime. Accordingly, some researchers have shown that particular types of veterans die at younger ages, while other researchers have shown that other types of veterans die at older ages, and still others have demonstrated that veterans die at the same ages as do non-veterans.

Some have argued that veterans die at younger ages because military service harms health. Cohorts in which a greater share of the members are veterans have higher mortality rates

than those in which a smaller share of the members are veterans (Bedard and Deschenes 2006). The association between service and mortality increases as cohorts age. According to this research, veterans die at younger ages because they are more likely than non-veterans to smoke (Bedard and Deschenes 2006). Among those who enlisted when they were younger or older than the average, veterans died at younger ages than did comparable non-veterans (London and Wilmoth 2006).

Some researchers have found that veterans are more likely than non-veterans to die of external causes, such as suicides and accidents. In the 1980s, researchers estimated instrumental variable regressions based on the fact that the government operated a lottery that determined the odds that a man would be drafted during the Vietnam war based on birthdate (Hearst et al. 1986). In regressions with birthdate as an instrument, men who were more likely to have been drafted during the Vietnam war were also more likely to die of external causes, such as accidents and suicides, before reaching their 40s (Hearst et al. 1986). But McLaughlin, Nielsen, and Waller (2008) conduct a meta-analysis of 12 studies and report the opposite finding, that veterans in general were 10 to 20 percent less likely to die from external causes as were comparable civilians.

There is some evidence that military service may be associated with reduced mortality, which could reflect the fact that the armed forces exclude people with poor health, or possibly that military service directly enhances health. According to a meta-analysis by McLaughlin et al. (2008), veterans from a wide array of time periods experienced on average 20 to 25 percent lower all-cause mortality rates than did comparable civilians. Their analysis may have been disproportionately influenced by a large-scale study of veterans of the first Persian Gulf war, who were only observed for a few years after they finished their service. It is striking that even

external-cause mortality appeared to be lower on average among veterans, but the average hid substantial heterogeneity in results across studies. Several of the examinations of mortality among Vietnam-era veterans showed precisely the reverse outcome, that mortality was higher among veterans, both for external and cancer mortality. Another difficulty with the McLaughlin et al. meta-study is that it is unclear whether the individual studies were observational, or attempted to control for selection, or a mix of the two. The approach and title of the meta-study, which emphasizes how selection produces healthy warriors (even though service may make them less healthy than they otherwise would have been) suggests that the constituent studies are all observational.

2. Excess mortality among certain veterans

While the preceding findings just compare veterans to non-veterans, other researchers have assessed how veterans are affected by particular types of military experiences, such as combat and rank within the military. Whether it ultimately results in physical wounds or not, combat is a high-intensity, stressful event that may produce lasting mental health trauma. Regardless of how it may have developed, post-traumatic stress disorder (PTSD) is associated with higher levels of post-service mortality (Boscarino 2006). Elder et al. (2009) find that veterans who reported combat exposure during World War II died at younger ages than similar veterans who had remained stateside during the conflict (Elder et al. 2009). Interestingly, Boscarino (2006) reports similar effects of PTSD on the mortality of Vietnam veterans regardless of deployment to the war zone. But the prevalence of PTSD measured roughly at age 40 was considerably higher among veterans who went to Vietnam than among those who did not, 10.6% compared to 2.9%. Combat or deployment to a war zone is not a prerequisite for PTSD

but appears to raise mortality through triggering PTSD. Researchers have shown that there is an association between military service in war zones and mortality. Among those who served in the Vietnam era, veterans had higher rates of mortality if they went to Vietnam than if they did not. They were most likely to die from external causes, such as suicide or accidents, in the first five years after finishing their service (Boehmer et al. 2004).

Other researchers argue that combat does not appear to increase particular types of mortality later in life. Among World War II, Korean and Vietnam veterans, men who saw combat were no more or less likely than those who did not to die of heart disease in the 36 years after entering service (Johnson et al. 2010). According to some studies, combat veterans appear to have a lower than expected likelihood of dying from external causes (McLaughlin et al. 2008).

Veterans may also live longer than comparable non-veterans if they are black (London and Wilmoth 2006). Previous researchers, however, have argued that black troops may have been disproportionately likely to be killed during the Vietnam war (Binkin 1993), which could have led to under-estimates of black mortality among surviving veterans.

Some researchers have evaluated the relationship between rank and mortality, finding that veterans die at older ages if they served at higher ranks. Among enlisted men, for example, those who were of a lower rank when they left the armed forces died when they were younger than those who were of higher rank (Keehn 1978). Military retirees experienced similar mortality differentials through rank between 1974 and 2003. They are a highly select group who typically served 20 years on active duty. Among these retirees, men who finished their service in the enlisted ranks faced higher mortality rates and died at younger ages than those who had served as officers, and the slope of the gradient through individual pay grades was fairly constant

(Edwards 2008). An O-5 typically faced a better post-service mortality environment than an O-1 through O-4, and also better than that faced by an E-9 and below.

These results are reminiscent of the famous Whitehall studies of British civil servants, which have revealed steep gradients in mortality, health, and unhealthy behaviors through grade or rank of employment (Marmot et al. 1991). In this literature, scholars have proposed the hypothesis that inequalities in the work environment harm health by producing psycho-social stress. One of the key questions for this literature is whether other well-known socioeconomic characteristics that tend to vary with rank or position, such as income or education, might be driving the results. In Keehn's study of military rank and mortality, he reports that education at entry cannot be responsible for the differentials, but Edwards (2008) is unable to control for education in the payroll data he examines. In both cases, there are clear gradients through rank in earnings and potentially pensions, either of which could also contribute to health differentials. MacLean and Edwards (2010) report disparities in self-reported health associated with rank even after controlling for education, income, and other covariates across four datasets (MacLean and Edwards 2010). Studies have shown that self reports of health tend to correlate with mortality (Idler and Benyamini 1997), but more conclusive evidence of an independent link between mortality and rank awaits future research with better data.

B. Service and other measures of health

1. Mental health

With the exception of the preceding research on mortality, researchers have been much more likely to assess how military service, particularly combat, affects mental health than to evaluate whether it affects physical health (Levy and Sidel 2009). Researchers have explored

how combat affects health from the perspective of different disciplines, including psychiatry, medicine, and epidemiology. Service-members experience greater stresses in combat, which may worsen both mental and physical health. Researchers have begun to explore the dimensions of post-traumatic stress disorder (PTSD), which was not a formal psychiatric diagnosis until the early 1980s (Kulka 1990). But at least the Civil War, observers have continuously remarked that some veterans seemed to experience negative effects of combat, however those symptoms may have been described or attributed (Dean 1997).

Scholars have often shown that veterans suffer worse mental health if they were deployed to a war zone or experienced combat than if they did not have combat experience. They have shown that veterans had symptoms of PTSD years or even decades later. Service members can suffer PTSD for short or long periods of time. They can also suffer symptoms that stop and start again. For these reasons, analysts often distinguish between lifetime and current prevalence of the disorder, and estimates vary depending on the instrument that is used to assess the disorder. Among Australian veterans of the Korean era, men had worse mental health if they experienced combat. They were more likely to be depressed or to have PTSD (Ikin et al. 2007). Within the U.S. population, combat veterans have been shown to suffer greater rates PTSD, depression, and substance abuse (Prigerson, Maciejewski, and Rosenheck 2002). According to these findings, cohorts with greater shares of combat veterans should also have higher rates of mental disorders as they age. According to one estimate based on the U.S. population, approximately 8 percent of people suffer from PTSD. Approximately one third of these cases are believed to stem from combat exposure (Institute of Medicine 2008). Among veterans of the wars in Iraq and Afghanistan, nearly one fifth report symptoms of one or more mental health diagnoses (Tanielian and Jaycox 2008). Other scholars have suggested that PTSD may reflect not the impact of

combat, but of pre-existing trauma. Veterans were, indeed, more likely to report having PTSD if they had experienced childhood abuse (Clancy et al. 2006).

Rohlf (2010) examines social outcomes linked to psychological trauma, namely rates of violent crime among Vietnam-era veterans in the NVVRS. His identification strategy draws from plausibly exogenous variation in rates of combat exposure by quarter of birth, similar to the method of Angrist and Krueger (1994) of examining WWII-era military service by birth cohort. In addition, the NVVRS measures self-reported combat exposure, for which the quarter-of-birth data provide a good instrument. Rohlf reports that combat exposure significantly raised violent acts committed by black men and may also have raised crime committed by white men.

2. Physical health

Other researchers have examined the effect of military service in general on physical health. Teachman (2010) reports that veterans of the AVF rate their physical health worse than expected. Self-reported health is a ubiquitous metric that surely reflects some elements of psychological health. But it is also known to be a good predictor of mortality outcomes independent of objective health measures (Mossey and Shapiro 1982). Physical and mental health are also thought to be connected (Prince et al. 2007), and military service could affect physical health indirectly through its impact on mental health. Schnurr and Spiro (1999) observe that veterans were more likely to rate their physical health as poor if they had worse mental health, which could reflect a connection between the two.

One of the great shortcomings in this literature stems from the difficulty involved in establishing causality and thus isolating a treatment effect of military service on physical health in general. A subset of service-related shocks to physical health, most notably lost limbs and

bodily functioning stemming from combat wounds, are relatively overt and easy to establish as having stemmed from service. The same may be true for some mental health trauma, but the challenges there are twofold: the objectivity of diagnosis is often in question, and the causal association with service is unclear. A broader set of potential health effects associated with service, both positive and negative, may exist but are much more difficult to connect to service as opposed to pre-existing sources. Here, as with mortality studies, the most convincing treatment analysis emerges from examining how health varies in response to an instrumental variable that determines military service.

In a recent study, Dobkin and Shabani (2009) examine health status among the Vietnam-era cohort (men born between 1950-1952) observed in the National Health Interview Surveys (NHIS) using the same identification technique as Hearst et al. (1986), the Vietnam draft lottery. They document significant health disparities associated with military service among survivors that emerge from standard multivariate analysis, without adjusting for the selection effects. Self-reported health grew worse and activity limitations rose among veterans as they aged, and depression or anxiety was more common throughout the life cycle.

But when they compare draft-eligible men to the rest of the cohort, Dobkin and Shabani find that the statistical significance of their results falls away. Although the draft lottery predicts military service very well, it apparently does not predict physical and mental health outcomes well. This could be because military service itself does not constitute a nonzero net treatment on health, perhaps because service primarily reflects selection on other characteristics, or there actually are multiple health treatments that are countervailing and offsetting. Or it could be that the draft lottery does not predict the key treatments associated with service, like smoking and combat exposure. It is unlikely that small sample size is a problem given the scope of the NHIS.

VI. Conclusion

There are many overt influences of military service on later-life health, but there are probably also many more that are much less apparent. Combat-related physical injuries present clear burdens for veterans, and many of these are long-lived, chief among them being major limb amputations, disfigurements, and probably also brain trauma, although much less is known about the long-term effects and persistence of traumatic brain injury (TBI), the signature wound of the conflicts in Iraq and Afghanistan this past decade (IOM, 2010). Psychological wounds have been a persistent element of warfare throughout human history, but only recently have we begun to develop more consistent methods of diagnosis and treatment, and much work remains to be done. The focus on service-connected wounds, disabilities, and associated challenges is altogether appropriate and deserving of continued attention and research.

But we feel it is our duty as social scientists to highlight a broader view of the effects of military service on health and other outcomes that may not be limited to disabilities or health conditions formally diagnosed by the VA. It is self-evident that military service has far-reaching influences on the minds and perspectives of all veterans whether they saw combat or not, and whether or not they were wounded. A far more difficult question to answer is whether and how military service may have exerted a treatment effect on the health of the average veteran independent of measurable service-related trauma, by which we mean an influence that would not have otherwise occurred in the absence of service and is not already measured by the standard method in veterans' care, the VA disability rating.

As we have shown in this review of the literature, there are partial answers to these questions, and there remain many open questions. One prevailing theme that emerges from the

economics literature on the effects of selection is that different cohorts of veterans are select in different ways, but all are select groups. Unadjusted comparisons of veterans with nonveterans are therefore interesting but unlikely to be informative about the causal impacts of military service on outcomes.

Emerging themes appear to be that broadly speaking, military service may have raised smoking behavior, whether because of price subsidies, stress, or the influence of social networks; it probably increased educational attainment through subsidies; it exposed some service members to the physical and psychological trauma of combat; and it kept service members out of the civilian labor force for a time. It is easy to see how these countervailing influences on later-life health may produce no clear net effect on the health of the average veteran, a finding that is not uncommon in this literature. The relevant question becomes whether these individual influences are themselves either small or unsystematic, or large, focused, and just offsetting; either story is consistent with the evidence on the sum of these effects.

Given the preponderance of evidence on diagnosed service-related injuries and their long-lived impacts, our view is that the latter story is more likely, but a definitive answer awaits further investigation. In particular, we think that combat exposure is probably a key transmission channel. Because less than half of all veterans report seeing combat, it is less surprising that the effect of military service on health might be much more attenuated. Recent work by Rohlfs (2010) and others that plausibly addresses the selection problem through the use of instrumental variables or other quasi-experimental methods should be a guide for future studies.

Data limitations are binding constraints for causal and observational studies alike. Even if they could control for every observable characteristic of veterans that is relevant for service and for health, many observational studies still cannot convincingly control for variables that we

know are unobservable and that we suspect are important for service and probably also for health. Granted, this is more important for studies of the effect of military service on health more broadly than for studies of combat-related trauma among veterans, which can rely on VA assessments of service-related health conditions, among other things. To date, causal inference has typically relied on a single, if high-quality, source of exogenous variation in military service, which typically requires large-scale data sets to draw statistical power. These large data sets, often drawn from Census sources, typically do not provide high enough resolution about key details like combat exposure and other characteristics of military service that might be relevant. In the case of Rohlfs's (2010) work, he gained considerable leverage from the unique data in the NVVRS and employed an instrumental variables strategy to reveal implied mental health effects of combat.

Enhanced resolution of military careers might provide more insights through the analysis of richer data, but the challenges to acquiring such data are considerable. Socio-demographic surveys of veterans and nonveterans typically do not have time to allot to extended questions about military service. The 1994 wave of the Panel Study of Income Dynamics, examined by MacLean and Edwards (2010), is an exception, but many in the military subsample were subsequently dropped in the sample redesign, hampering detailed analysis. Surveys of veterans are much larger in scale and scope but typically do not provide longitudinal detail.

Administrative data exist in the form of military service records, but those require a formal request under the Freedom of Information Act, and acquisition may be a lengthy undertaking.

One of the great unknowns is precisely how individuals develop during military service, and it seems likely that formulating new understanding in this regard could inform research about the effect of service on health. It is often said that military service “straightened out”

wayward youths in need of discipline. This should be a testable hypothesis, and it is practically inconceivable that any change in attitudes and behavior would not also affect later-life outcomes including health. But the data requirements of such a study are immense. The National Longitudinal Study of Adolescent Health, which covers cohorts born around 1980, asks fairly detailed questions of its military subsample and may ultimately provide suitable insights.

Future work can also extend knowledge about the health of veterans by examining differences by sex and race in greater detail. Previous efforts have assessed the average associations between service and health, but these associations may differ for women and men, and for whites and non-whites, as for example Rohlf's (2010) shows in his study of post-combat violent crimes. Over the last 40 years, women and non-whites have become increasingly likely to serve in the armed forces. Indeed, some scholars have begun to assess whether female veterans suffer different health pressures and stresses than do male veterans (Goldzweig et al. 2006). Research should also assess how the effects on mortality may differ by gender. Blacks are affected differently by their service in terms of their marital outcomes and work satisfaction (Lundquist 2004; Lundquist 2008). Yet apparently no researchers have evaluated whether black veterans have different average health from black non-veterans or from white veterans.

After a decade of vastly expanded responsibilities for service members and their families, which has occurred simultaneously with the aging of the Baby Boom and its Vietnam-era veterans, the salience of research into the lifelong well-being of veterans is more clear than ever before. Results with the most value-added in terms of policy implications will derive from well-designed studies with rich data and appropriate identification strategies.

VII. Policy Implications

Improving our understanding of the lifelong health impacts of military service would improve our knowledge about the determinants of good health and health disparities among human populations more generally. These are not the motivations or charges of the Department of Defense or the Department of Veterans Affairs, but both groups should be directly interested in the health impacts of service, whether for planning purposes, for designing preventive measures to minimize costs and personnel losses, or for harnessing the productive potential of any positive influences. A challenge is that positive influences of military service on health and well-being have been difficult to fathom with available data. Veteran subsamples in civilian datasets typically do not answer many questions that shed light on their military experiences. It is in the best interests of policymakers and researchers alike for there to be enhanced access to data that can inform new inquiries into the causes and consequences of military service.

A relatively easy step would be to grant selective access to restricted versions of publicly available datasets like the National Survey of Veterans in which there are individual-level identifiers of some type that simultaneously safeguard the privacy of participating veterans while enabling researchers to conduct quasi-experimental studies through exploiting exogenous variation based on geography, birthdate, or other characteristic.

A bolder move would be for the Defense Department to de-identify and release data that is not public such as the Pre-Deployment Assessment (PDA), the Post-Deployment Health Assessment (PDHA), or the Post-Deployment Health Reassessment (PDHRA). The ideal dataset is a longitudinal follow-up of veterans whose characteristics were measured prior to service or deployment. Assembling such data is by no means easy, but the use of retrospective questions in a survey that is linked to administrative data could suffice. The recent National Survey of

Veterans 2010 was recently fielded too late to incorporate these suggestions, but future studies might.

In an era when burdens of deployment are rising, policymakers should take a proactive stance toward measuring their effects. To best inform support policies for new veterans of the wars in Iraq and Afghanistan, this may well involve understanding the effects of deployments among older veteran cohorts first.

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Table 1: Participants, deaths, and wounded in major U.S. wars

Conflict	Participants	Killed	Wounds Not Mortal	Surviving Veterans	Wounded per participant	Wounded per survivor	Wounded per killed
Revolutionary Wars (1775-1783)	217,000	4,435	6,188	212,565	0.029	0.029	1.395
War of 1812 (1812-1815)	286,730	2,260	4,505	284,470	0.016	0.016	1.993
Mexican War (1846-1848)	78,718	13,283	4,152	65,435	0.053	0.063	0.313
Civil War (1861-65)	3,277,556	622,511	478,968	2,655,045	0.146	0.180	0.769
Confederate	1,064,193	258,000	197,087	806,193	0.185	0.244	0.764
Union	2,213,363	364,511	281,881	1,848,852	0.127	0.152	0.773
Spanish American War (1898)	306,760	2,446	1,662	304,314	0.005	0.005	0.679
World War I (1917-1918)	4,734,991	116,516	204,002	4,618,475	0.043	0.044	1.751
World War II (1941-1945)	16,112,566	405,399	671,846	15,707,167	0.042	0.043	1.657
Korea (1950-1953)	5,720,000	36,576	103,284	5,683,424	0.018	0.018	2.824
Vietnam (1964-1972)	8,744,000	58,200	153,303	8,685,800	0.018	0.018	2.634
First Gulf War (1990-1991)	2,225,000	383	467	2,224,617	0.000	0.000	1.219
Iraq and Afghanistan (OEF/OIF) (2001-)	2,100,000	5,376	36,906	2,094,624	0.018	0.018	6.865

Note: For sources, see (Edwards 2010).

ⁱ Our reasoning here is the following. If Vietnam veterans were less selected than WWII veterans, one would expect to see less of a difference between ordinary least squares estimates, which cannot correct for selection, and instrumental variables estimates. Instead, we see a similar wedge between them in the same direction for both cohorts. That evidence is more supportive of a larger negative impact of service during the Vietnam era on earnings.

ⁱⁱ The data show higher average VA disability ratings among younger cohorts of veterans earlier in their lives compared to older cohorts. But it is unclear whether that is the result of greater average disability. Other candidate explanations include increasing generosity in VA disability programs, greater knowledge and thus accelerated acquisition of VA disability ratings, trends in social mores regarding health or public benefits, or other factors.