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ARTICLE

The Military VSL

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Abstract

Our research reviews theory and evidence in the economics literature to provide a standard value of a statistical life (VSL) applicable to the Department of Defense (DOD). We follow Viscusi (Best estimate selection bias in the value of a statistical life, *Journal of Benefit-Cost Analysis*, 9(2), 205–246, 2018a) by conducting a meta-analysis of 1,025 VSL estimates from 68 different labor market studies and find a best-set average VSL estimate of $11.8 million (US$2021) across all studies. For DOD analysts and practitioners, we advocate using our best-set VSL estimate for the vast majority of benefit–cost analyses (BCAs) within the DOD. In addition to providing a VSL benchmark to use in DOD BCAs, we disaggregate casualty types and provide a range of VSL estimates to use in sensitivity analyses. Employing restricted data from the DOD on over 6,700 US military fatalities in Afghanistan and Iraq from 2001 to 2021, we show that (1) fatalities are highly concentrated among young, White and enlisted males, and that (2) the Army and Marines account for the vast majority of the fatality totals (73 and 22%, respectively), in contrast to the low number of fatalities (<5%) in the Air Force and Navy. The monetized cost of US military fatalities in Afghanistan and Iraq would involve individual VSL levels that range from $3.2 to $27.6 million per statistical life (US$2021), after applying standard pay grade and income adjustments.

1. Introduction

The Department of Defense (DOD) is the largest government agency in the United States, employing roughly 1.3 million active duty service members and 600,000 civilians with an annual budget of $715 billion (US$2022) (Federal Register, 2022; U.S. DOD, 2021). Critical procurement decisions are made annually in the DOD by allocating resources to protect our nation and save lives (e.g. body armor and armored vehicles). Government guidelines (see Circulars A-4 and A-94 for details) recommend the use of standard benefit-–cost analysis (BCA) techniques to make important safety-enhancing policy decisions.

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(Office of Management and Budget, 2022a, 2022b). The most important component of a standard BCA when allocating resources to save lives is the monetization of the risk reduction using an accurate value per statistical life (VSL) estimate in the analysis. Despite decades of research and widespread use of VSL estimates within other government agencies, the DOD still does not have a standard VSL framework to use in its own internal analyses. The approach we present here seeks to improve the DOD's calculations of the value of reducing combat casualties.

We begin by reviewing theory and empirical evidence in the economics literature and provide a standard VSL applicable to the DOD. We build upon a growing body of literature that has used VSL estimates in the context of military operations and force protection.[1] In the process, our findings expand the use of VSL estimates to another (major) US government agency. Currently, three agencies (EPA, 2010; U.S. DOT, 2016; U.S. HHS, 2016) have standard VSL estimates in place for researchers to use in BCAs. The Environmental Protection Agency (EPA) uses an updated value of $11.0 million, Department of Transportation (DOT) uses a $11.9 million valuation and Department of Health and Human Services (HHS) uses a $11.6 million valuation per statistical life (US$2021). Although the values currently used by other agencies are useful for BCAs in the context of environmental, transportation and health, they might not be appropriate for BCAs in the military.[2] The estimates presented here provide a specific value for analysts to use in the context of military BCAs.

To provide a specific VSL for the military, we use the VSL data from Viscusi (2018a) to conduct a meta-analysis of 1,025 VSL estimates from 68 different labor market studies. To maintain consistency, we primarily focus on the results from studies that use Census of Fatal Occupational Injury (CFOI) data in their analyses, which are the VSL estimates that have been shown to be least affected by publication selection effects. Using the sorting criterion of the best estimates from the CFOI-based studies, we find a best-set average VSL estimate of $11.8 million (US$2021) across the studies. For DOD analysts and practitioners, we advocate using our best-set VSL estimate for the vast majority of BCAs within the DOD.

In addition to providing a VSL benchmark to use in DOD BCAs, we also use restricted data from the Defense Manpower Data Center (DMDC) to distinguish casualty types and provide a range of VSL estimates to use in sensitivity analyses. The DMDC personnel records include detailed demographic information on over 6,700 US military fatalities in Afghanistan and Iraq from 2001 to 2021. The demographic breakdown of fatalities generally follows the findings of previous studies in the literature (Armey *et al.*, 2022). Fatalities are highly concentrated among young, White and enlisted males. In addition, we find that the Army and Marines account for a disproportionately large share of the overall fatality totals (73 and 22%, respectively), in contrast to the low number of fatalities (<5%) in the Air Force and Navy. Over 80% of the fatalities are categorized as being killed in action (KIA) or dying of wounds.

A variety of methods have been used in the literature to assess the VSL corresponding to different demographic characteristics (Kniesner & Viscusi, 2019; Viscusi, 2010, 2018a,

[1] A wide range of VSL estimates have been used in military applications (Armey *et al.*, 2022, Bilmes & Stiglitz, 2006, 2008, Davis *et al.*, 2006, Edwards, 2014, Greenberg *et al.*, 2021, Rohlfs, 2012, Rohlfs & Sullivan, 2013, Rohlfs *et al.*, 2015b; 2016, Viscusi, 2021b, Wallsten & Kosec, 2005). See Kniesner *et al.* (2015) and Viscusi (2019) for a review of the literature on applications of VSL to the military.

[2] We do not believe the Department of Defense should use other agencies' VSL levels to inform us in setting a value for the military. There is, for example, no standardized VSL across all civilian agencies. However, the fact that other agencies utilize VSL values, and the military does not, indicates that the military is "out of step" with how society values mortality risks in policy contexts.

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2018b). Examples include adjusting the VSL by gender, race, immigration status or job type. We advise *against* using typical demographic adjustments, such as race, gender or age, due to equity and ethical concerns (Kniesner & Viscusi, 2023). Consistent with the practices of other government agencies, the DOD could adopt a standard average VSL for all policy analyses. It is also possible to refine VSL estimates based on the affected military population. For our sensitivity analysis, we provide a range of estimates by using pay grade and income data from the DOD, in conjunction with estimates of the income elasticity of the VSL. Applying standard VSL pay grade and income adjustments to US military fatalities in Afghanistan and Iraq, we find adjusted individual VSL estimates ranging in value from $3.2 to $27.6 million per statistical life (US$2021).

In summary, we highly recommend that the DOD implement our primary VSL estimate of $11.8 million (US$2021) as the standard benchmark to use in future DOD BCAs. In addition, estimates of the VSL adjusted for pay grade and income provide a range of values to use in sensitivity analyses. Should they wish to incorporate the heterogeneity of the VSL, the DOD appears to be uniquely situated to be able to use disaggregated VSL estimates in their internal analyses. Many lives and billions of dollars are at stake and require the use of the best estimates available. We believe that the VSL estimates presented here are the most up-to-date and relevant for analysts within the DOD and strongly advocate that the DOD adopt them in future BCAs.

2. The value of a statistical life (VSL)

Historical connections and theory in the VSL literature can be traced back to Adam Smith (1776) and his discussion of compensating wage differentials in labor markets. That said, the modern-day VSL literature was largely initiated by way of military analyses in the RAND Corporation in the 1950s and 1960s. Carlson and Schelling built off the initial framework within RAND and applied their method of valuing lives toward saving Air Force pilots and casualty probabilities in their seminal work on the VSL (Banzhaf, 2014). Since the 1950s, the literature has made large advances in the method and precision in estimating the VSL.

The basic concept of the VSL is that individuals often make everyday tradeoffs between wealth or income and fatality risks. Economists then use quantified tradeoffs to calculate the implicit valuation that individuals place on their own lives. A variety of techniques (revealed preference or stated preference studies) have been used over the years to provide VSL estimates across numerous market settings (product safety risks and labor market studies) and non-market settings (environmental protections). A standard practice is to examine how much money individuals are willing to pay (or be paid) for small changes in their probability of death.

The most common method based on revealed preferences is to use labor market data to estimate the VSL of workers by studying the connection between wages and fatality risk (Kniesner *et al.*, 2012; Kniesner & Viscusi, 2019; Leeth & Ruser, 2003; Viscusi, 1993, 2018b; Viscusi & Aldy, 2003).[3] The underlying economic rationale is that workers are

[3] The predominant labor market model used to estimate the VSL is based on the wage equation

$$wage_i = \beta_0 + \beta_1 fatality\ rate_i + X_{i'}\beta_2 + \varepsilon_i, \quad (1)$$

where $wage_i$ is worker i's hourly wage rate, $fatality\ rate_i$ is the annual fatality rate for worker i's job, and $\boldsymbol{X_i'}$ is a vector of control variables including worker i's demographic characteristics such as race and gender, job type characteristics such as union membership, and occupation and regional characteristics. See Viscusi (2018a) for details.

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willing to take on more dangerous jobs, *ceteris paribus*, as long as they are paid an acceptable compensating wage differential.

As a hypothetical example, suppose Audie Murphy, a worker in the widget-making industry, is trying to decide between two identical jobs that differ only in terms of fatality risk. One of the jobs (Job A) is quite safe with a yearly workplace fatality rate of 1 per 100,000 workers. Job B, on the other hand, has a fatality rate of 2 per 100,000 workers. Mr. Murphy is willing to take on Job B only if he is offered a compensating wage differential of at least $110 per year. The implicit valuation of his own life in the example can be calculated by taking the compensating wage differential of $110 and dividing it by the additional fatality risk from Job B. Therefore, the calculation in this example can be shown as

$$VSL_{Audie\ Murphy,\ Job\ A,\ Job\ B} = \frac{\$110}{1/100{,}000} = \$11{,}000{,}000 \tag{2}$$

The example of Mr. Murphy shows the implicit valuation (or VSL) of $11 million for his own life. However, this is just one (hypothetical) case among many in the marketplace for fatality risk. The same type of calculation could be done in other labor markets with more or less fatality risk. Some examples might show relatively high VSL estimates ($20 million or more) for risk-averse, high-income individuals or low estimates ($1 million or less) among risk-seeking individuals with low incomes. In addition, economists have made similar calculations across individuals purchasing safety products, such as airbags or seatbelts, to reduce their risk of death or injury (Blomquist, 2004; Hakes & Viscusi, 2007; Rohlfs *et al.*, 2015a; Svensson, 2009).

The above types of calculations in real-world settings have led to a wide range of VSL estimates in the literature. After decades of research on the VSL across numerous markets, economists have found the most precise estimates have an average value around the $11–$12 million range (US$2021) (EPA, 2010; Kniesner *et al.*, 2012; Kniesner & Viscusi, 2019; Robinson & Hammitt, 2016; Viscusi, 2018b, 2020, 2021a, 2021b; U.S. DOT, 2016; U.S. HHS, 2016). Thus, the average individual in the United States appears to value risk reductions at a rate of about $110 to $120 for every 1 per 100,000 reductions in fatality risk. The VSL estimates for the health risk reductions just mentioned are similar to VSLs used in government agencies, including the EPA, HHS and DOT. As highlighted throughout our article, we advocate using similar estimates within the DOD.

3. A VSL for the DOD

Every year, the DOD conducts a wide variety of BCAs across the different services. The literature has shown that DOD force protection decisions involving the tradeoff between dollars spent and lives saved require the use of accurate VSL estimates in their analyses (Kniesner *et al.*, 2015). We now conceptualize a standard VSL benchmark to use in future BCAs in the DOD.

We first follow Viscusi (2018a) by using a meta-analysis of 1,025 VSL estimates from 68 different labor market studies after updating the values for inflation.[4] Table 1 shows the

[4] All values shown here in Section 3 are in USD 2021. Appendix A shows a list of the VSL studies used in the original Viscusi (2018a) meta-analysis.

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Table 1. *Distributions of VSL estimates by quantile*

	5%	10%	25%	50%	75%	90%	95%
All-set estimates							
Whole sample	−1.938	0.508	5.133	11.058	17.576	29.191	40.838
USA	−1.938	1.016	6.018	11.724	17.623	28.392	38.127
Non-USA	−2.037	0.043	1.254	8.167	17.460	29.865	72.233
USA CFOI	2.050	4.915	8.273	12.699	19.196	31.689	40.839
USA non-CFOI	−5.587	−1.980	0.655	4.618	14.841	28.381	28.381
Best-set estimates							
Whole sample	1.421	1.681	4.961	11.589	17.899	25.930	30.221
USA	1.681	2.197	5.203	11.634	15.386	21.941	25.930
Non-USA	0.094	1.421	3.785	8.979	23.473	28.640	45.065
USA CFOI	3.826	6.169	9.434	11.709	15.445	22.506	37.789
USA non-CFOI	1.526	1.681	3.861	10.326	15.386	21.941	25.930

Note: For the all-set sample, N = 1,025. For the best-set sample, N = 68.
See text in Viscusi (2018a) for details. All values in million USD 2021.

distribution of the VSL estimates by quantile.[5] Table 1 shows the all-set estimates (all estimates presented by the authors in the original articles) and the best-set estimates (estimates preferred by the authors of the original studies).[6] Further breakdowns are shown by US-specific estimates versus non-US estimates and estimates based on the Bureau of Labor Statistics (BLS) CFOI) data versus non-CFOI-based estimates.

The top panel of Table 1 shows the all-set VSL estimates, which include all reported VSL estimates in each study rather than just the best estimate. The median value for the all-set estimates for the whole sample is about $11.06 million per statistical life. As is clear from the table, there is a wide range of estimates depending on the type of data used in the analysis. The lowest value for the all-set estimates shows a VSL of about −$5.59 million for the US non-CFOI-based studies at the 5th percentile. In contrast, the VSL estimate for non-US studies at the 95th percentile is about $72.23 million. Table 1 also shows that US-based studies generally have higher median VSL estimates in comparison to their non-US-based counterparts. The median VSL estimate for US-based CFOI studies is about $12.7 million versus a value of about $4.62 million for US non-CFOI studies.

The bottom panel of Table 1 shows values for the best-set estimates from the meta-analysis. The median best-set estimate for the whole sample is about $11.6 million per statistical life. However, the range across studies is quite broad, with a low of $0.94 million

[5] That there is a distribution of VSL estimates rather than a single VSL number for all individuals does not cast doubt on the validity of these results. The variation of the VSL across studies is a combination of the two influences. Viscusi (2018a) explicitly accounts for factors such as differences in variables included and estimation techniques and discusses their respective roles. Among the key estimation differences are whether the study accounted for variables such as workers' compensation benefits and non-fatal risk levels. There are also differences in samples being examined, such as male workers or blue-collar workers only. Estimation techniques, such as instrumental variables and semi-logarithmic wage equation or linear wage equation, also matter. The role of the particular fatality risk variable used is highly influential, as estimates using the CFOI data considered here are less problematic.

[6] The "best set" designation was made by Viscusi (2018a) based on what the authors of the articles in the meta-analysis selected as their focal estimate.

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Table 2. *CFOI-based VSL estimates*

Method	VSL
Publication bias adjusted using all set data	11.4
Best set uncorrected average	**11.8**
All-set uncorrected average	13.1

Note: For the all-set sample, N = 1,025. For the best-set sample, N = 68.
See text in Viscusi (2018a) for details on the bias-corrected values. All values in million USD 2021.

for non-US studies at the 5th percentile up to about $45.06 million for non-US studies at the 95th percentile. For the best-set estimates, the median estimates are much closer in value in comparison to the all-set estimates. The median best-set estimate for US CFOI-based studies is about $11.71 million versus a value of about $10.33 million for US non-CFOI-based studies.

Because we seek to provide a benchmark VSL for the US DOD, we primarily focus on the US-based estimates that use CFOI data. The literature has shown that CFOI-based VSL studies are generally considered the gold standard in economics due to their rigor. Viscusi (2018b) provides a rationale for employing VSL estimated using CFOI data in the following short passage from his book *Pricing Lives* (page 27, see below):

> Beginning in 1992, the BLS developed the gold standard in fatality rate data through its Census of Fatal Occupational Injuries (CFOI). Instead of relying on a sample of firms and individual reports of fatalities, these data are based on a comprehensive census of all occupational fatalities, each of which must be verified using multiple sources, such as reports by the firm, death certificates, and workers' compensation records. These statistics are also available on an individual fatality basis including information about the characteristics of the worker and the fatality event. As a result, instead of assuming that all workers in the industry face the same risk, it is possible to construct risk measures based on both the industry and occupation of a worker, thus providing a more accurate reflection of the risk faced by the worker.

To maintain consistency, therefore, we focus on the results from studies using CFOI data. This narrows the range of values and restricts the analysis to the most precise estimates available in the literature. Using only CFOI-based studies from the meta-analysis, we find a publication bias-corrected estimate of $11.4 million, a mean best-set VSL of $11.8 million, and a mean all-set VSL of $13.1 million, which are shown in Table 2.[7]

Each of the VSL estimates we have been mentioning is useful in its own right and could technically provide a range of estimates to be used in sensitivity analyses. However, the

[7] One concern with some estimates that has been discussed in the economics literature is that publication selection bias may play a role in the final calculations (Viscusi, 2018a). Basically, authors may cherry-pick their estimates for publication purposes because editors are less likely to publish outlier VSL estimates, which is one reason why we might see large differences between the best-set and all-set averages. To correct for publication selection bias effects we use the bias-correction method outlined in Viscusi (2018a), which yields a mean bias-corrected VSL estimate of $11.4 million (US$2021) across all studies as shown in Table 2. The bias correction is based on a meta-regression analysis that includes the standard error of the VSL. The econometric basis for this approach is discussed in Stanley and Doucouliagos (2012).

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federal government has generally advised analysts and practitioners to use best-set estimates from the literature for their regulations and programs (EPA, 2010; U.S. DOT, 2016; U.S. HHS, 2016). To keep with standard practice, therefore, we advise using the mean best-set value of $11.8 million (US$2021) per statistical life for the vast majority of BCAs within the DOD.

4. Military fatalities and sensitivity analysis

We now consider US military fatalities in the two most recent wars – Iraq and Afghanistan. In particular, we provide a breakdown of fatalities in the two recent conflicts and present a range of VSL estimates based on data specific to pay grade and income that can be used in sensitivity analyses. While this exercise is a retrospective assessment of the mortality costs, it provides a template for how DOD could value risks prospectively. In addition, we include a discussion of the theoretical and empirical arguments (pros and cons) for adjusting the VSL across demographic traits of military personnel.

4.1 Distribution of fatalities

We now use restricted data from the DMDC to disaggregate individual casualty types within the US military.[8] The dataset includes detailed information on all DOD fatalities in Iraq and Afghanistan from 2001 to 2021. The variables in the DMDC dataset include individual-level fatality data by age, gender, race, conflict (Iraq or Afghanistan), service (Air Force, Army, Marine Corps or Navy), pay grade, various categories of casualty causes and types and compensation.

Table 3 provides summary statistics for the DMDC fatality data, and Figure 1 displays the data graphically. Our final sample includes 6,722 fatalities after cleaning the dataset for any inconsistencies.[9] We find fatalities are highly concentrated among young, White and enlisted males. For example, males comprise 98% of the fatalities in the DMDC data. Whites represent 83% of theater deaths, with Blacks and other races accounting for 9 and 7% of the fatalities, respectively. The number of fatalities in Iraq (4,398, 65%) is almost double the amount in Afghanistan (2,324, 35%). In addition, we find that the Army and Marines account for a disproportionately large share of the overall fatality totals (73 and 22%, respectively), in contrast to the low number of fatalities (<5%) in the Air Force and Navy.

Enlisted personnel dominate the fatality totals, with roughly 90% of the observations categorized as enlisted versus 10% categorized as officers. The average age for fatalities is 26 years old. However, the distribution is highly skewed, with 1,784 fatalities (27% of the overall fatality total) concentrated in the 18- to 21-year-old population age group, 2,071 (31%) in the 22–25 age group, 1,206 (18%) in the 26–29 age group, and a steady decline in

[8] The DMDC is the central data depository for personnel records within the Department of Defense. Similar data requests by authorized personnel can be made to the DMDC data request portal at: https://dmdcrs.dmdc.osd.mil/dmdcrs/public/

[9] The original dataset included detailed information on 6,723 fatalities in Iraq and Afghanistan from 2001 to 2021. One observation lacked demographic information, so we dropped it from the analysis. Our final dataset, therefore, includes information on 6,722 fatalities.

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Table 3. *Summary statistics*

	Mean	Standard deviation	Minimum	Maximum
Age	26.37593	6.656257	18	60
Male	0.978132	0.146265	0	1
White	0.838441	0.3680732	0	1
Black	0.091342	0.2881161	0	1
Other race	0.070217	0.2555317	0	1
Iraq	0.65427	0.4756412	0	1
Afghanistan	0.34573	0.4756412	0	1
Air Force	0.022464	0.1481965	0	1
Army	0.734305	0.4417353	0	1
Marine Corps	0.217644	0.4126744	0	1
Navy	0.025588	0.1579133	0	1
Enlisted	0.895567	0.3058444	0	1
Officer	0.104433	0.3058444	0	1
Hostile	0.808539	0.3934802	0	1
Non-hostile or pending	0.191312	0.3933635	0	1
Casualty type				
Accident	0.116483	0.3208273	0	1
Died of wounds	0.195329	0.3964831	0	1
Killed in action	0.612169	0.4872919	0	1
Self-inflicted	0.049093	0.2160773	0	1
Other casualty type	0.026927	0.1618807	0	1
Cause of casualty			0	1
Explosion	0.195478	0.3965974	0	1
Gunshot	0.221363	0.415195	0	1
Multiple trauma	0.27224	0.4451461	0	1
Other causes or unknown	0.310919	0.4629043	0	1

Note: Data for this table are taken from DMDC records for all fatalities in Iraq and Afghanistan from 7 October 2001 through 21 December 2021.
N = 6,722.

the fatality totals until the age 40 years and above group, which had a total of 370 fatality observations (6%).

As a comparison, a 2023 DOD report shows that the distribution of fatalities we have been discussing does not match the general demographic composition of the US military (U.S. DOD, 2023). The age distribution of the US military is reported as: 25 years and younger (39%), 26–30 years (20%), 31–35 years (16%), 36–40 (13%), and 41 years or older (12%). In terms of gender, males comprise 81% of the total DOD military force. With respect to race, Whites and Blacks represent 70 and 17% of the force, respectively. Enlisted personnel comprise 82% of the force. More recent data from a 2025 DOD report indicate military

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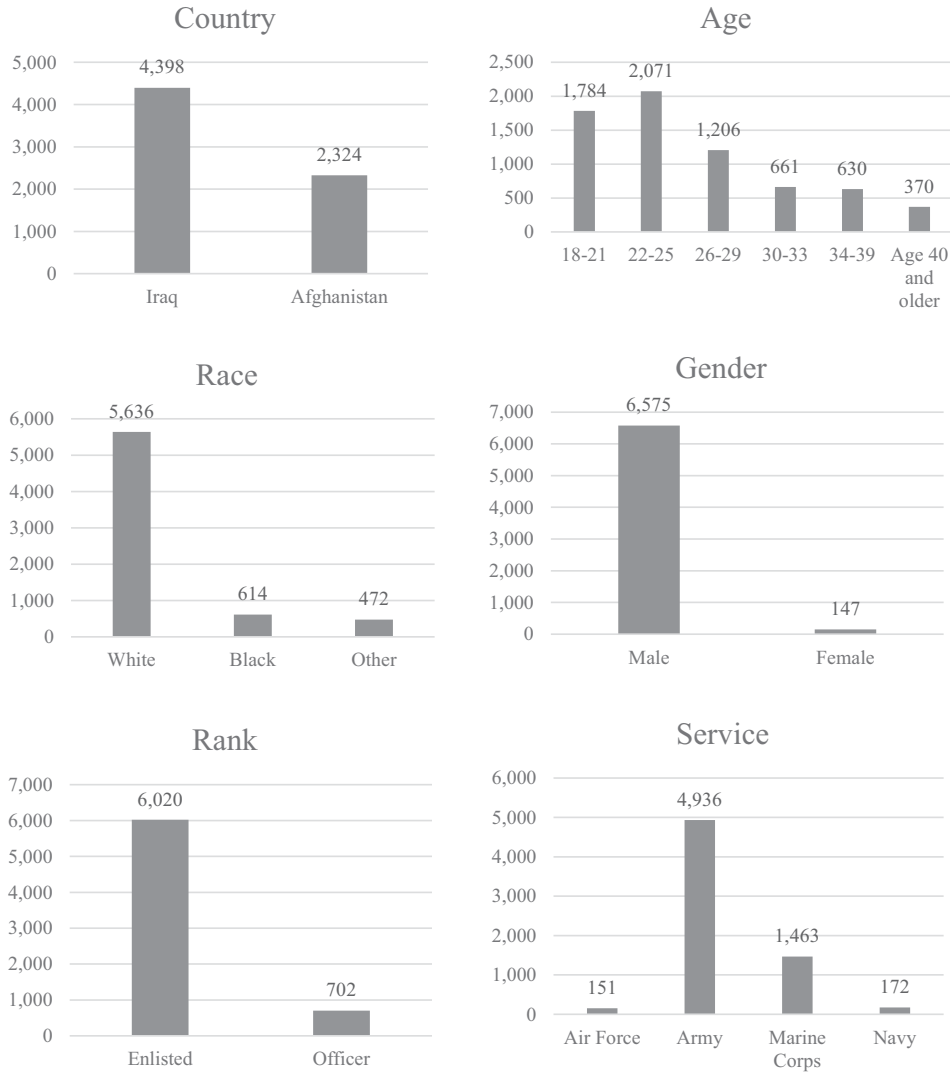


Figure 1. US fatalities in Iraq and Afghanistan by demographic. Note*: Data for the figure are taken from DMDC records from 7 October 2001 through 21 December 2021.*

personnel are distributed across the services as follows: Army (45%), followed by the Air Force (23%), Navy (19%), Marine Corps (10%), and Space Force (4%) (U.S. DOD, 2025).

Over 80% of the fatalities are categorized as a "Hostile" fatalities. As for the type of fatality, we find 61% of the observations are listed as KIA, 20% are listed as died of wounds, 12% were accidents, 5% were self-inflicted, and 3% were in the "other" category. In terms of causes, 20% were due to an explosion, 22% were due to gunshots, 27% were listed as multiple trauma, and 31% were listed as "other causes or unknown."

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4.2 Adjusting the Military VSL by pay grade and income

Previous research has shown that higher (or lower) incomes or wealth can change the VSL calculations (Viscusi, 2018b), as there is a positive income elasticity of the VSL. Government agencies, such as the DOT and HHS, have advocated updating the VSL across time periods by using inflation and earnings adjustments and not by inflation levels alone.[10] Overall, the VSL income elasticity literature has shown that the US income elasticity values generally range from 0.6 to 1.4. The range is based on estimates in Kniesner *et al.* (2010) and the meta-analyses in Viscusi and Aldy (2003), Viscusi and Masterman (2017), and Masterman and Viscusi (2018). To undertake a sensitivity analysis of how the military VSL might vary, it is possible to adjust the military VSL depending on the income level of the DOD personnel.

One unique feature of the DMDC data is the availability of basic pay data that are linked in from the financial accounting system in the DOD.[11] Notably, the DMDC pay data are person-specific (not pulled from generic pay tables). Table 3 shows the DMDC pay data merged into the same military fatality dataset. The key difference is that there were 81 observations missing the basic pay variable for the time period we studied. Therefore, there is only basic pay information on 6,641 observations in comparison to the 6,722 observations as shown in Table 2. The data include the last basic monthly pay for the service members before their death. We multiply the monthly value by 12 to calculate the annual basic pay. All basic pay data are updated to USD 2021.

Table 4 details fatality totals and annual basic pay averages for military personnel, broken down by pay grade. Pay grades E01 (equivalent to a private) through E09 (equivalent to a command sergeant major) describe the enlisted pay grade data. Pay grades O01 (equivalent to a second lieutenant) through O07 (equivalent to a brigadier general) describe the officer data. Pay grades W01 (warrant officer 1) through W05 (chief warrant officer 5) describe the warrant officer data.

Fatality totals are heavily weighted toward the lower pay grades, with 72% (4,792/6,641) of the fatalities at the pay grade of E5 (equivalent to a sergeant) or below. In contrast, only two general officers were in the fatality totals. In terms of average annual basic pay, the dollar values range from a low of $19,488 for E1s up to $166,009 per year (US$2021) for the O7 general officer rank. The average annual basic pay for all 6,641 observations is $34,838 (US$2021).

[10] For reference, the U.S. DOT (2016) guidance uses an income elasticity adjustment of 1.0 in their VSL calculations. The following formula (see pages 8–9 in the DOT guidance) is used to update VSL estimates across time periods:

$$\mathrm{VSL}_T = \mathrm{VSL}_0[(P_T/P_0)(I_T/I_0)^e], \tag{3}$$

where
0 = original base year,
T = updated base year,
P_T = price index in year T,
I_T = real incomes in year T,
e = income elasticity of VSL.

[11] Other pay variables from the DMDC were available as well, including information on special pays, bonuses, and basic allowance for housing (BAH). Unfortunately, the other pay variable data appears to be wildly inaccurate due to missing observations and possible miscoding. After discussions with DMDC analysts, we deemed the so-called other pay data to be unreliable and left them out of the analysis.

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Table 4. *Income-adjusted life valuation (all values shown are in US$2021)*

Pay grade	Fatalities	Average annual basic Pay salary	VSL (in millions of dollars)
E01	48	$19,488	$3.24
E02	299	$22,779	$3.79
E03	1,436	$24,301	$4.04
E04	1,842	$27,765	$4.62
E05	1,167	$33,509	$5.57
E06	776	$40,875	$6.80
E07	280	$49,022	$8.16
E08	75	$59,219	$9.85
E09	24	$69,644	$11.59
O01	66	$43,077	$7.17
O02	163	$52,738	$8.77
O03	213	$72,881	$12.12
O04	78	$85,125	$14.16
O05	39	$102,338	$17.02
O06	9	$124,109	$20.65
O07	2	$166,009	$27.62
W01	6	$48,028	$7.99
W02	71	$56,949	$9.47
W03	29	$68,073	$11.32
W04	14	$82,322	$13.70
W05	4	$102,990	$17.13
Total fatalities:			**6,641**
Weighted average VSL (in millions of dollars):			**$5.80**

Note: We use the $11.8 million best-set VSL from Table 2 for our baseline value.
We use a 1.0 income elasticity to adjust the VSL estimates by income.
We use a baseline GNI of $70,930 taken from The World Bank (2021).
We include all observations that had basic pay data available in this analysis.
Data for this table are taken from DMDC records for all fatalities in Iraq and Afghanistan from 7 October 2001 through 21 December 2021.

In Table 4, we convert the average annual basic pay data into VSL values using an income elasticity of 1.0, which is in the estimated income elasticity range, is analytically convenient and has been used by government agencies (U.S. DOT, 2016). Other assumptions include using a US gross national income per capita of $70,930 (The World Bank, 2021) as a comparison income value and a baseline VSL of $11.80 million from our best-set uncorrected average estimate that we advocate in Table 2 below. The basic pay VSL values range from $3.24 per million for the E01 pay grade up to $27.62 million per statistical life (US$2021) at the O07 pay grade. The 6,641 observations in the fatality sample have a weighted average VSL of $5.80 million per statistical life (US$2021).

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In addition to the estimates provided in Table 4, we examined a variety of robustness checks with the basic pay data. One limitation of using the basic pay data is that some of the observations appear to be outliers. To address concerns over outliers, we limit the observations to only include those pay levels within the bounds of the 2021 military basic pay chart values (DFAS, 2021).

Using the sorting mechanism just described, we use a lower-bound basic pay cutoff of $1,650.30 per month (or $19,803.60 per year) and an upper-bound cutoff of $16,608.30 per month (or $199,299.60 per year). The lower-bound cutoff ($19,803.60) is taken from E1s with <4 months of service, and the upper-bound cutoff ($199,299.60) is taken from O10s with 40 years of service. Our method eliminates one high-end observation ($357,542.70) and 464 low-end observations, leaving a total of 6,176 observations with an average annual basic pay salary of $36,660.94. The weighted average VSL is $6.10 million per statistical life (US$2021) using pay-grade bounds.

Another concern with the estimates presented in Table 4 is that they only include the basic pay component of overall compensation. It is well known that military personnel have many other compensation components (bonuses, tax savings, basic allowance for housing and other special pays), which on balance exceed the fringe benefits for the private sector. As a result, the values from Table 4 should be taken as *lower-bound* estimates of the military VSL, both in absolute terms and relative to the VSL in the private sector.

Studies in the VSL literature do not consider the full value of fringe benefits. Although wage equations estimates often include industry and occupation dummy variables that will be correlated with fringe benefits, and some studies include workers' compensation benefits, these are only partial adjustments. Regardless of the equation specification, the question researchers are attempting to resolve is the overall rate of tradeoff between fatality risks and money, including wages and the value of fringe benefits. Non-wage benefits can be quite substantial, as the private fringe benefit rate is about 30% of total employee compensation (BLS, 2025).

Another consideration for the estimates provided in Table 4 is how the values might change when using different income elasticities. The main estimates that we provide use an income elasticity of 1.0 (U.S. DOT, 2016). As discussed previously, income elasticity estimates from the literature generally range from 0.6 (Viscusi & Aldy, 2003) to 1.4 (Kniesner *et al.*, 2010). Using an income elasticity of 0.6 increases the weighted average VSL in Table 4 to $7.70 million per statistical life, and using a 1.4 elasticity decreases the weighted average VSL to $4.36 per statistical life (US$2021).[12]

We also include a variety of robustness checks, including separate analyses across pay grades, elasticity adjustments, and the inclusion of fringe benefits in the VSL calculations. The primary military VSL estimates, as presented in Table 4, range from a low of $3.24 million for the E01 pay grade up to $27.62 million for the O07 pay grade, with a weighted average value of $5.80 million per statistical life for all observations. Due to the many different ways researchers might adjust the VSL, Table 4 highlights the importance of using a range of VSL estimates in sensitivity analyses for any DOD BCA.

[12] As discussed in footnote 10, inflation and income elasticities can be used to adjust the VSL. The base VSL used here is updated for inflation and set at $11.8 million as highlighted previously. In addition, we use a GNI value of $70,930 from The World Bank (2021), and the average basic pay for military personnel in the DMDC fatality dataset is $34,838. Thus, the equation to adjust VSL based on income elasticity is $VSL_T = VSL_0[(I_T/I_0)^e]$. Using a 0.6 income elasticity increases the VSL to $11,800,000[($34,838/$70,930)$^{0.6}$] = $7.70 million. When using a 1.6 income elasticity, the VSL decreases to $11,800,000[($34,838/$70,930)$^{1.4}$] = $4.36 million.

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4.3 Discussion

Our calculations emphasize that the types of fatalities in military settings (young, heavily male-dominated) do not appear to closely resemble the typical distribution of deaths displayed in the rest of society. Results presented here lead to several theoretical and empirical questions. For example, is it ethical to value one group of individuals in society at different levels in comparison to others? How does equity play a role in the valuations? Should combat training and capabilities be considered in the valuations? Are there other characteristics that should be considered when adjusting the military VSL? The questions just posed require us to delve further into the VSL literature.

Due to equity and ethical concerns, we generally advise against using demographic characteristics to adjust the military VSL. Historically, government regulations have generally not adjusted the VSL by use of demographic traits.[13] Although most of the current government guidelines require the use of an invariant population-wide VSL, it is possible that changing regulations could require demographic adjustments of the VSL in future BCAs, assuming that the demographic distribution of mortality reductions can be estimated ex ante. We, therefore, now discuss various options and review the literature for these possible adjustments for future researchers in this section.

As shown in Section 4.2, adjusting the VSL by pay grade and income can lead to different VSL estimates for military members. Notably, using pay grade and income adjustments is the only consideration we currently advocate for in sensitivity analyses. That said, other characteristics (mainly demographic adjustments) have been used in the past to adjust in previous research (Viscusi, 2010). One such consideration is age (Aldy & Viscusi, 2008; Kniesner & Viscusi, 2019, 2023; Kniesner *et al.*, 2006; Murphy & Topel, 2006; Robinson *et al.*, 2021b; Viscusi & Aldy, 2007; Viscusi, 2018b, 2020, 2021b, 2021c).

A commonly used way to adjust the VSL by age is the inverse-U age-related distribution of the VSL (Aldy & Viscusi, 2008), which accounts for differences in valuations stemming from age variations in wealth, family obligations and life expectancy. The VSL follows an inverted-U shape (or hump shape) over the course of people's life cycles. More specifically, the VSL increases as people age up until around mid-life and then declines as they approach old age. As a practical example, we apply the inflation-adjusted values from Aldy and Viscusi (2008) to military fatalities in Appendix B. We find adjusting the military VSL estimates by age creates a range of values from $7.99 to $10.29 million (US$2021) per statistical life.

Another consideration is race. The DMDC data show that 84% of the military fatalities in Iraq and Afghanistan are White. Blacks and other races represent only 9 and 7% of the military fatalities, respectively. As a comparison, Whites represent 76% of the general population, and Blacks represent 14% of the general population (U.S. Census Bureau, 2021).

The literature has shown that Whites generally have higher VSLs in comparison to Blacks (Viscusi, 2003). Part of the reason is a difference in labor market opportunities, as the market opportunities locus for Blacks is flatter and lower than for Whites. Additionally, Black workers typically work fewer hours at lower wages on average, resulting in much lower

[13] One notable exception is when the EPA used an age-adjusted VSL in their 2003 analysis of the Clear Skies Initiative. In that example, the EPA initially discounted the lives of the elderly by 37% in their analysis. The EPA only changed its discount policy after an outcry from senior citizen advocacy groups. Since then, the EPA has not made any VSL age adjustments for the topic. See Viscusi (2018b) and Kniesner *et al.* (2023) for details.

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VSLs. On the extreme end, some estimates indicate that the VSL for Whites may be as much as twice as high as that for the Black population (Viscusi, 2003). Adjusting the military VSL by race, therefore, would increase the values since the DMDC data show higher White fatality totals in the military in comparison to the general population. Once again, to be clear, we do not support adjusting the military VSL by race due to equity concerns.

The gender composition of the fatalities is another possible consideration. The DMDC data indicate that males comprise 98% of military fatalities in the wars in Iraq and Afghanistan. It is possible that adjusting the military VSL by gender could alter the values. However, the literature shows a mixed picture for VSL differences across genders, with a wide range of estimates – some showing differences and others indicating none (Hersch, 1998; Leeth & Ruser, 2003; Viscusi, 2004).

Leeth and Ruser (2003) estimate VSL differences by gender using standard labor market regressions. They find mixed results with some point estimates indicating a VSL premium for women and others showing no premium. Notably, the largest VSL premium for women is more than double that of men (Leeth and Ruser, 2003). Hersch (1998) analyzes the value of statistical injury estimates using labor market data and finds little to no difference in the valuations between males and females for blue-collar workers. Lastly, Viscusi (2004) uses BLS and Current Population Survey data to estimate the VSL for both men and women. He finds a VSL of $7.0 million for blue-collar males, and $8.5 million for blue-collar females (US$1997) – indicating a 21% VSL premium for females in that study.

In contrast to the results in Leeth and Ruser (2003) and Viscusi (2004), a number of factors could be used to justify a lower VSL for females. Women often work in much safer jobs in comparison to men, and there is no danger heterogeneity comparable for women as there is for men. To the extent that women are out of the workforce and have lower incomes, this could lead to lower VSL estimates. In our view, there is not enough evidence (even setting aside equity concerns) in the VSL literature to justify adjusting the values by gender. Therefore, adjusting the military VSL by gender should not be used in sensitivity analyses.

Previous research has documented how the type of death may also play a role in the calculations. Particularly dreadful deaths may command a VSL premium – meaning people are willing to pay more, *ceteris paribus*, to avoid dreadful deaths in comparison to more common deaths, such as car accidents. For example, cancer deaths have been shown to have a VSL premium of about 21% in comparison to other death types (Viscusi *et al.*, 2014). Other VSL premiums have been found with deaths associated with severe acute respiratory syndrome, terrorism and deaths related to influenza (Gyrd-Hansen *et al.*, 2008; Liu *et al.*, 2005; Robinson *et al.*, 2010; Viscusi, 2009). The studies indicate people are generally willing to pay more to avoid dreadful deaths. Should we consider military deaths as a dreaded type?

It is possible that military deaths might command a dread premium, but the answer to that question is highly uncertain. It largely depends on how closely related military death types might be to others in the literature and what the expectations of the military and the general public are with respect to these risks. For example, terrorism deaths have been shown to have a VSL premium of roughly two times that of normal deaths (Robinson *et al.*, 2010; Viscusi, 2009). It can be argued that many military deaths closely resemble terrorism deaths. The DMDC cause of casualty data (see Table 3) show explosions make up 20% of fatalities, and gunshots make up 22% of fatalities in Iraq and Afghanistan. If one considers these closely related to terrorism type deaths, then it would justify a VSL premium based on past estimates in the literature. However, the nature of the dread may differ. A principal difference of

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terrorism valuations by the citizenry versus similar types of mortality risks faced by the military is that the public may have less familiarity with respect to what are likely to be more novel and unexpected risks. In contrast, the military in combat zones is more likely to consider explosions and gunshots as potential hazards, which would affect the psychological aspects that affect dread. There is also a large number of "other causes or unknown" deaths (31%) in the DMDC data. Some of the deaths from unknown causes could involve extreme outcomes, such as being captured and tortured by victims in the military. Especially gruesome types of deaths would almost certainly justify a VSL premium given the extreme suffering involved.

In contrast, a recent working paper by Greenberg *et al.* (2021) suggests the military VSL should be discounted in comparison to the population average VSL. In that article, the authors used reenlistment data on roughly 430,000 US Army soldiers to examine the tradeoff of wealth and mortality risk for military members. They find average VSL estimates for military personnel based on the tradeoff between reenlistment bonuses and fatality risk ranging from $500,000 to $900,000. The Greenberg *et al.* (2021) estimates suggest that the military does not appear to need as much compensation to take on fatality risks as the population at large. Whether the military views reenlistment bonuses as different from the annual income based on regular pay is not clear. Also, a difference in revealed VSL levels is hardly surprising given the general commitment by service members to sacrificing for their country and a strong focus on patriotism within the ranks. If the estimates in Greenberg *et al.* (2021) are accurate, then the implicit personal VSL valuations of military members would be an order of magnitude lower than those found in the general economics literature and the levels used for all other governmental efforts.

A more complex question is whether DOD should consider external benefits to society in valuing military personnel. As an example, in 2011, a group of 15 US Navy Sea, Air and Land (SEAL) operators from Team Six's Gold Squadron died in a helicopter crash in Afghanistan (Pruitt, 2018). Of note, SEAL Team Six is the same unit that conducted the raid on Osama bin Laden's compound in Pakistan. Therefore, they are some of the most highly trained military personnel in the world. The training and expertise of uniquely highly trained military members almost surely make them more valuable than the standard VSL estimates found in the literature. Should the DOD take this into consideration when applying VSL estimates for BCAs?

The applicable VSL does not change. The relevant VSL for valuing the mortality risk to the military remains the same. However, when undertaking the BCA for a risk situation, other costs that are averted by reducing the mortality risk are consequential. If a reduction in deaths to those in armored vehicles is also accompanied by a reduction in costs because the vehicles are not damaged, the benefit from the risk reduction should be included. Similarly, if the reduced risk to the military leads to a reduction in training costs or a reduction in the costs of relocating personnel, that value should enter the BCA. As an asset, the years of training for high-level operators could justify a higher value for them in a standard BCA. However, using such an adjustment would be a step away from the typical guidance used in other US government organizations. Most of the estimates used by DOT, HHS, and EPA are based solely on the personal willingness-to-pay or willingness-to-accept estimates to avoid risk. They do not include a premium for additional societal benefits. However, the reduction in costs due to decreases in the mortality risks to the military may be more evident and straightforward to compute. Further research is needed to provide a more detailed exploration of the feasibility and desirability of such further adjustment.

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The size of the risk factor is another variable to consider for military personnel. Most of the estimates in the VSL literature are calculated by analyzing small changes in fatality risk for wealth or income. As discussed in Section 2, an average person in the United States is typically willing to pay about $110–$120 for every 1 in 100,000 reduction in fatality risk. This equates to a standard $11–$12 million VSL. However, estimates can change dramatically depending on the size of the risk factor (Alolayan *et al.*, 2017; Eeckhoudt & Hammitt, 2001, 2004; Hammitt, 2020; Kaplow, 2005; Robinson *et al.*, 2021b). For example, most people are not willing to pay $1.1 million to reduce their fatality risk by 1 in 10 (equating to a similar $11 million VSL). The reason is straightforward: budget constraints become much more restrictive at a 1 in 10 fatal risk reduction level for most ordinary citizens.

As a practical matter, the literature has generally found that the size of the risk factor does not change the calculations until fatality risks reach around 1 per 1,000 (Hammitt, 2020; Robinson *et al.*, 2021b). Most military personnel do not face this high a risk level, even in combat units. For example, Armey *et al.* (2022) found US military personnel on average increase their fatality risk by 45 per 100,000 when deployed to Iraq or Afghanistan – a far cry from the risk levels needed to cause any kind of distorted VSL calculations. However, some of the more elite units (Delta Force, SEAL Team 6) often have much higher fatality risks in comparison to regular units. Baffer (2020) found Navy SEAL personnel deployed to Iraq or Afghanistan had a total likelihood of death of 800 per 100,000. Therefore, it appears that some of the elite units in the DOD are beginning to approach the 1 in 1,000 fatality risk threshold as outlined in previous VSL research. Therefore, the VSL for some personnel might be lower if adjusted for higher risk factors.[14]

As just discussed, there are a large number of variables that could be used to adjust the military VSL based on previous research. Although some of the adjustments just mentioned could be justified on empirical grounds, our view is that ethical and equity concerns outweigh the possible benefits of using a modified VSL. Thus, we generally advise against using demographic characteristics to adjust the military VSL. For sensitivity analyses, we advise using the range of VSL estimates provided in Table 4 that focus on pay grade and income adjustments.

In addition to the VSL estimates provided here, we introduce a case study in Appendix C for practitioners to use as an example for how to value the statistical lives lost in military BCAs. Specifically, the case study emphasizes calculating the mortality costs of lost US military personnel in the recent military conflicts in Iraq and Afghanistan. The case study highlights how mortality cost estimates can vary significantly due to a variety of assumptions used in the analysis, such as different data sources, timelines, and contrasting VSL estimates. The best point estimates available show a total mortality cost of $79 billion (US $2021) for the wars in Iraq and Afghanistan from 2001 through 2021 (see Appendix C for details).

[14] A related issue is that in-theater military can have combat or non-combat (supportive) roles. In both cases, we would use the same VSL. In the case of a combatant's death, there is an additional cost to the military in terms of mission disruption. Thus, combatant death reduction produces a separate benefit that should be taken into account when estimating the value of mortality risk reduction. So, the overall benefit of reducing mortality risks for those in combat roles includes both the VSL of those for whom the risk has been reduced, as well as any additional cost savings for DOD. We thank the referee for pointing out the issue of fatality risk in combat versus non-combat roles.

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5. Conclusion

For years, analysts in the US DOD have rarely used estimates of the VSL in policy assessments, and when they did, they have had to rely on outside VSL estimates for their internal BCAs – borrowing VSL benchmarks from other agencies such as the EPA or DOT. It is unclear whether other agencies' benchmark values are appropriate for military personnel. Given the size of the DOD and its unique mission, it makes sense that they should have a standard VSL benchmark in place for their own personnel and internal BCAs. This requires the use of accurate VSL estimates directly related to the DOD in BCA analyses.

Here we have reviewed theory and evidence from the VSL literature and provided a benchmark VSL to use in future DOD BCAs. In addition, we have provided a range of estimates (adjusting the VSL by pay grade and income) for use in sensitivity analyses. Our findings indicate the pay grade and income-adjusted VSL estimates range in value from $3.2 to $27.6 million per statistical life. Although we find a wide range of estimates depending on fatality type and method, our preferred estimates are obtained from CFOI-based studies. Using the recommended sorting criteria, we find a mean best-set VSL estimate of $11.8 million (US$2021). For analysts and practitioners, we strongly advocate using the mean best-set VSL estimate of $11.8 million as a benchmark for the vast majority of BCAs within the DOD.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/bca.2025.10045.

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Appendix B: Adjusting the military VSL by age

A variety of demographic characteristics (gender and race) have been used to adjust the VSL over the years. Notably, adjusting the VSL by age is one of the most common modifications found in the literature (Aldy & Viscusi, 2008; Kniesner & Viscusi, 2019; Kniesner *et al.*,

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2006, 2023; Murphy and Topel, 2006; Robinson *et al.*, 2021b; Viscusi & Aldy, 2007; Viscusi, 2018b, 2020, 2021b, 2021c). In this section, we show a practical example of how researchers might use age to change their calculations.

One of the most common techniques used to adjust the VSL by age is the inverse-U technique. Aldy and Viscusi (2008) provide a standard outline for how researchers might adjust the VSL values by age when using the inverse-U technique. We follow their work as a basis for the age-adjusted analysis below.

Aldy and Viscusi (2008) use standard labor market regressions (regressing wages as a function of job market fatality risk and a vector of control variables) to back out VSL estimates by age. They use five different age categories in their primary analysis (18–24, 25–34, 35–44, 45–54, and 55–62 years old). In addition, they provide both Cross-section and Cohort-adjusted VSL estimates. Regardless of the method used, Aldy and Viscusi (2008) produces VSL estimates that follow an inverted-U-shaped pattern across the age groups.

For the Cross-section results, Aldy and Viscusi (2008) find a $3.74 million VSL for the 18–24 age group, $9.43 million for the 25–34 age group, $9.66 million for the 35–44 age group, $8.07 million for the 45–54 age group, and a $3.43 million VSL for the 55–62 age group (US$2000). As for the Cohort-adjusted values, Aldy and Viscusi (2008) find a $3.80 million VSL for the 18–24 age group, $6.00 million for the 25–34 age group, $7.50 million for the 35–44 age group, $7.57 million for the 45–54 age group, and a $5.75 million VSL for the 55–62 age group (US$2000).

In Table B1, we update the Aldy and Viscusi (2008) age-adjusted VSL values into 2021 dollars and group the DMDC fatality data into similar age bins. The DMDC data show that the number of fatalities is highly grouped into the younger age categories. The 18–24 age group has a total of 3,403 fatalities, the 25–34 group has 2,450, the 35–44 group has 737, the 45–54 group has 119, and the 55–62 age group only has 13 fatalities.

Panel A in Table B1 shows the main Cross-section values for military personnel lost in Iraq and Afghanistan. The far right column shows the total life value lost for each of the respective age bins. The 25–34 age bin shows a total life lost value of around $36 billion. The smallest value is shown in the 55–62 age bin with a loss of life of $70 million. The total life value lost for all age bins using the Cross-section results is $69 billion. The final weighted average, age-adjusted VSL is $10.29 million per statistical life.

Panel B in Table B1 shows the cohort-adjusted values. Similar to the cross-section results, the cohort-adjusted values indicate the 25–34 age bin has the largest life value lost ($23 billion) among the different age bins. Next is the 18–24 age group with a total life value loss of around $20 billion. The age bin with the lowest life value lost ($118 million) is the 55–62 age group. The total life value lost for all age bins using the cohort-adjusted results is $54 billion. The final weighted average, age-adjusted VSL for the cohort-adjusted results is $7.99 million per statistical life. After adjusting the values by age, we find the total life value lost in the Iraq and Afghanistan wars is between $54 and $69 billion, with a weighted average value of $7.99–$10.29 million per statistical life.[15]

[15] The values are only for fatalities and do not include non-fatal injury valuations. In addition, the values do not adjust for earnings changes over time. If earnings are included in the adjustments, the numbers are increased. For example, using a 1.0 income elasticity adjustment increases the weighted average values to $8.80 million for the cohort-adjusted results and $11.33 million for the cross-section results.

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Table B1. *Age-adjusted military VSL (US$2021 millions)*

Age group (years)	Age-adjusted VSL (million USD 2021)	Fatalities	Total life value (million USD 2021)
Panel A: Aldy and Viscusi (2008) Cross-section values			
18–24	$5.89	3,403	$20,027
25–34	$14.84	2,450	$36,355
35–44	$15.20	737	$11,203
45–54	$12.70	119	$1,511
55–62	$5.40	13	$70
Total life value (million USD 2021):			**$69,167**
Total fatalities:			**6,722**
VSL average (million USD 2021): total life value/total fatalities			**$10.29**
Panel B: Aldy and Viscusi (2008) Cohort-adjusted values			
18–24	$5.98	3,403	$20,349
25–34	$9.44	2,450	$23,132
35–44	$11.80	737	$8,698
45–54	$11.91	119	$1,417
55–62	$9.05	13	$118
Total life value (million USD 2021):			**$53,713**
Total fatalities:			**6,722**
VSL average (million USD 2021): total life value/total fatalities			**$7.99**

Appendix C: Case study of US military fatalities in Iraq and Afghanistan

As with any military operation, the cost of the wars in Iraq and Afghanistan includes standard budgetary costs as well as the loss of human life. Previous research has attempted to quantify total costs using a wide range of assumptions and methods (Bilmes & Stiglitz, 2006, 2008; Crawford, 2017, 2023; Davis *et al.*, 2006; Edwards, 2014; Nordhaus, 2002; Viscusi, 2019; Wallsten & Kosec, 2005). Estimates include detailed accounts of various costs, including personnel costs, military hardware, medical care, and macroeconomic effects. Here we focus our attention on a critical component of the overall cost puzzle – the cost of US military fatalities in Iraq and Afghanistan. What follows is effectively a case study for practitioners to use for calculating the value of lives lost in future military BCAs.

Table C1 shows the total mortality cost of the wars in Iraq and Afghanistan for US military personnel using VSL estimates provided here. The table displays US military fatality totals from 7 October 2001 through 21 December 2021. Our preferred estimates in Panel A use an $11.80 million VSL from the best-set uncorrected average results as shown in Table 2. Multiplying the $11.80 million value by the number of US military fatalities across conflicts (4,398 in Iraq and 2,324 in Afghanistan) provides an aggregate mortality cost of $51.90 billion for the Iraq War, $27.42 billion for the war in Afghanistan, and a total mortality cost of $79.32 billion for the combination of both wars.

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Table C1. *Total mortality cost of the wars in Iraq and Afghanistan*

	Iraq war	Afghanistan war	Total mortality cost
Panel A: Average VSL cost estimates			
US military fatalities	4,398	2,324	6,722
VSL (in millions)	$11.80	$11.80	$11.80
Total mortality cost (in billions)	**$51.90**	**$27.42**	**$79.32**
Panel B: Income-adjusted VSL cost estimates			
US military fatalities	4,398	2,324	6,722
VSL (in millions)	$5.80	$5.80	$5.80
Total mortality cost (in billions)	$25.51	$13.48	$38.99

Note: Data for the above table are taken from DMDC records for all fatalities in Iraq and Afghanistan from 7 October 2001 through 21 December 2021. All values shown are in US$2021.
Panel A estimates obtained from Table 2 and Panel B estimates from Table 4 here.

Panel B in Table C1 uses the income-adjusted VSL estimate of $5.80 million from Table 4 as a basis for the overall mortality cost of the wars. As a comparison, the income-adjusted results in Panel B are roughly half of the values shown in Panel A. The income-adjusted results show a mortality cost of $25.51 billion for the Iraq War, $13.48 billion for the Afghanistan War, and $38.99 billion for both wars combined.

The estimates provided in Table C1 detail how adjusting the VSL can have a dramatic impact on the overall totals. The overall values for both wars range from a low of $38.99 billion to a high of $79.32 billion. The driving force for the differences is directly related to how practitioners might adjust the VSL. We recommend future researchers use a range of VSL estimates in their sensitivity analyses, similar to the example shown here.

A comparison of our estimates with those found in the general economics literature is shown in Table C2. Panel A shows the mortality cost estimates for the wars in Iraq and Afghanistan from previous studies. The early Iraq War studies, such as Wallsten and Kosec (2005) and Davis *et al.* (2006), had to use strong assumptions about how the war might play out in terms of fatalities.[16] The two studies estimated US military fatalities in Iraq would be between 4,000 and 5,846 by the end of the war. Notably, the early fatality projections appear to have been quite accurate given the uncertainty of combat. As a comparison, our final fatality total for US military personnel in Iraq was 4,398 (see Panel B in Table C1). Furthermore, the early studies all used similar VSL estimates in the $6–$7 million range, which resulted in the final projected total mortality cost for Iraq being in the $28 billion (US $2003)–$38 billion (US$2005) range.

The NBER working paper by Bilmes and Stiglitz (2006) provides a detailed cost breakdown for the war in Iraq, roughly 3 years into the conflict. For the mortality cost estimates, Bilmes and Stiglitz (2006) assumed a $6.5 million (US$2005) VSL. Their medium war scenario (5-year occupation) estimated a total of 4,462 fatalities with a total

[16] We are unaware of any early mortality cost estimates for the war in Afghanistan. This is likely due to the speed of the military operation for that conflict. The deployment of troops to Iraq was more delayed in comparison to Afghanistan, and planning took more time, allowing for the development of more rigorous academic studies on the Iraq War. Mortality cost estimates for Afghanistan did not take place until far later in the conflict.

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Table C2. *Mortality cost estimates of the wars in Iraq and Afghanistan*

Authors	War	Time period	VSL	US military fatalities	Total mortality cost
Panel A: Previous literature					
Wallsten and Kosec (2005)	Iraq	2003–2015	$6.5 million (US$2005)	5,846[a]	$38 billion (US$2005)
Davis *et al.* (2006)	Iraq	2003–2008	$6.9 million (US$2003)	4,000	$28 billion (US$2003)
Bilmes and Stiglitz (2006)	Iraq	2003–2015	$6.5 million (US$2005)	4,462[a]	$29 billion (US$2005)
Bilmes and Stiglitz (2008)	Iraq and Afghanistan	2001–2017	$7.2 million (US$2007)	8,889[a]	$64 billion (US$2007)
Edwards (2014)	Iraq and Afghanistan	2001–2010	$9.2 million (US$2008)	5,376	$49 billion (US$2008)
Viscusi (2019)	Iraq	2003–2019	$8.9 million (US$2010)	6,229[a]	$57 billion (US$2010)
Viscusi (2019)	Afghanistan	2001–2019	$8.9 million (US$2010)	4,142[a]	$38 billion (US$2010)
Viscusi (2019)	Iraq and Afghanistan	2001–2019	$8.9 million (US$2010)	10,371[a]	$95 billion (US$2010)
Panel B: This study					
Kniesner *et al.* (2025)	Iraq	2003–2021	$11.8 million (US$2021)	4,398	$52 billion (US$2021)
Kniesner *et al.* (2025)	Afghanistan	2001–2021	$11.8 million (US$2021)	2,324	$27 billion (US$2021)
Kniesner *et al.* (2025)	Iraq and Afghanistan	2001–2021	$11.8 million (US$2021)	6,722	$79 billion (US$2021)

[a]Indicates US contractors were included with US military fatality totals.

mortality cost of $29 billion (US$2005). A follow-up book by Bilmes and Stiglitz (2008), titled *The Three Trillion Dollar War*, extended the work of their previous NBER working paper. However, in their 2008 work, the authors updated their numbers to include new cost estimates for Afghanistan and more up-to-date fatality estimates for Iraq. Furthermore, they used a $7.2 million (US$2007) VSL for their final calculations in comparison to the $6.5 million (US$2005) VSL used previously. Bilmes and Stiglitz (2008) projected an estimated 8,889 US fatalities in Iraq and Afghanistan by the end of 2017, with a total mortality cost of $64 billion (US$2007).

Edwards (2014) uses an ex-post approach to calculating total mortality costs for the wars in Iraq and Afghanistan. His data cover a total of 5,376 US military fatalities from 2001 through 2010. Applying a $9.2 million VSL (US$2008), Edwards (2014) estimates a total mortality cost of $49 billion for the wars in Iraq and Afghanistan.

Viscusi (2019) provides mortality cost estimates for US contractors and military personnel in Iraq and Afghanistan from 2001 through 2019. He uses an $8.9 million VSL (US $2010) and breaks down fatality estimates across each of the wars (6,229 for Iraq and 4,142

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for Afghanistan). Viscusi (2019) finds a total mortality cost of $57 billion in Iraq, $38 billion in Afghanistan, and $95 billion for both wars in total.

How do our estimates compare against others in the literature? Our preferred estimates, as detailed in Panel B in Table C2, show a total mortality cost of $79 billion (US$2021) for the wars in Iraq and Afghanistan. This number is somewhat different when compared to previous estimates for a variety of reasons. The main contrasts occur because of different timelines and assumptions used on the VSL and the estimated number of fatalities.

For example, the mortality cost estimate of $49 billion (US$2008) by Edwards (2014) is lower than our figure (even after adjusting for inflation) because he used a shorter time period. The updated casualty figures that we use inflate the numbers due to the time period correction. In contrast, Viscusi (2019) has the highest mortality cost estimates in the literature. Viscusi (2019) finds an estimated mortality cost of $95 billion (US$2010) for the wars in Iraq and Afghanistan. The main reason his numbers are higher than our estimates is that the fatalities were totaled differently. Viscusi (2019) includes both US contractors and military personnel in his analysis, in contrast to our estimates, which only include US military personnel. Furthermore, our estimates here only include US military personnel who died in Iraq and Afghanistan. Our dataset omits personnel who may have been injured in Iraq or Afghanistan, but later died in another country due to their wounds. This naturally reduces the fatality totals in our dataset. Therefore, it is not surprising that Viscusi (2019) has a higher total mortality cost in comparison to our analysis.

Our case study above is just one example of how practitioners might value the lives lost in military BCAs. Although we focus on the mortality cost for the wars in Iraq and Afghanistan, we believe our above case study provides a blueprint for how other studies might use VSL estimates in their calculations. As discussed throughout the text, we recommend practitioners use a range of VSL estimates in their sensitivity analyses, such as the income-adjusted values shown in the text. For specific point estimates, we recommend using the best-set uncorrected average VSL of $11.80 million (US$2021) for military BCAs.

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