Overseas Deployment, Combat Exposure, and Well-Being in the 2010 National Survey of Veterans

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November 6, 2014

Abstract

Recent engagements in Iraq (OIF) and Afghanistan (OEF) raise questions about impacts on service members of overseas deployment. The 2010 National Survey of Veterans asked a broad cross section of veterans about deployment to OEF/OIF and combat exposure. Analysis of these data suggests that impacts of deployment and combat on the current socioeconomic well-being of OEF/OIF veterans may be small, but combat appears to reduce self-reported health and other nonpecuniary indicators. Among older cohorts, with clearer sorting into treatment and control groups, patterns are similar, consistent with a system that compensates for lost earnings but not necessarily other trauma.

Keywords National security; Health; Mental Health; Economics of Warfare
JEL Classifications: H56 · I1 · N42

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1 Introduction

The impacts of military service on individuals and families are a perennial topic of interest to researchers and policymakers, and they have become more salient recently as a result of the unprecedented pace of deployments to Iraq and Afghanistan as part of Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF). By April of 2009, the number of service members ever deployed had reached 1.9 million (Institute of Medicine, 2010). Data from the 2010 National Survey of Veterans (NSV), shown in Table 1 and described in more detail below, suggests that by early 2010 there were between 1.5 and 1.8 million veterans of the conflicts in Iraq and Afghanistan who had returned to civilian life, out of about 2.5 million veterans of the Post-9/11 era.[1]

There is a vast body of research evaluating the health and well-being of earlier cohorts of veterans, and an array of studies have focused broadly on outcomes among Post-9/11 veterans, including the ongoing Millennium Cohort Study (MCS) (Smith et al., 2007) and the Invisible Wounds effort and others by the RAND Corporation (Tanielian and Jaycox, 2008). But aside from the MCS, which suffers from its own limitations of scope, there are relatively few data sources that can reveal the impacts of deployment or other characteristics of military service on a broad array of socioeconomic and health outcomes. An exception is the National Longitudinal Survey of Adolescent Health, which Cesur, Sabira and Tekin (2013) utilize to reveal significant effects of combat deployment on mental health outcomes among young veterans.

The 2010 National Survey of Veterans is the latest in a series of public datasets that provide assessments of health and socioeconomic well-being for living veterans in households. It included 753 veterans of the Post-9/11 era, of whom 453 reported being deployed in support of OEF/OIF. Although the 2010 NSV is not a comprehensive survey of health,

[1]There are two estimates of the total population of veterans deployed in support of OEF/OIF because separate questions in the NSV asked the veteran to identify his or her period of service and then whether he or she had deployed to OEF/OIF. As shown in Table 1, 112 veterans in the survey indicated they had deployed while not indicating they had served during the Post-9/11 period. The phrasing of the question, shown in section 2.2, suggests that some veterans may have thought that by answering yes they were registering their political or moral support for OEF/OIF, rather than deploying in support of OEF/OIF. In my regression analysis of deployment to OEF/OIF, I restrict the data universe to veterans who reported serving in the Post-9/11 era. By comparison, data from the 2010 American Community Survey suggest there were 3,326,129 veterans who served in 2001 or later (Ruggles et al., 2010).

employment, or income, the data provide a unique look at the current well-being of many veterans of different eras. In particular, the 2010 NSV reveals how the self-reported well-being of veterans varies with self-reported characteristics of military service like deployment to OEF/OIF and two key outcomes associated with deployment: service in a combat or war zone, and exposure to dead, dying, or wounded people.

The basic research and surveillance questions we can begin to assess with these data are how deployment and combat exposure among Post-9/11 veterans may be associated with their well-being shortly after separation from the military. And because all veterans in the 2010 NSV are asked about their combat exposure, it is possible to formulate expectations about the potential longer-term impacts of combat on Post-9/11 veterans based on the experience of earlier veteran cohorts, although such comparisons are inherently speculative.

An advantage of this second strategy is that it can leverage the identification power of earlier natural experiments in combat exposure across birth cohorts that better identify treatment and control groups. Because young men have traditionally borne the burden of going to war, and because even long wars have discrete beginnings and endings, both military service and combat exposure has varied sharply among men of the conscription era, in large part because they ceased to be drafted into combat when wars ended. Data in the 2010 NSV confirms these strong patterns among earlier veteran cohorts, but at least among the Post-9/11 veterans who had separated prior to 2010 and were sampled, such patterns are nonexistent and cannot be leveraged for identification. In this analysis of the effects of deployment and combat among Post-9/11 veterans, the best I can do is use propensity-score matching to attempt to correct for nonrandom selection into treatment and control. That the results are broadly consistent with comparable ordinary least squares (OLS) results, and with instrumental variables (IV) estimates of the effects of combat exposure on outcomes among veterans from many birth cohorts, offers a modicum of reassurance that selection bias may not be overwhelmingly large. In focusing on deployment among veterans I am avoiding the well-known and potentially thornier problem of selection into the military (Angrist, 1990; Angrist and Krueger, 1994). But whether selection into deployment given military service is any weaker than selection into service is far from clear. The changing nature

of military service motivates much caution in interpreting any results that treat multiple veteran cohorts similarly.[2] But the underlying questions are important enough to be worth asking and answering as precisely as the data allows.

Estimation results suggest that deployment to OEF/OIF appear to have had few direct effects yet on the current socioeconomic well-being of Post-9/11 veterans, but the subsample is small and standard errors are large. Utilization of educational benefits may be higher, as might employment rates. But deployment is also a significant risk factor for service in a war zone and for exposure to casualties, both of which are strongly associated with current self-reported health, but in an interesting twist, not with physical disability. These patterns are consistent with a disability compensation system designed to replace lost earnings, and with mental health trauma associated with combat exposure among returning OEF/OIF veterans, which is suggested by the results of Cesur, Sabira and Tekin (2013).

Among veterans of all ages in the 2010 NSV, both OLS and IV regressions reveal significant impacts of service in a war zone and of exposure to casualties on an array of outcomes, but they often take opposite sign. Neither seem to affect household income at all, which is further evidence of a functioning disability compensation program, but service in a war zone often improves or does not affect outcomes while exposure to casualties, which displays much independent variation, tends to harm them. This is most evident in patterns of marriage, divorce, and homeownership, and less so for self-reported health and disability, both of which are strongly reduced by exposure to casualties but basically unaffected by service in a war zone. Robustness of a key result across estimation strategies and samples, namely that exposure to casualties appears to have negative impacts on nonpecuniary aspects of well-being, is a relatively clear indication of one type of lifelong burden of military service. There is also some evidence of lifelong benefits associated with military service, for veterans

[2] As suggested by an anonymous referee, elements of the All-Volunteer Force who fought in Iraq and Afghanistan are in general a more select group of long-term military than war veterans from the draft era. We expect this selection to have washed out individuals with more overt health problems in the modern era. Today's war veterans are also different than earlier cohorts because of improvements in military medicine (Goldberg, 2010) and equipment (Rohlfs and Sullivan, 2013) that have significantly enhanced survival. Also, military occupation specialty (MOS) is likely to be a key variable that determines combat exposure and potentially deployment, and the relationship between these has likely changed across conflicts. Unfortunately MOS is not measured in the 2010 National Survey of Veterans. Finally, the relationship between skills learned in military service and skills relevant for civilian employment may have changed over time and across conflicts. All these points speak to omitted variables that may be biasing my results.

who served in war zones but were able to avoid exposure to casualties. But whether these effects could have improved outcomes for nonveterans, i.e., whether military service per se might improve some outcomes, is far from clear and impossible to answer with these data.

These results are relevant for understanding historical trends in the well-being of veterans and for emerging issues and challenges associated with service in the U.S. military. In this journal, Mann (2012) models the decision to enter military service as a function of civilian and military wages, and he reports that the risk of combat death strongly impacts military participation during the era of the All-Volunteer Force. Greenstone, Ryan and Yankovich (2014) explore detailed data on reenlistment bonuses and report wide variation in implied values of a statistical life based on fatality risk and substantial sorting behavior. These results raise questions about preference for risk, the information set, and nonpecuniary rewards associated with service. Advances in military medicine have arguably made coping with service-connected disabilities a far greater concern for potential enlistees than in the past. The findings presented in this paper suggest that whether and how such concerns are understood and met should be a focal point for future research.

The paper proceeds as follows. In section 2, I describe the dataset in greater detail. I provide an analytical framework in section 3, and I formulate several testable regression models of outcomes on deployment, combat, and characteristics. In section 4, I present and discuss evidence on deployment, combat, and outcomes among Post-9/11 veterans first using simple mean differences, then propensity-score adjusted differences, and then multivariate regression. Section 5 presents comparable results for all veterans employing an instrumental variables strategy that leverages sharp differences in combat exposure by year of birth. In section 6, I discuss conclusions and limitations.

2 The 2010 National Survey of Veterans

2.1 Survey design

The 2010 National Survey of Veterans (NSV), the sixth in a series of repeated cross sections first surveyed in 1977, was conducted between October 16, 2009, and March 19, 2010 by

Westat on behalf of the U.S. Department of Veterans Affairs (VA) (Westat, 2010). Each one of six subcomponent surveys in the 2010 NSV targeted a different veteran or military subpopulation: (1) all veterans who had separated from service; (2) demobilized National Guard or Reserves; (3) active duty service members; (4) spouses of living veterans; (5) spouses of active duty service members; and (6) surviving spouses of deceased veterans. My focus in this study is on the survey of all veterans.

The 2010 NSV veterans questionnaire was mailed out to 14,163 recipients in households, of whom 8,710 or about 61 percent responded.[3] Recipients were identified through a tiered process in which the first stratum consisted of users of VA services or retirees with addresses on file with VA or DOD, matched to a vendor's random sample of 1.8 million postal addresses (Westat, 2010). The second stratum included matched individuals present in the DOD's Prior Service Military Address Files but not present in VA or retiree files. A third stratum included all other unmatched postal addresses from the initial random sample.

Westat computed sampling weights to adjust for selection probability and item nonresponse, using the VA's VetPop2007 demographic data, which are derived from Census surveys of the civilian noninstitutional population, as population controls. Westat also constructed 100 replicate weights using a grouped jackknife method. In my analysis, I use both the final sample weight and the 100 jackknife replicate weights to produce point estimates and standard errors.[4] Figure 1 shows estimates of the national veteran population by year of birth derived from the 2010 NSV.

As discussed by Westat in the accompanying documentation, the NSV 2010 universe excludes veterans who are institutionalized, homeless, or living overseas. All three of these omissions could lead to biased inference if the covariates of interest, deployment and combat, also affect institutionalization, homelessness, or overseas residence in addition to key out-

[3]Respondents were initially asked via mailout to complete an online version of the survey. After one subsequent reminder mailout, nonrespondents were mailed the paper questionnaire.

[4]Westat employed the JK1 routine in their proprietary software WesVar, whose documentation is available online. I use the suite of `svy` commands in Stata 12.0 to estimate models using survey data. Estimation routines in Stata require the final sample weight in addition to the 100 jackknife replicates. Although the final sample weight was missing from the public file of the 2010 NSV, the documentation for WesVar's JK1 routine shows that the simple average over the 100 replicates for each observation is equal to the final sample weight. Thus I reconstructed the final sample weight as the average (including the zeros) of the replicate weights.

come variables. Overseas residence could be a marker of higher or lower status depending on circumstances, thus it is unclear what effect that omission may impart. But institutionalization and homelessness are presumably caused by poor mental or physical health, reduced earnings or wealth, or poor social relationships, all of which we hypothesize could be caused by exposure to combat or casualties. If this story is correct, the average marginal effects of combat and casualties on health or status that we observe within the sample are likely to be no larger than the true population average effects, because treated veterans who reach very low levels of health or status are not observed, while untreated veterans probably are.

But it is difficult to gauge how salient these universe omissions may be, because the causal effects of combat and casualties on institutionalization and homelessness are not well understood. Rohlfs (2010) reveals causal effects of combat exposure on violence and crime but not on incarceration among Vietnam Veterans. In a recent review of observational studies, Tsai, Pietrak and Rosenheck (2013) report that PTSD and other combat-related trauma are actually less prevalent among older homeless veterans, but that young homeless veterans of Iraq and Afghanistan are more likely to report combat and PTSD diagnoses. With many open questions remaining, a comprehensive treatment of this issue likely awaits the development of new longitudinal studies that can increase understanding (Balshem, Christensen and Tuepker, 2011).

2.2 Scope

Like its predecessors, the 2010 NSV was primarily designed to gauge veterans' awareness and use of VA programs, but the survey also collected demographic characteristics in order to adjust for selection and nonresponse. In addition, the survey also asked about socioeconomic characteristics like the household's total income plus transfers,[5] homeownership, employment status, and education. It also asked several questions about the veteran's health

[5] In the survey's income module, veterans were first asked whether or not they or resident family members had received any income during the past year from a list of 10 sources beginning with labor earnings and capital asset income and ending with government transfers like VA disability compensation and any private transfers. Then they were asked to indicate the total amount received last year from those sources by choosing among a set of ranged responses. I measure dollars of household income plus transfers using the middle value within the reported range.

and disability status and VA disability rating,[6] and the survey began with several questions about the veteran's military service.

The 2010 NSV is the first public study to ask specifically about deployment to Iraq or Afghanistan in the conflicts following the events of September 11, 2001. As is common in Census data, the NSV ascertained period of service on active duty by presenting a set of checkboxes including one for the Post-9/11 era. Then the survey asked about deployment:

> A4. Did you deploy in support of Operation Enduring Freedom (OEF) or Operation Iraqi Freedom (OIF)? (Yes/No)

There are no comparable questions about deployment to war theaters from previous eras. The NSV then asked the years in which the veteran first entered and was last released from active duty[7] before presenting two questions about exposure to combat or war zones and to casualties, both of which I will refer to as "combat exposure" questions:

> A7. Did you ever serve in a combat or war zone? [NOTE: Persons serving in a combat or war zone usually receive combat zone tax exclusion, imminent danger pay, or hostile fire pay.] (Yes/No)

> A8. During your military service, were you ever exposed to dead, dying, or wounded people? (Yes/No)

There is some overlap but far from a one-to-one correspondence between these three binary indicators of deployment and combat exposure, as shown in Table 2. The top panel in the table cross-tabulates responses to questions A7 and A8 among veterans who reported deployment in support of OEF/OIF.[8] Almost 10 percent of veterans reporting such deployment indicated they had not served in a combat or war zone. Among the 91.6 percent

[6]The questionnaire asks the veteran to report the VA disability rating using a set of ranged responses similar to income, and I measure the VA disability rating using the middle of the reported range. I assign a zero rating to veterans who report not having a VA disability rating.

[7]I measure total years on active duty as the difference between these two reported years. This is probably an overestimate of the true time spent on active duty, but while the bias is likely to vary across different classes of veterans, i.e., career military or conscripts, it is unlikely to vary within classes, which would be worrisome.

[8]Because the questionnaire asked about period of service (question A3) and deployment in support of OEF/OIF (A4) separately, it was possible for veterans to report the latter but not the former, which presumably is impossible. There are 111 such observations in the data, 108 of which also include data on the most recent year of separation from active duty (A6). Only 13 of the latter are 2001 or later, suggesting that many veterans may have misread or misunderstood "deploy in support of" in question A4 to mean

who had, 31.1 percent or about a third reported no exposure to dead, dying, or wounded people. The remaining 60.5 percent reported exposure to casualties. This is large relative to other veteran cohorts. Some OEF/OIF veterans may have been exposed to casualties during earlier conflicts and not during OEF/OIF; because the question asks about lifetime exposure, there is no easy way to tell. The middle and bottom panels of Table 2 repeat the analysis for Post-9/11 veterans and for all veterans. The comparison reveals considerably higher self-reported rates of service in a combat or war zone and exposure to casualties among recent veterans, no doubt a byproduct of the transition to the All-Volunteer Force (AVF) and a larger share of career military serving during an era with two long wars.

2.3 Comparisons of veteran cohorts

Table 1 displays a selected set of average characteristics among veterans in the 2010 NSV by period of service, which is shown along the rows.[9] Combat exposure rates for Post-9/11 veterans and those deployed in support of OEF/OIF differ slightly from those shown in Table 2 because some veterans answered only one of the two combat exposure questions. As one would expect, surviving veterans from earlier periods are older and more often male, while patterns in combat exposure and VA disability are more complicated. Service during a major conflict is naturally associated with higher levels of each, but there is also some evidence of U-shaped trend through age or year of birth. Very old and very young veterans report higher VA disability ratings and more combat exposure than middle-aged veterans. This pattern could reflect any combination of several factors: trends in average exposure to combat, differential survival favoring older veterans with greater access to VA care and benefits, differential screening or detection of disability, or changes in the disability rating system.

Figure 2 plots the percent of veterans who report combat exposure against the year of their birth, revealing a similar U-shaped pattern punctuated by a spike in combat exposure

something other than deployment, perhaps feelings of solidarity. In my analysis of the effects of deployment to OEF/OIF, I effectively drop these observations by conditioning on veterans' identifying themselves as belonging to the Post-9/11 era.

[9] Veterans who report multiple periods appear in multiple rows in the table and contribute to the averages for each period they identify.

among Vietnam veterans born mostly in the late 1940s. Especially prior to the AVF period, birth cohorts of veterans who were in their late teens and early twenties at the time of major military conflicts were disproportionately exposed to combat. This is similar to patterns of elevated military service among all male civilians in the same birth cohorts because of the draft, which ended in 1973 (Angrist and Krueger, 1994; Card and Lemieux, 2001). It is also reminiscent of patterns in combat exposure by year of birth among veterans and nonveterans in the National Vietnam Veterans Readjustment Study (Rohlfs, 2010).

These relatively sharp differences in combat exposure across otherwise similar birth cohorts are likely to identify differences in outcomes that are directly attributable to combat exposure rather than to confounding factors. Unfortunately, rates of combat exposure by birth cohort among veterans of the Post-9/11 period, who were the only group at risk of deployment to OEF/OIF, follow no such clear pattern. This is shown in Figure 3, which depicts noisy but basically flat rates of combat exposure by year of birth among Post-9/11 veterans in the 2010 NSV.

3 Analytical framework

Military service may represent a treatment that affects socioeconomic and health outcomes for service members and families; or it may reflect selection into the military along a variety of characteristics like health, ability, budgets, and preferences; or both of these stories could be true (MacLean and Edwards, 2012). To the extent that it is a treatment, military service could either positively or negatively affect many outcomes.[10] The specific treatments of overseas deployment and combat exposure seem more likely to bring harms than benefits, but their net effects on financial and other outcomes might be zero or positive, given that the veterans compensation system is designed to replace earnings lost to service-related

[10]Service may enhance self-control or patience, characteristics that would improve socioeconomic and health outcomes. It also imposes new peer groups, which could be good or bad for health and other outcomes. Exposure to combat can result in physical and psychological wounds, which may reduce well-being directly and indirectly through reduced earnings. But if survived, combat or service in a war zone might also produce feelings of optimism, control, or invincibility. Deployment may strain family relationships and reduce a range of individual and family outcomes, and it could also affect future employment for reservists, either through lost experience or strategic responses by employers. Compared to time spent in the civilian labor force, military service either could enhance or reduce earnings depending on whether service adds or subtracts skills or experience relevant for the civilian labor market.

disabilities (Institute of Medicine, 2007), and that service is voluntary. The 2010 NSV provides a unique opportunity to examine how deployment may be associated with a broad array of socioeconomic outcomes, how deployment and combat exposure are related to each other and to outcomes among Post-9/11 veterans, and how combat exposure is related to later-life outcomes among older veteran cohorts.

My empirical strategy begins with examining how a set of individual and family outcomes y_i for each Post-9/11 veteran i vary across groups defined by deployment to OEF/OIF. A simple comparison of means reveals a number of statistically significant differences, including across basic demographics, a sign that deployment is not a random treatment in the sample. A commonly used statistical method to deal with nonrandom assignment is propensity score matching (Rosenbaum and Rubin, 1983), which adjusts for the probability of assignment to treatment and control groups based on observables. What emerges from the analysis is that deployment is strongly associated with exposure to combat or war zones and with exposure to casualties, but not with much else among Post-9/11 veterans in the 2010 NSV. This suggests that deployment could affect outcomes through the combat exposure variables and motivates modeling the latter as treatments.

With that in mind, I next turn to multivariate regression analysis of the set of outcomes y_i by nesting several reduced-form linear models:

$$y_i = \alpha + \beta \cdot deploy_i + X_i B + \epsilon_i \quad (1)$$

$$= \alpha + \beta \cdot deploy_i + \gamma \cdot combat_i + \delta \cdot casualty_i + X_i B + \epsilon_i \quad (2)$$

$$= \alpha + \beta \cdot deploy_i + \gamma \cdot combat_i + \delta \cdot casualty_i + H_i C + X_i B + \epsilon_i \quad (3)$$

where β, γ, and δ are the marginal effects on y_i of deployment in support of OEF/OIF, service in a combat or war zone, and of exposure to dead, dying, or wounded. The vector X_i measures demographic characteristics, and the vector H_i measures health and the VA disability rating. Health is likely to be independently important for other non-health outcomes y_i but it may also be the channel through which deployment and combat exposure affects y_i. Short of pursuing a structural modeling approach, which would be difficult with these

data, it is helpful to nest these reduced-form models in order to best ascertain proximate effects and transmission channels. I initially estimate equations (1)–(3) using ordinary least squares (OLS), so that ϵ_i is assumed to be a white-noise, conditionally homoscedastic error term.[11] The OLS estimates of β, γ, and δ are identified by the conditional cross-sectional variation in deployment, which is only random if all the characteristics relevant for outcomes and deployment are included in X_i and not in ϵ_i. Given the limited scope of the NSV and thus of X_i, this assumption seems likely to be violated.

Whether there is selection into deployment or combat given military service is the main question this and other studies of veterans must confront. If service members were randomly assigned to these treatments, then a simple comparison of means between groups could reveal the average treatment effect. But deployment is likely to be endogenous. First, it may reflect a command assessment of a unit's readiness and effectiveness, the latter of which probably depends the characteristics of service members. But Lyle (2006), Engel, Gallagher and Lyle (2010), and Cesur, Sabira and Tekin (2013) argue that deployment of a unit is determined primarily by its readiness, and thus that deployment of a particular individual is exogenously determined by the armed forces given rank and occupation. Because rank and occupation are not available in the NSV 2010, nor is longitudinal information on preservice conditions, the case for deployment or combat exposure being orthogonal to individual characteristics in my data is weaker. A second reason why deployment and combat exposure are likely to be endogenous is that service members probably have heterogeneous preferences about risk or duty (Greenstone, Ryan and Yankovich, 2014), and through their own actions would presumably be partially successful in choosing the degree of both which they ultimately face.

When combat exposure x_i is likely to be endogenous in a regression of y_i on x_i with an error term ϵ_i, a good instrumental variable z_i is correlated with x_i ($cov[z_i, x_i] \neq 0$) but not with ϵ_i ($cov[z_i, \epsilon_i] = 0$). That is, the instrument should predict combat exposure but not be

[11] Although we are interested in several outcomes y_i that are dichotomous, I proceed with the linear probability model because I am primarily concerned with consistent estimates of β, the causal effect of deployment on the outcome, and deployment and other endogenous regressors are themselves dichotomous. The econometrics literature does not speak with one voice on this issue, but Angrist (2001) argues that two-stage least squares is adequate for causal inference regarding marginal effects.

correlated with the unobserved characteristics that also cause y_i. On theoretical grounds, the average combat exposure of the birth cohort is likely to be a good instrument because it represents the military's demand for combat duty by service members of a particular age. The latter is driven by external events such as overseas wars, which have historically required the combat services of young men. Although different individuals within a birth cohort are likely to have different levels of ability and different preferences for military service, there is no *a prior* reason to expect that adjacent birth cohorts will systematically differ from one another along either dimension. Thus when z_i is the birth cohort's combat exposure, we are likely to find that z_i predicts an individual's combat exposure x_i, and that it should be uncorrelated with unobservables like ability and preferences that also predict y_i and are relegated to ϵ_i.

As reviewed recently by Small and Rosenbaum (2008), Angrist and Krueger (1994) use a similar method in their classic paper to separate the causal effect on later earnings of military service in World War II from the positive effects of selection into the military among the birth cohorts of the late 1920s. The end of that war created a sharp difference in military service across otherwise similar birth cohorts that was not reflected in those cohorts' average earnings, even though individual WWII veterans earned more than nonveterans because they were positively selected. Rohlfs (2010) employs a similar strategy in his analysis of Vietnam veterans, among whom combat deaths were sharply peaked around the birth cohort of 1947. Figure 2 makes a compelling visual case for sharp identification of effects of combat exposure on outcomes using these birth cohort exposure instruments among all veterans in the 2010 NSV. Unfortunately the same cannot be said for the Post-9/11 veterans depicted in Figure 1, whose exposure does not appear to vary systematically by year of birth.

This approach produces one instrumental variable z_i for each endogenous combat exposure x_i by averaging the x_i's across members of a birth cohort. Thus the standard validity test of overidentifying restrictions to check whether $cov[z_i, \epsilon_i] = 0$ is not available. As a feasible alternative, Rohlfs (2010) examines whether z_i is correlated with x_i but not with other preservice characteristics w_i, like having been arrested before age 18, which ought to affect y_i. Although my covariate set in the 2010 NSV is more limited than Rohlfs's, I can

replicate his test to assess validity of the instruments.

Table 3 shows pairwise correlations between fourteen covariates in the full 2010 NSV sample of all veterans. The matrix contains ten regressors that measure sociodemographic and military characteristics, the two individual-level combat exposure variables which we suspect are endogenous, and at the bottom, two instrumental variables that equal the proportions of the year-of-birth cohort reporting combat exposure. By and large, these correlations are all fairly small except for those between the instrumental variables and their corresponding individual-level combat exposures, which are around 0.3. Aside from the covariate measuring years since separation, where the correlations with the instruments are -0.037 and -0.130, no other covariate is highly correlated with the instrumental variables. Overall, these results suggest that the instruments are valid. First-stage F-statistics (shown later) also support the validity of the instruments.

Using this IV strategy, I estimate the following using two-stage least squares (2SLS) on the full sample of veterans of all eras:

$$y_i = \alpha + \gamma \cdot \widehat{combat}_i + \delta \cdot \widehat{casualty}_i + X_i B + \epsilon_i \tag{4}$$

$$= \alpha + \gamma \cdot \widehat{combat}_i + \delta \cdot \widehat{casualty}_i + H_i C + X_i B + \epsilon_i \tag{5}$$

where the combat exposure variables are instrumented with z_1 and z_2 and the other covariates:

$$combat_i = a + b_1 z_1 + b_2 z_2 + X_i B + \nu_i \tag{6}$$

$$casualty_i = c + d_1 z_1 + d_2 z_2 + X_i B + \eta_i. \tag{7}$$

An unfortunate limitation to this approach is that because the sharpest identification derives from the experiences of older veterans, our results must be primarily reflecting the effects of combat at older ages. Impacts on younger veterans could easily differ, and we will have no way of telling whether the difference might be interesting or trivial. Effects of combat may be long-lived and slow to emerge over the life cycle, or they could simply not exist among

young veterans, perhaps because they are select volunteers rather than conscripts. These as well as other stories could be consistent with null results on combat or deployment among Post-9/11 veterans combined with positive findings among all veterans. For that reason, it is helpful to estimate equations (4) and (5) by OLS as well as IV, in order to compare OLS estimates across all veterans of the marginal effects of combat with earlier estimates across Post-9/11 veterans only. If OLS results are similar across both groups, it is more plausible that the IV estimates may generalize.

4 Effects of deployment to OEF/OIF on outcomes

4.1 Simple mean differences

Table 4 presents average characteristics among Post-9/11 veterans in the 2010 NSV according to whether they reported deployment in support of OEF/OIF, the difference between those averages, and the statistical significance of the difference using an adjusted Wald test (Korn and Graubard, 1990). Averages differ significantly across 12 of the 34 listed characteristics, but 4 of these are basic demographics, and 2 more are branches of service. Of the remaining 6, the most significant differences are in the combat exposure variables, where deployment appears to have raised the lifetime rates of service in a combat or war zone and exposure to casualties by 73.3 and 37.2 percentage points respectively.

Trends in other characteristics reveal no clear differences in status, but several are worth noting. There is limited evidence of different marital status, with a slightly lower rate of never-married and a large but insignificant increase in the rate of being divorced among deployed veterans. Household income is lower among the deployed, but they are also younger by 3 years on average. Rates of being unemployed are very high among both groups, at 18.2 and 19.1 percent among those not deployed versus those deployed. These are rates among all veterans and are slightly lower than official unemployment rates.[12] The share not in the labor force due to disability is 4.5 percentage points lower among veterans who deployed,

[12]The official definition of the unemployment rate is the number of unemployed divided by the sum of the employed plus the unemployed. Calculated that way, unemployment rates of non-deployed and deployed veterans in the 2010 NSV are 21.3 and 21.9 percent respectively.

and while statistically insignificant, their VA disability ratings are 3.2 percentage points lower as well, suggesting selection by physical ability. Levels of educational attainment are indistinguishable, but higher shares of the deployed had used VA educational benefits and had completed the training or degree that was subsidized. There are no statistically significant differences in health status, although the point estimates revealing the deployed to be slightly healthier. Smoking is slightly more prevalent among those deployed, but again the differences are insignificant.

4.2 Differences based on propensity-score matching

Running a propensity-score algorithm based on nearest-neighbor matching (Abadie et al., 2004) corrects for systematic differences in outcomes by observable characteristics, in particular age, sex, race, ethnicity, and branch of service, and it may reveal a causal treatment effect if the observables capture selection mechanisms. Table 5 displays average treatment effects of deployment on socioeconomic and health outcomes based on this method.[13]

Compared to Table 4, most marginal effects of deployment are insignificant here. The most interesting developments here are that the effects on household income and log household income have switched signs. The propensity score match corrects for the differences we see in Table 4 across several demographic characteristics that are normally correlated with income, in particular education. Household income plus transfers could be higher because of increased work or wages, or because of increased transfers. Deployment appears to stimulate the use of VA educational benefits, raising the probability of self-reported use by 11.5 percentage points. There are no clear effects on health or disability here. But effects of deployment on combat exposure are again large and significant, as they were in Table 4. Indeed, the only consistent finding across Tables 4 and 5 is that deployment in support of OEF/OIF significantly raises combat exposure.

[13]The implementation is `nnmatch.ado` version 1.3.1. Diagnostic results show that nearest-neighbor matching produces control and treatment groups that appear relatively well balanced but not perfect. The standardized differences metric proposed by Rosenbaum and Rubin (1985), the difference in sample means as a percentage of the square root of the average sample standard deviation, is small for many covariates in the balanced sample. The exceptions are for service in the Army and years since separation. Full diagnostic results are available upon request.

4.3 Determinants of combat exposure

Table 6 further explores the relationship between deployment to OEF/OIF and combat exposure by running the equivalent of "first stage" regressions that estimate combat exposure. In the top panel, I continue to restrict attention to Post-9/11 veterans, among whom deployment to OEF/OIF made veterans about 70 percent more likely to report service in a combat or war zone and about 33 percent more likely to report exposure to dead, dying, or wounded people. These effects fall slightly in size when I add in the instrumental variables that measure cohort exposure, which are fairly predictive of individual-level combat exposure among Post-9/11 veterans.

In the bottom panel, I estimate the same first-stage regressions among all veterans in the 2010 NSV, also including indicator variables for other periods of service. The size and statistical significance of the instrumental variables both increase here, although deployment to OEF/OIF also remains a good predictor of individual combat exposure, as one would expect it should. Taken together, these results are consistent with the view that deployment causes combat exposure.

5 Effects of exposure to combat and casualties on outcomes

5.1 Post-9/11 veterans

Table 7 reports results from estimating nested multivariate regressions of outcomes among the subsample of Post-9/11 veterans. The key covariates shown are deployment to OEF/OIF, the two combat exposure indicators, health, and the VA disability rating; other controls are the same variables used to generate the propensity score used earlier and are listed in the notes. Many of the marginal effects on these outcomes are insignificant. But the tables also reveal that for every outcome, deployment to OEF/OIF loses any significance it may have had once the combat exposure variables are introduced. In a simple horse race, combat exposure wins because it is more tightly correlated with outcomes than is deployment. Even

controlling for self-reported health status on a five-point scale and for the VA disability rating, both of which are often significant, does not in general reduce the significance of the combat exposure variables in these regressions.

Still, Table 7 offers relatively limited evidence of any impacts of deployment or combat on current socioeconomic outcomes among Post-9/11 veterans. Veterans who deployed or were exposed to combat were perhaps 5 to 10 percent more likely to be divorced. Effects on household income are insignificant although occasionally large, but there are large impacts of self-reported health status and VA disability on income, and they work in opposite directions. For each step on the five-point scale toward worse health, these veterans report 16.5 percent less income, while an increase of 10 percentage points in the VA disability rating is associated with an increase in income of 2.6 percent. This contrasts with the jointly positive effects of both these variables on the probability of being out of the labor force due to disability, and it reveals the operation of the system of VA disability compensation.

The lower half of the table reveals some evidence of health impacts. Self-reported health is strongly associated with exposure to dead, dying, or wounded people, as is reporting either fair or poor health status, and this effects exists independently of the VA disability rating. In the rest of the table, there is little evidence that disability or smoking responds to combat exposure.

These findings concerning combat and self-reported health are interesting for three reasons. First, we suspect that self-reported health status summarizes perceptions of mental as well as physical health, while the disability measures solely measure the latter. These results suggest that deployment and combat may have harmed the mental health of OEF/OIF veterans, consistent with the findings of Cesur, Sabira and Tekin (2013) and others, although they are far from conclusive. Second, it is interesting that combat reduces self-reported health but not household income, which is itself reduced by worsened self-reported health. Offsetting influences such as disability compensation must be strong enough to negate the effect of combat on income. Third, the protective influence of service in a combat or war zone against being in fair or poor health is noteworthy because of its contrast with the harmful effect of exposure to casualties. Differing magnitudes or opposing signs are reassuring

indicators that these variables are measuring real influences whose effects could naturally differ. Service in a war zone without exposure to casualties could be a positive influence if it provides feelings of optimism, satisfaction, or invincibility, while exposure to casualties seems likely to be a negative influence regardless of context.

5.2 All veterans

A pattern of countervailing effects on socioeconomic status of service in a combat zone versus exposure to casualties is more evident in Table 8, which presents regression coefficients estimated over the entire pool of surviving veterans sampled in the 2010 NSV. In many cases where the combat exposure variables are significant in these tables, service in a combat or war zone appears to improve outcomes by some amount while exposure to casualties worsens them by an equal or larger amount. Sometimes signs and significance changes with the estimation strategy, and magnitudes often change, but this general result appears to persist.

For example, OLS results indicate that the probability the veteran is married rises by 3.2 to 3.4 percentage points with service in a combat or war zone, but it declines by 3 to 4 percentage points with exposure to dead, dying, or wounded people. The net effect would be roughly zero for the 23.2 percent of veterans report both of these exposures in Table 2. The IV estimates of these effects are about ten times larger than the OLS estimates, which could reflect attenuation bias stemming from measurement error in individual combat exposure variables. In the case of divorce, war zone exposure is protective while casualties increase it, with the effects again netting out roughly to zero for veterans reporting both.

As was the case with the subset of Post-9/11 veterans, there is no evidence here of any impact of combat exposure on household income, here among all veterans. Health status and VA disability are still important in the same ways as before, but combat exposure has no effect in either the OLS or IV results. This is further evidence that suggests the disability compensation system is effective at replacing income.

Effects on employment status are somewhat less meaningful among all veterans since the median age in the data is 65 and many are retired. Most of those who are not in the

labor force due to reasons other than disability are retired. Results in Table 8 indicate that war zone service increases the probability of retirement while exposure to casualties reduces it by more. Part of this could be connected to patterns in homeownership and capital income, both of which are reduced by exposure to casualties. Effects of combat exposure on educational attainment are unclear, with roughly offsetting OLS results that are not confirmed by the IV estimates.

The bottom half of the table shows that service in a combat or war zone does not in general have much of an effect on health, protective or not, while exposure to dead, dying, or wounded people appears to be robustly harmful. We see both self-reported health and indicators of disability worsening with exposure to casualties, irrespective of controlling for the VA disability rating, which is also significant across the board. Effects on smoking change sign and significance, but there are some indications that past service in a war zone may be protective against current smoking, while exposure to casualties may increase it.

6 Conclusion

Understanding the effects of deployment on military service members and their families is an important task for research and policy, and the 2010 National Survey of Veterans provides new insights. It is the first public survey of veterans to ask specifically about deployment in support of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), the two major conflicts thus far in the 21st century, and it measures combat exposure along two dimensions that are empirically linked to outcomes: service in a combat or war zone; and exposure to dead, dying, or wounded people.

As one might expect, deployment to OEF/OIF is associated with service in a war zone and to exposure to casualties. In particular, deployment appears to raise the probability of each by about 75 and 35 percentage points respectively. The data also support the supposition that deployment causes combat exposure, which in turn causes VA disability ratings and other outcomes. These patterns suggest it is worthwhile to examine how combat exposure in addition to deployment may affect outcomes, an analysis that can be extended

to all veterans in the survey in order to gather additional, if necessarily tentative, insights.

Among veterans of the Post-9/11 era, I find statistically insignificant associations between deployment or combat exposure and current socioeconomic outcomes like household income plus transfers or wealth in the form of homeownership or asset earnings. These results are fully consistent with the existence of a disability compensation system that is designed to replace lost earnings. I also find statistically significant and deleterious associations between combat and nonpecuniary outcomes like marriage or divorce and self-reported health status, but not on disability. Because self-reported health is likely to measure an average of mental and physical well-being, these results are consistent with those of Cesur, Sabira and Tekin (2013) and others who report mental health trauma among young combat veterans. In conjunction with the findings on household income, which appears not to vary with combat exposure, my results suggest that service-related transfers may replace earnings but may not fully compensate for the harms associated with combat. If they did, we would see combat exposure raising household income or wealth to compensate for the additional harms to health status or marital outcomes.

There are relatively sharp discontinuities in combat exposure across birth cohorts of veterans in the 2010 NSV, which appear to be driven by the experiences of conscripts. The timing of major wars and the focused incidence on young men of service and combat prior to the All-Volunteer Force provide a set of natural experiments that can reveal the causal influences of combat exposure on outcomes among older veterans. Exploiting variation in exposure across birth cohorts as an instrumental variable for self-reported combat exposure should eliminates any econometric problems associated with selection into combat.

Instrumental variables and ordinary least squares estimates of the effects of combat exposure on outcomes among all veterans tend to agree on the signs if not the magnitudes of the effects of combat, which are broader in scope than among young OEF/OIF veterans. Impacts on socioeconomic outcomes are often at least partially offsetting, with service in a war zone often improving outcomes while combat exposure worsens them. A consistent finding across the two samples is that there seems to be no effect of combat on household income, probably because disability compensation offsets it. But impacts of combat on

marriage, wealth, and especially health status and disability emerge from the analysis of older veterans. Whether or not they will generalize to the future status of currently younger veterans would be entirely speculative, but it is tempting to conclude that the past will be a guide to the future, especially given the small number of effects that appear already to be shared by the two samples.

These results are interesting in light of what they say about the ex post well-being of veterans and about the determinants of military service and compensation in the era of the All-Volunteer Force. Whether and to what degree enlistees value or bargain for insurance against the risk of fatality and injury is an open question relevant for military manpower and welfare considerations alike. Mann (2012) presents a recent analysis of the enlistment decision contingent on wages, the macroeconomy, and risk of combat death, and Greenstone, Ryan and Yankovich (2014) examine selection into military occupation class. Given the trends in survival rates from major injuries, an emerging challenge will surely be the extent to which policies compensate for permanent changes in health status. Further analysis of these questions is likely to hinge on the availability of better longitudinal data.

One of the key challenges facing researchers studying veterans is the long-lived nature of effects of military service on outcomes. Based on the experiences of older cohorts of veterans, service-connected disability benefits, which are a good indicator of assessed need, typically peak more than three decades after the end of hostilities (Institute of Medicine, 2010). With at most only 8 years separating the beginning of Post-9/11 hostilities and the point of data collection in the 2010 NSV, it is eminently possible that impacts of deployment to OEF/OIF are still latent. Effects might also be undetectable because of another challenge facing researchers: low statistical power due to small data samples. There are only 753 veterans of the Post-9/11 era in the 2010 NSV, of whom 565 were deployed to OEF/OIF. Because of these limitations, the estimated effects of deployment should be interpreted with circumspection. Results are often statistically insignificant, but the typical reason is that the marginal effects have large standard errors, and not that the effects are precisely estimated zeros. Such a pattern might reflect heterogeneity in veterans' experiences, small sample size, a true null effect, or some combination of these.

Acknowledgements

I am grateful to Tom Garin and Mike Grierson at the U.S. Department of Veterans Affairs, to Cary Haver at the Institute of Medicine for assistance in obtaining and understanding the public file of the 2010 National Survey of Veterans, and to seminar participants at Lafayette College for helpful comments. All analysis, opinions, and any mistakes expressed in this paper are solely my own and do not reflect the perspectives or positions of any other group or institution. I declare no conflicts of interest nor external funding sources.

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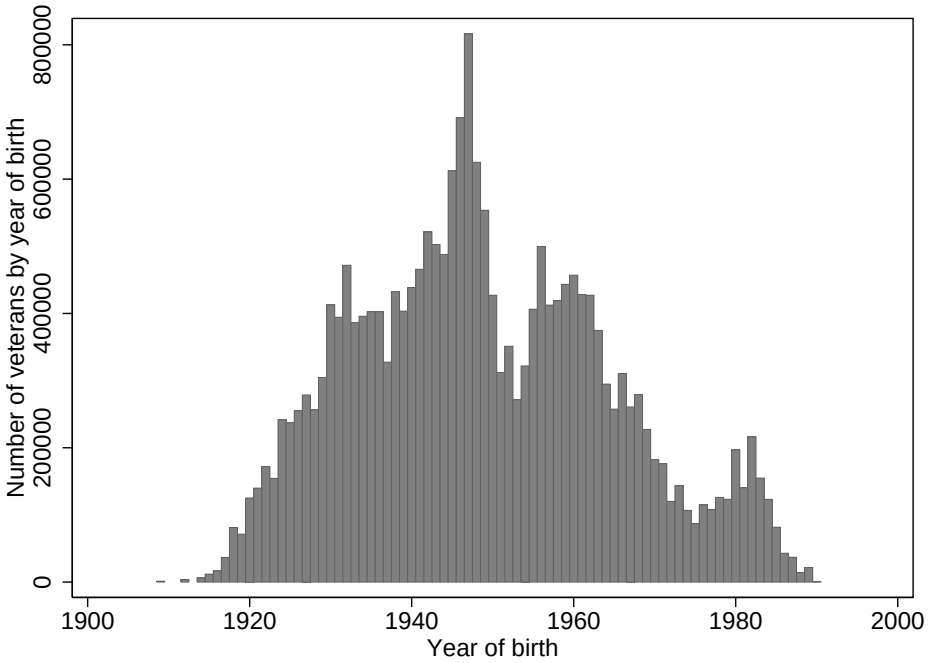
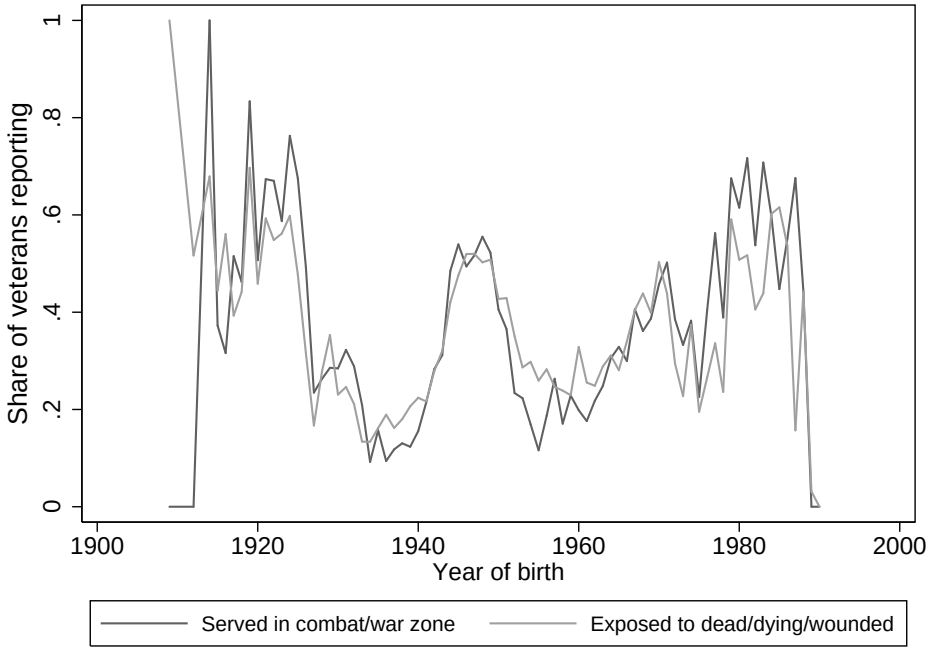
Figure 1: Estimates of U.S. veterans by year of birth



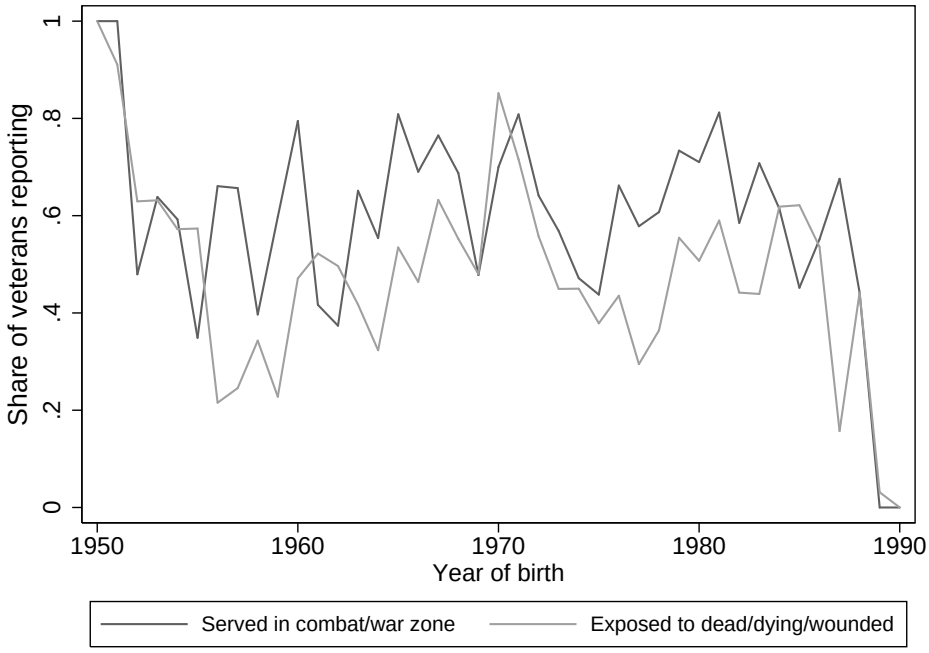
Source: 2010 National Survey of Veterans. Counts are computed with survey weights.

Figure 2: Veterans' exposure to combat and casualties by year of birth



Source: 2010 National Survey of Veterans. Statistics are computed with survey weights. See the text for a discussion of the variables measuring service in a combat or war zone and exposure to dead, dying, or wounded people.

Figure 3: Post-9/11 veterans' exposure to combat and casualties by year of birth



Source: 2010 National Survey of Veterans. Statistics are computed with survey weights. The sample is restricted to veterans who reported serving during the Post-9/11 period. See the text for a discussion of the variables measuring service in a combat or war zone and exposure to dead, dying, or wounded people.

Table 1: Veterans by period of service in the 2010 National Survey of Veterans

Period of service	Dates	Raw count	Estimated national population	Avg. year of birth	Pct. male	Pct. in combat or war	Pct. exp. to dead or dying	Avg. VA disab.
Pre-WWII	Nov 1941 or earlier	34	89,503	1921.2	100.0	74.8	55.4	7.1
WWII	Dec 1941 - Dec 1946	887	1,876,041	1923.7	96.2	54.2	44.9	3.9
Peacetime 1	Jan 1947 - Jun 1950	165	362,980	1928.1	99.1	30.9	30.7	2.5
Korea	Jul 1950 - Jan 1955	1,137	2,388,470	1931.2	97.5	31.0	26.0	3.2
Peacetime 2	Feb 1955 - Jul 1964	1,638	3,819,478	1937.8	98.4	14.0	17.7	2.9
Vietnam	Aug 1964 - Apr 1975	3,661	7,312,478	1946.7	97.4	43.6	44.0	7.0
Peacetime 3	May 1975 - Jul 1990	1,801	5,937,772	1958.3	85.2	25.2	31.1	8.0
Gulf War 1	Jul 1990 - Aug 2001	1,134	4,090,311	1965.1	82.2	45.2	41.3	12.4
Post-9/11	Sep 2001 or later	753	2,545,940	1972.4	82.0	60.9	48.2	14.8
Deployed to OEF/OIF		565	1,819,195	1970.2	86.5	88.1	63.0	12.8
Deployed to OEF/OIF & Post-9/11		453	1,467,529	1973.8	87.3	91.7	63.6	13.5

Sources: 2010 National Survey of Veterans and author's calculations. The universe is all veterans. Those who report service during multiple periods appear multiple times and affect the averages for each period with which they self-identify. Statistics are computed with survey weights. OEF/OIF stands for Operation Enduring Freedom, conducted mostly in Afghanistan starting in October 2001, and Operation Iraqi Freedom, beginning in March 2003. See the text for a discussion of the variables measuring service in a combat or war zone and exposure to dead, dying, or wounded people. The average VA disability rating is calculated by assigning zero ratings to all veterans who report no VA disability rating.

Table 2: Percent exposed to combat zones and casualties by cohort

		Ever exposed to dead, dying, or wounded		
Deployed to OEF/OIF		No	Yes	Total
Ever serve in a	No	5.3	3.1	8.4
combat or war zone	Yes	31.1	60.5	91.6
	Total	36.4	63.6	100.0
Post-9/11 veterans		No	Yes	Total
Ever serve in a	No	30.5	8.8	39.3
combat or war zone	Yes	21.1	39.6	60.7
	Total	51.6	48.4	100.0
All veterans		No	Yes	Total
Ever serve in a	No	55.5	10.6	66.1
combat or war zone	Yes	10.7	23.2	33.9
	Total	66.2	33.9	100.0

Sources: 2010 National Survey of Veterans and author's calculations. The universe in the top panel is Post-9/11 veterans; in the bottom panel, it is all veterans. Percentages are computed with survey weights. See the text for a discussion of the variables.

Table 3: Correlation matrix of explanatory and instrumental variables

	Female	African Amer.	Hispanic	Years of educ.	Navy	Air Force	Marines	Coast Guard	Active years	Years since separ.	Served in comb. war zone	Exposed to dead/ dying/ wounded	Birth cohort service in comb.	Birth cohort expos. to dead/die
Female	1.000													
African American	0.102	1.000												
Hispanic	0.030	−0.016	1.000											
Years of education	0.056	−0.022	−0.014	1.000										
Navy	−0.003	−0.046	−0.029	−0.006	1.000									
Air Force	0.063	−0.019	−0.024	0.093	−0.261	1.000								
Marines	−0.042	0.011	0.023	−0.026	−0.152	−0.155	1.000							
Coast Guard	−0.007	−0.011	−0.010	−0.001	−0.062	−0.056	−0.022	1.000						
Active years	0.029	0.090	0.017	0.122	0.035	0.156	0.000	0.041	1.000					
Years since separation	−0.232	−0.156	−0.093	−0.090	0.053	−0.067	−0.091	−0.012	−0.482	1.000				
Served in combat/war zone	−0.081	0.012	0.048	−0.024	0.034	−0.096	0.067	−0.044	0.193	−0.111	1.000			
Exposed to dead/ dying/wounded	−0.040	0.024	0.041	0.012	−0.052	−0.097	0.075	0.033	0.159	−0.129	0.548	1.000		
Birth cohort service in combat/war zone	0.002	−0.029	0.026	−0.001	0.002	−0.039	0.023	−0.012	−0.075	−0.037	0.364	0.259	1.000	
Birth cohort exposure to dead/dying/wounded	0.006	−0.010	0.029	−0.008	−0.016	−0.034	0.036	−0.012	−0.034	−0.130	0.329	0.282	0.896	1.000

Sources: 2010 National Survey of Veterans and author's calculations. The universe is all veterans. Each cell shows the pairwise Pearson correlation between the row and column variable. The birth cohort's service in combat/war zone and the birth cohort's exposure to dead/dying/wounded are the instrumental variables. They are the average exposures reported by the cohort that shares the same year of birth in the NSV 2010.

Table 4: Average characteristics of Post-9/11 veterans by deployment to OEF/OIF

Characteristic	Not deployed to OEF/OIF	Deployed to OEF/OIF	Difference = "effect" of deployment
Age	39.3	36.2	−3.1***
Percent female	25.1	12.7	12.4***
Percent African American	25.6	16.3	−9.3*
Percent Hispanic	7.2	12.6	5.3*
Percent married	61.0	60.5	−0.5
Percent never married	25.0	24.1	−0.9**
Percent divorced	12.4	15.3	2.9
Number of dependent children	1.17	1.13	−0.05
Household income plus transfers	$67,266	$63,690	−$3,577
Log household income plus transfers	10.79	10.72	−0.07
Percent employed	67.2	68.0	0.8
Percent unemployed	18.2	19.1	0.9
Percent not in labor force due to disability	5.8	1.4	−4.5**
Percent not in labor force, other	8.7	11.5	2.8
Percent owns home	50.4	52.2	1.8
Percent with any capital income	35.3	31.0	−4.3
Percent Internet at home	89.4	92.4	3.0
Years of education	14.3	14.1	−0.2
Percent used any VA educational benefits	37.9	46.6	8.6*
Percent completed VA-subsidized education	37.3	51.5	14.2*
Self-reported health status (1 = excellent, 5 = poor)	2.64	2.59	−0.04
Percent in fair or poor health	18.2	14.5	−3.8
Percent needing aid & attendance	4.3	2.9	−1.4
Sum of any difficulty on 11 ADLs	0.57	0.56	−0.01
Average VA disability rating	16.7	13.5	−3.2
Percent smoked cigarettes ever	43.0	46.4	3.5
Percent smoking cigarettes now	20.1	24.8	4.7
Percent Army	35.0	47.4	12.4**
Percent Navy	22.2	20.6	−1.6
Percent Air Force	29.0	21.9	−7.1
Percent Marines	12.8	14.5	1.7
Percent Coast Guard	5.1	0.6	−4.4**
Years on active duty	10.9	9.9	−1.0
Percent ever served in a combat or war zone	18.4	91.7	73.3***
Percent ever exposed to dead, dying, or wounded	26.3	63.6	37.2***

Sources: 2010 National Survey of Veterans and author's calculations. The universe is Post-9/11 veterans. Statistics are computed with survey weights. See the text for a discussion of the variables. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Table 5: Estimates of the causal effects of deployment to OEF/OIF based on propensity score matching

Characteristic	Marginal effect of deployment
Percent married	−6.1
Never married	3.7
Divorced	3.0
Household income plus transfers	4,700
Log household income plus transfers	0.091
Percent employed	1.4
Percent unemployed	−1.5
Percent not in labor force due to disability	−0.9
Percent not in labor force, other	1.0
Percent owns home	2.4
Percent with any capital income	4.0
Percent with Internet at home	2.9
Percent used any VA educational benefits	11.5**
Percent completed VA subsidized education	10.7
Self−reported health status (1 = excellent, 5 = poor)	0.102
Percent in fair or poor health	−0.1
Percent needing aid & attendance	−0.9
Sum of any difficulty on 11 ADLs	−0.064
Percent ever smoke cigarettes	−4.0
Percent smokes cigarettes now	−0.6
Percent ever served in a combat or war zone	71.4***
Percent ever exposed to dead, dying, or wounded	35.6***

Sources: 2010 National Survey of Veterans and author's calculations. The universe is Post-9/11 veterans. The propensity score matching routine is nearest-neighbor (`nnmatch` in Stata), based on the following variables: age, age squared, sex, race, ethnicity, years of education, branch of service, an estimate of years on active duty based on starting and ending years, and years since leaving service. Statistics are computed with survey weights. See the text for a discussion of the variables. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Table 6: Determinants of exposure to combat and casualties

Endogenous variable	Deployed to OEF/OIF	Birth cohort service in comb.	Birth cohort expos. to dead/die
Post-9/11 veterans			
Ever served in a combat or war zone	0.703***		
Ever served in a combat or war zone	0.688***	0.275**	−0.009
Ever exposed to dead, dying, or wounded	0.343***		
Ever exposed to dead, dying, or wounded	0.329***	−0.018	0.636**
All veterans			
Ever served in a combat or war zone	0.594***	0.744***	0.005
Ever exposed to dead, dying, or wounded	0.310***	−0.039	0.843***

Sources: 2010 National Survey of Veterans and author's calculations. The universe in the top panel is Post-9/11 veterans, in the bottom panel it is all veterans. Each row reports ordinary least squares (OLS) estimates of a separate regression of the endogenous variable in the row on the covariates shown along the columns and a set of controls. Regressions are estimated with survey weights. See the text for a discussion of the variables. Covariates include the same variables listed in Table 5 plus, for the bottom panel, indicators for period of service. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Table 7: Marginal effects of deployment, exposure to combat and casualties, and health on socioeconomic outcomes among Post-9/11 veterans based on cross-sectional variation

Endogenous variable	Deployed to OEF/OIF	Ever served in a combat or war zone	Ever exposed to dead, dying or wounded	Self-reported health status	VA disability rating
Married or partnered	−0.069				
	−0.066	0.044	−0.098		
	−0.063	0.034	−0.087	0.008	−0.109
Divorced or separated	0.073*				
	0.018	0.037	0.079*		
	0.007	0.050	0.079*	−0.028	0.057
Log household income plus transfers	0.077				
	0.126	−0.063	0.026		
	0.116	−0.042	0.074	−0.165***	0.260*
Unemployed	−0.090*				
	−0.043	−0.053	−0.039		
	−0.048	−0.060	−0.035	0.025	−0.186**
Not in labor force due to disability	−0.038*				
	−0.037*	−0.020	0.036		
	−0.014	−0.024	0.002	0.046***	0.253***
Not in labor force, other	0.007				
	−0.019	0.048	−0.026		
	−0.009	0.052	−0.035	−0.009	0.189***
Owns home	0.045				
	0.002	0.081	−0.029		
	0.009	0.084	−0.041	0.014	0.117
Any capital income	0.021				
	−0.012	0.095	−0.128**		
	−0.042	0.106	−0.106*	−0.040	−0.108
Internet at home	0.033				
	0.071	−0.083	0.062		
	0.070	−0.080	0.075	−0.037	0.070
Self-reported health status	0.057				
(1 = excellent, 5 = poor)	−0.163	0.122	0.405***		
	−0.079	0.145	0.311***		1.484***
Fair or poor health	−0.020				
	−0.023	−0.066	0.166***		
	0.016	−0.060	0.131***		0.595***
Needs aid & attendance	0.009				
	−0.003	0.001	0.034*		
	0.008	0.003	0.023		0.180**
Sum of any difficulty on 11 ADLs	−0.150				
	−0.049	−0.188	0.076		
	0.072	−0.162	−0.042		1.904***
Ever smoked cigarettes	0.060				
	0.048	−0.034	0.071		
	0.057	−0.036	0.067		0.094
Currently smokes cigarettes	0.030				
	−0.022	0.094	−0.054		
	−0.016	0.094	−0.060		0.092

Sources: 2010 National Survey of Veterans and author's calculations. The universe is Post-9/11 veterans. Each row reports ordinary least squares (OLS) estimates of a separate regression of the endogenous variable in the row on the covariates shown along the columns and a set of controls for demographic characteristics and branch of service. Covariates include the same variables listed in Table 5. Regressions are estimated with survey weights. See the text for a discussion of the variables. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.

Table 8: Marginal effects of deployment, exposure to combat and casualties, and health on socioeconomic outcomes among all veterans based on cross-sectional and birth-cohort variation

						First-stage F-stat. in:	
Endogeous variable	Model	Ever served in a combat or war zone	Ever exposed to dead, dying or wounded	Self-reported health status	VA disability rating	Ever served in a combat or war zone	Ever exposed to dead, dying or wounded
Married or partnered	OLS	0.030*	−0.039**				
	IV	0.285**	−0.277			156.21	48.26
	OLS	0.031*	−0.029*	−0.028***	−0.058		
	IV	0.278*	−0.263	−0.025***	−0.058	150.27	48.42
Divorced or separated	OLS	−0.018	0.028**				
	IV	−0.268**	0.304**			156.21	48.26
	OLS	−0.019	0.024*	0.015**	0.060		
	IV	−0.279**	0.319**	0.009	0.046	150.27	48.42
Log household income plus transfers	OLS	−0.021	−0.049				
	IV	0.407	−0.206			152.27	46.73
	OLS	−0.008	−0.015	−0.186***	0.150**		
	IV	0.282	−0.039	−0.192***	0.089	146.01	46.42
Unemployed	OLS	−0.005	0.009				
	IV	0.004	−0.062			157.87	46.6
	OLS	−0.003	0.012	0.012**	−0.093***		
	IV	0.022	−0.077	0.015**	−0.077**	152.47	46.73
Not in labor force due to disability	OLS	0.009	0.025***				
	IV	−0.128	0.170			157.87	46.6
	OLS	−0.006	0.005	0.051***	0.316***		
	IV	−0.122*	0.133	0.048***	0.311***	152.47	46.73
Not in labor force, other	OLS	0.035**	−0.032**				
	IV	0.433***	−0.676***			157.87	46.6
	OLS	0.029**	−0.037***	0.002	0.100**		
	IV	0.422***	−0.684***	0.018**	0.171***	152.47	46.73
Owns home	OLS	0.041**	−0.051***				
	IV	0.414***	−0.342**			153.04	47.25
	OLS	0.040**	−0.039**	−0.044***	0.054		
	IV	0.388***	−0.311**	−0.042***	0.038	146.99	47.26
Any capital income	OLS	0.001	−0.063***				
	IV	0.095	−0.062			138.19	42.4
	OLS	0.012	−0.048***	−0.060***	−0.098***		
	IV	0.070	−0.002	−0.064***	−0.124***	130.97	42.8
Internet at home	OLS	0.016	−0.032**				
	IV	−0.074	0.147			146.14	45.18
	OLS	0.015	−0.022	−0.046***	0.068		
	IV	−0.111	0.198	−0.052***	0.041	139.39	45.35
Self−reported health status	OLS	0.106***	0.209***				
(1 = excellent, 5 = poor)	IV	−0.344	0.756*			153.46	47.17
	OLS	0.065*	0.162***		1.270***		
	IV	−0.381	0.732*		1.215***	150.95	48.63
Fair or poor health	OLS	0.025	0.099***				
	IV	−0.160	0.398**			153.46	47.17
	OLS	0.007	0.080***		0.531***		
	IV	−0.175	0.385***		0.485***	150.95	48.63
Needs aid & attendance	OLS	−0.008	0.045***				
	IV	−0.142	0.245**			152.67	47.27
	OLS	−0.012	0.037***		0.182***		
	IV	−0.139	0.234**		0.155***	150.35	48.78
Sum of any difficulty on 11 ADLs	OLS	−0.008	0.323***				
	IV	−1.367*	1.941**			158.1	47.28
	OLS	−0.054	0.249***		1.744***		
	IV	−1.454*	1.959**		1.592***	155.17	48.97
Ever smoked cigarettes	OLS	0.007	0.052***				
	IV	0.018	−0.070			154.5	48.08
	OLS	0.005	0.049***		0.038		
	IV	0.008	−0.079		0.078	152.19	49.66
Currently smokes cigarettes	OLS	−0.019	0.030*				
	IV	−0.272*	0.231			154.19	48.08
	OLS	−0.016	0.024		0.031		
	IV	−0.261*	0.215		0.041	152.48	49.57

Sources: 2010 National Survey of Veterans and author's calculations. The universe is all veterans. Each row reports estimates of a separate regression of the endogenous variable in the row on the covariates shown along the columns and a set of controls for demographic characteristics and branch of service. Covariates include the same variables listed in Table 5 plus indicators for period of service. Models are estimated by ordinary least squares (OLS) or instrumental variables (IV). The IV regressions are two-stage least squares procedures that instrument for exposures to combat and casualties using exposures reported by the birth cohort. All regressions are estimated with survey weights. See the text for a discussion of the variables and estimation strategy. Asterisks denote statistical significance at the 1% (***), 5% (**), and 10% (*) level.