

# Is the Rate of Suicide Among Veterans Elevated?

The article by Miller et al.<sup>1</sup> in this issue of the *Journal* raises new questions about Kaplan et al.'s<sup>2</sup> findings regarding the elevated rate of suicide among America's veterans. The original findings, which were based on data from the National Health Interview Survey (NHIS) for 1986 to 1994 and linked to the National Death Index (NDI) for 1986 to 1997 (using 12 weighted criteria: social security number, first and last names, middle initial, race, gender, marital status, birth date [day, month, and year], and state of birth and residence), found a two-fold increased risk of suicide among veterans relative to non-veterans (hazard ratio [HR]=2.13; 95% confidence interval [CI]=1.14, 3.99), adjusted for age, marital status, living arrangement, race, education, family income, employment status, region, time since last doctor visit, self-rated health, and body mass index. No effects were seen for other causes of death. The new study, which expanded the data acquisition period through 2000 with mortality data from the date of interview through 2006, found no increased risk of suicide among veterans when the data were adjusted for differences in age, race, and survey year (HR=1.1; 95% CI=0.96, 1.29). The article by Miller et al. also attempted to replicate the earlier analysis using an updated dataset and confirmed the earlier finding of a significant effect of veteran status on suicide, but of a smaller magnitude (HR=1.33; 95% CI=1.03, 1.71). The fully adjusted model using the expanded data yielded a somewhat marginal effect (HR=1.18; 95% CI=1.02, 1.36).

So what is the difference? As noted by Miller et al.,<sup>1</sup> Kaplan et al.<sup>2</sup> used a restricted-use mortality data file, whereas they used a public-use file. They were not

able to reproduce the same marginals that Kaplan et al.<sup>2</sup> used, and the findings were not numerically identical. We attempted the same analysis as Miller et al. and found that the earlier marginal frequencies and findings were not reproducible using the current dataset. Something has clearly changed with the dataset since the time of the original study. We know of no definitive way to validate one version of this dataset over another, so we are unable to comment on the accuracy of either of these datasets. Instead, this editorial focuses on what we believe to be more extensive data that are publically available to address this question of suicide risk among veterans. It should be noted that because of the rarity of suicide, the first study that relied on NHIS interviews later linked to NDI death records from the time of interview through 1997 was based on analysis of only 508 suicides. The newer study with NDI data through 2006 had 1317 suicides, still a relatively small number. To add perspective, there were 34 598 suicides in the United States in 2007 (the most current year reported by the Centers for Disease Control and Prevention), with 26 615 among male adults aged 18 years and older. Thus, both the previous and new analyses were based on a nationally representative but still small proportion of the population.

The question of whether veterans are at increased risk of suicide remains a critical one, and as noted by the 2008 Blue Ribbon Working Group on Suicide Prevention<sup>3</sup> and the two studies reviewed here, the results are equivocal. In an attempt to obtain a more definitive answer, we took another route than the two previous studies and relied on the most complete enumeration

available on suicides. The National Violent Death Reporting System (NVDRS),<sup>4</sup> provides standardized and detailed data (including veteran status—current or former military) on all violent deaths—including confirmed and uncertain suicides—for 16 states (Alaska, Colorado, Georgia, Kentucky, Maryland, Massachusetts, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Virginia, and Wisconsin) from 2005 to 2008. We examined cases for men aged 17 years and older, which included a total of 27 391 deaths classified as confirmed suicides. In 2005, these 16 states represented 27% of the total adult male population in the United States.<sup>5</sup> Among suicide victims, 24.6% were identified as current or former military (“Has the person served in the US Armed Forces?”). Note that this estimate included active military, during which time there were 854 suicides.<sup>6</sup> Assuming that active duty suicides are equally distributed to the NVDRS and non-NVDRS states, the estimated number of suicides in the 16 NVDRS states for current military was  $0.27 \times 854 = 231$ . As such, the number of suicide deaths among veterans not in active service in the NVDRS states was  $6750 - 231 = 6519$  or  $6519 / (27\,391 - 231) = 24.0\%$  of all adult male suicide deaths, where 6750 was the total number of active and former military suicides in the 16 NVDRS states (see Table A, available as a supplement to the online version of this article at <http://www.ajph.org>). This estimate was slightly biased (downward) because it was adjusted for suicides among both males and females among the active military (although we would expect few suicides among

**TABLE 1—Number of Suicides, Populations at Risk, Rates, and Relative Risk Among Males: 16 States, National Violent Death Reporting System, 2005–2008**

Age, y	No. of Suicides Among Veterans	No. of Veterans In 16 States	Veterans, Rate per 100 000 per Year	No. of Suicides Among Nonveterans	No. of Nonveterans In 16 States	Nonveterans, Rate per 100 000 per Year	Relative Risk (95% CI)
17–24	161	65 974	61.01	2827	4 442 150	15.91	3.84 (3.26, 4.51)
25–34	329	302 379	27.20	3490	4 997 418	17.46	1.56 (1.39, 1.75)
35–44	748	544 281	34.36	4068	4 804 281	21.17	1.62 (1.50, 1.76)
45–54	1186	808 175	36.69	4249	4 852 566	21.89	1.68 (1.57, 1.79)
55–64	1413	141 2933	25.00	2041	2 969 481	17.18	1.46 (1.36, 1.56)
65–74	1046	1 094 061	23.90	865	1 424 385	15.18	1.57 (1.44, 1.72)
≥75	1636	1 269 990	32.20	595	627 695	23.70	1.36 (1.24, 1.49)
Total	6519	5 497 793	29.64	18 135	24 117 976	18.80	1.58 (1.53, 1.62)

Note. CI = confidence interval.

females). To obtain the proportion of veterans in the population, we used data from the 2009 American Community Survey,<sup>7</sup> which indicated that 18.6% of the adult male US population (17 years and older) were veterans. This represented an overall risk ratio of  $24.0/18.6=1.29$ , which was similar to the crude risk ratio of  $26.2/18.8=1.39$  reported by Miller et al.<sup>1</sup>

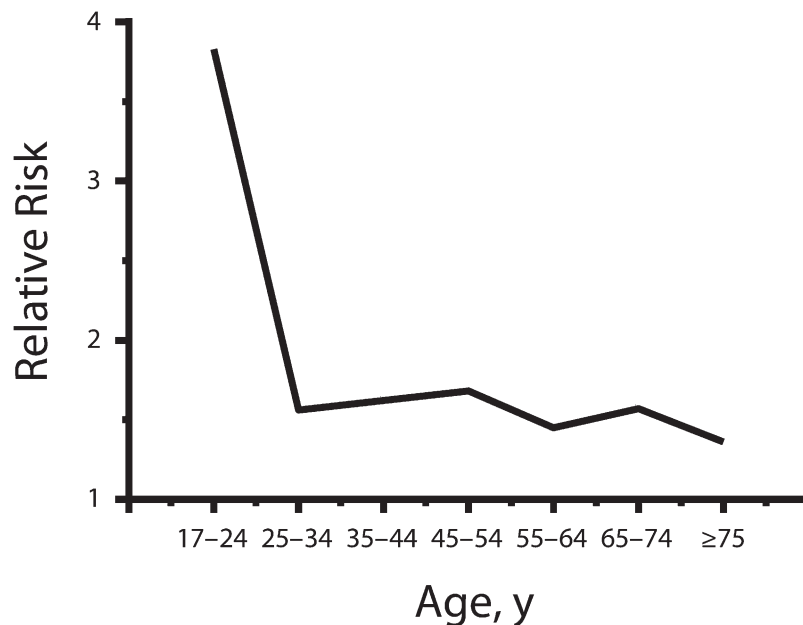
However, a quite different picture was seen when the data were stratified by age. Subtracting out the 231 suicides in amounts proportional to the age distribution of men in the active military<sup>8</sup> revealed that for the youngest group (age 17–24 years), the relative risk was 3.84, indicating that risk of suicide was almost four times higher among the youngest veterans compared with same age group among men without military service (Table 1 and Figure 1). Between the ages of 25 to 75 years, the relative risk was fairly constant at approximately 1.5 and then decreased to 1.36 for veterans aged 75 years or older; all relative risks were highly significant by conventional statistical tests. The absolute magnitude of the risk per 100 000 is presented in Table 1 and Figure 2. Unlike nonveterans, in whom the highest

risk of suicide was for those older than 75 years (24 per 100 000), the youngest veterans, aged 17–24 years, had the highest risk (61 per 100 000). These data revealed that there was a strong age-by-veteran status interaction in terms of suicide, with veterans of recent military actions being at much higher relative and absolute risk of suicide than veterans of

less recent wars or conflicts. These results, which were based on 16 states' data in the NVDRS, are likely representative of the entire US population because the overall percentage of veterans (men and women) in the 16 NVDRS states (10.6%) was quite similar to the entire United States (9.3%).<sup>9</sup>

The articles by Miller et al. and Kaplan et al.,<sup>1,2</sup> which yielded

contradictory results, both treated age as a main effect in their statistical models (i.e., they compared the difference in suicide rates between veterans and nonveterans adjusting for the effect of age on suicide rate). The analyses that we performed revealed that age moderated the relationship between veteran status and suicide, and as a consequence, the



**FIGURE 1—Relative Risk of Suicide as a Function of Veteran Status and Age.**

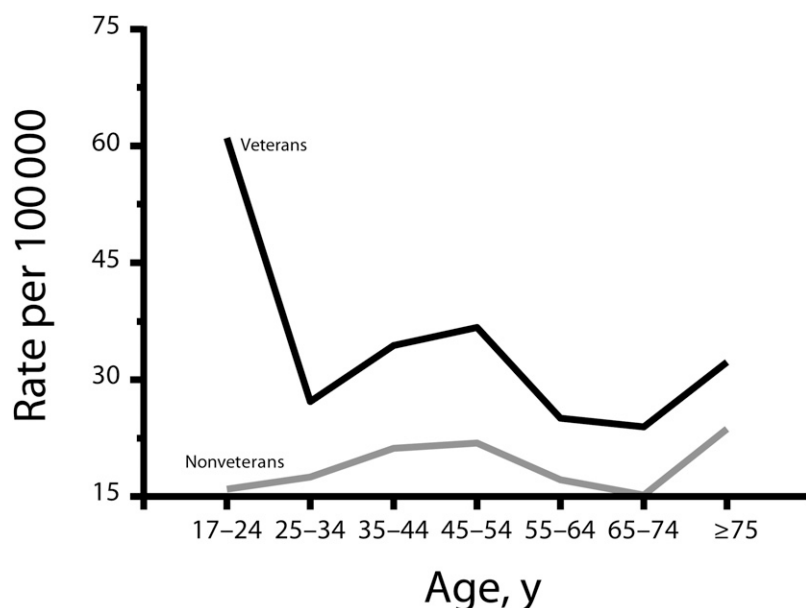


FIGURE 2—Suicide Rate per 100 000 in Male Veteran and Nonveterans.

two articles might be biased by differences between the age distributions of the two veteran cohorts. There were several plausible explanations for the clear age differences seen with veterans' risk for suicide. First, each age cohort in the military experienced unique military, medical, mental health, sociopolitical, and personal contexts that had profound effects on their lives and potentially on the rate of suicide across the life course. Second, it was also possible that the increased absolute and relative suicide risk observed in the youngest veterans had less to do with the specific conflicts in which they were engaged and more to do with factors experienced by returning military from all conflicts. It might simply be that suicide risk was highest directly after (or during) military service. Older veteran cohorts might have already experienced large losses because of suicide, and what we

observed was a more modest residual suicide rate that was closer to that observed for nonveterans. This is a serious limitation of survey-based studies, such as the two reviewed here, in that those veterans at highest risk might have been selectively censored because they had died by suicide before the survey. Also, age was measured at the time of the survey and might have provided little information regarding the actual timing of a person's military service and the nature of that service.

Because the data we reported here did not capture lifetime history of suicide, our finding of higher suicide rates among younger veterans in recent years could not by itself distinguish between the two possibilities found in the studies we reviewed.<sup>10</sup> If we do take the two reported findings of the NCIS–NDI studies at face value and append our results, there was a suggestion that the elevated rate of suicides in

years immediately after military service began to lessen. ■

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Contributors

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