



# HHS Public Access

Author manuscript

*Arch Suicide Res.* Author manuscript; available in PMC 2019 January 01.

Published in final edited form as:

*Arch Suicide Res.* 2018 ; 22(1): 1–10. doi:10.1080/13811118.2017.1304308.

## Suicide Risk by Unit Component among Veterans Who Served in Iraq or Afghanistan

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### Abstract

This study assessed the risk of suicide by time since separation from the military for US veterans who served in Iraq or Afghanistan. Suicide risk was assessed by comparing the number of suicides among veterans, when stratified by active vs. reserve/National Guard status to the expected number based on rates of suicide in the US general population. Hazard rates were used to assess suicide risk since the time each veteran separated/deactivated from active duty service. Compared to the US general population, active duty veterans had a 56% increased risk of suicide and reserve/National Guard veterans had a 29% increased risk. Suicide risk decreased as time since separation/deactivation increased for both groups. The risk of suicide for both groups was greatest during the first year of follow-up.

### Keywords

hazard rate; suicide; veterans

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Between September 2001 and November 2011 over 1.4 million U.S. military personnel were deployed as part of Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), or Operation New Dawn (OND) (Department of Veterans Affairs, Office of Public Health, Environmental Epidemiology Service, 2012). There has been concern that there may be an epidemic of suicides among veterans returning from their OEF/OIF/OND deployment (Keteyian, 2007). In response to the widespread concern about the risk of suicide among veterans in general, and OEF/OIF/OND veterans specifically, multiple studies have been conducted to both determine the magnitude of suicide and identify suicide risk factors among veterans. The U.S. Department of Veterans Affairs (VA) has also instituted

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significant programmatic efforts to address the issue of veteran suicides (Bullman & Kang, 2013).

It has been assumed that suicides among recent veterans may be due to OEF/OIF/OND deployment. A study examining suicide risk among all separated/deactivated OEF/OIF veterans through 2005 reported an increased risk of suicide only among former Active component veterans. (Kang & Bullman, 2008). Examining suicide risk among all former Active component veterans who served in the military between 2001 and 2007, a recent study found that both deployed, i.e., served in either Iraq or Afghanistan, and non-deployed had an increased risk of suicide when compared separately to the U.S. general population (Kang et al., 2015). Interestingly, that study also reported that risk of suicide among deployed veterans was not greater than that of non-deployed veterans. A study assessing suicide among all military personnel, i.e., both Active and Reserve/National Guard components, who served between October 2001 and December 2007, also did not find an association between deployment as part of OEF/OIF and rate of suicide (Reger et al., 2015). In contrast, a study limited to Active duty Army personnel reported an increased risk of suicide associated with OEF/OIF deployment (Schoenbaum et al., 2014).

Also of interest to those involved with veteran health issues is the pattern of suicide risk over time. If a specific post-deployment time period of high suicide risk can be discerned among OEF/OIF/OND veterans, public health efforts might be better able to target suicide prevention programs to veterans when they are at greatest risk for suicide. Studies of Vietnam veterans and OEF/OIF veterans have reported that the rate of suicide generally decreases with time since separation from the military or end of deployment (Boehmer, Flanders, McGeehin, Boyle, & Barrett, 2004; Kang et al., 2015).

In studies that included both Active component and Reserve/National Guard component veterans, the rate of suicide was higher among Active component veterans (Kang & Bullman, 2008; Reger et al., 2015). To date there has been little attempt to explain the higher suicide rate among Active component veterans compared to Reserve/National Guard component veterans. Interestingly, characteristics of Active component service compared to Reserve/National Guard service would seem to suggest the opposite, i.e., Reserve/National Guard veterans should have a higher rate of suicide than Active component veterans. For example, Active duty personnel are engaged with the military full time, reporting to a military installation or duty station each day where they receive routine supervision and health care from the military. On the other hand, Reserve/National Guard personnel typically only report for military duty or training for one weekend a month, 2 weeks of annual training, and episodic active duty assignments, suggesting that perhaps their mental and physical readiness for deployment may differ from their Active duty counterparts. There may also be differences between Active and Reserve/National personnel both during their deployment and post-deployment. Reserve/National Guard have been reported to experience less unit cohesion and social support than Active duty personnel, as they may not be deployed with their unit (Griffith, 2011). It has also been reported that Reserve/National Guard personnel face unique post-deployment readjustment problems that increase their risk for psychiatric disorders relative to that of formerly deployed Active component veterans (Thomas et al., 2010).

While previous studies have assessed risk of suicide among Active compared to Reserve/National Guard veterans both separately and collectively, they have not addressed potential differences in suicide risk over time between the two groups. This current study again examines the differential overall suicide risk by Active vs. Reserve/National Guard service status; however its primary focus is to assess suicide risk separately for these two groups of veterans' suicide risk by time since the veterans separated/deactivated from the military.

## METHODS

### Data

This study's cohort includes 1,401,382 veterans who served in either Active component units or Reserve/National Guard units as part of OEF/OIF/OND and ended their deployment or separated from the military through December 31, 2011. Deployment as part of OEF/OIF/OND includes deployment in one or more of almost 20 countries in southwest Asia, the Horn of Africa, and Europe as part of the War on Terror. The OEF/OIF/OND designation does not imply service in either Iraq or Afghanistan. All military service and demographic characteristics were obtained from the U.S. Department of Defense (DOD), Defense Manpower Power Data Center, which is a data depository of all U.S. military personnel records.

Mortality was ascertained by matching all cohort veterans against data included in the VA/DOD Suicide Data Repository (SDR). The SDR contains all cause mortality for all service members who separated from military service since 1979. At the time this study was conducted SDR had cause of death data through 2011. Cause of death and fact of death in the SDR is based on data from the National Death Index (NDI). Suicides were all deaths identified with one of the following ICD-10 codes; X60-X84, Y87.0 (World Health Organization, 1992).

### Statistical Analysis

To assess whether a differential pattern of suicide risk over time existed between former Active versus Reserve/National Guard component veterans, most analyses were conducted separately for these two groups. An additional analysis including all veterans was conducted to assess differences in overall suicide risk by Active versus Reserve/National Guard status, with adjustment for covariates. Beginning of follow-up for Active component veterans started the date they separated or retired from the military through the end of 2011, while beginning of follow-up for Reserve/National Guard component veterans was the end date of their last OEF/OIF/OND deployment through the end of 2011. End of follow-up for all veterans was the earlier of date of death or December 31, 2011. For the purpose of analysis, suicide risk as referred to in this study is approximated by the various measures of reported suicide rates.

Suicide risk was assessed first by comparing the observed number of suicides among OEF/OIF/OND veterans, when stratified by service in either Active versus Reserve/National Guard component, to the expected number of suicides based on the U.S. general population, with adjustment for race, sex, age at entry to follow-up and year of death. This comparison

is expressed as a standardized mortality ratio (SMR) (Schubauer-Berigan et al., 2005). Suicide risk by Active versus Reserve/National Guard status was further assessed using a Cox Proportional Hazards Model generated by SAS ® PHREG procedure. The Cox Model, which incorporates time at risk, was used to calculate Hazards Ratios (HR)s that assessed the effect of covariates on risk of suicide among all 1.4 million cohort veterans (SAS Institute, 2011). Covariates included in the model were: age at entry to follow-up; race (white); gender (male); marital status (single); rank (Enlisted); served as a ground troop, i.e., served in either Army or Marines; and service in an Active component unit during OEF/OIF/OND deployment.

Differences in suicide rates over time between Active versus Reserve/National Guard veterans was first assessed using the SAS ® LIFETEST procedure. LIFETEST generated crude hazard rates separately for Active and Reserve/National Guard veterans to assess trends in risk of suicide over time since separation/deactivation from the military (SAS Institute, 2011). Hazard rates are estimates of the probability of occurrence of an event during a specific time interval (Lee, 1980). For this analysis, hazard rates were calculated by 1 year intervals from beginning of follow-up. Due to the small number of suicides among those who survived eight or more years after entry to follow-up, analysis of suicide risk by number of years since separation/deactivation was limited to the first 7 years. All hazard rates were calculated per 100,000 persons at risk. Difference in temporal patterns of suicide by Active versus Reserve/National Guard component were further examined using Joinpoint regression software, which evaluated the potential for nonlinear trends and calculated the annual percent change in suicide rates by years since separation (Kim, Fay, Feuer, & Midthune, 2000). Standardized Mortality Ratios were also calculated comparing the observed number of suicides among OEF/OIF/OND veterans, when stratified by Active versus Reserve/National Guard component, to the expected number of suicides based on the U.S. population.

## RESULTS

### Demographic/Military Service Characteristics

Table 1 has select demographic and military service characteristics for the 782,082 former Active component veterans and 619,300 Reserve/National Guard component veterans included in this study. As expected, former Active component veterans were younger than their Reserve/National Guard counterparts; with mean age at entry to follow-up, 29.3 and 33.6 years, respectively. Active component veterans were more likely than Reserve/National Guard veterans to be single prior to their separation/deactivation from the military, 59.4% vs. 51.5%. A higher percentage of Reserve/National Guard veterans than Active component veterans served in either Army or Marines (75.6 vs. 58.6%).

### Suicide Risk

There were 951 suicides among Active component veterans for a crude rate of 29.0 per 100,000 person years at risk and 664 suicides among Reserve/Nation Guard veterans for a crude rate of 25.7 per 100,000 person years at risk. Results from the Cox Proportional Hazards Model analyzing the effects of covariates on risk of suicide are presented in Table 2.

Whites had a higher risk of suicide than non-whites (HR = 1.60; 95%, C.I., 1.43–1.80); suicide risk among males was higher than that of females (HR = 3.26; 95%, C.I., 2.53–4.20); and single veterans had a higher risk than married veterans (HR = 1.39; 95%, C.I., 1.24–1.56). Assessing suicide risk by military service characteristics; those who served in the Army or Marines had a higher suicide risk than those who served in other branches (HR = 1.18; 95%, C.I., 1.05–1.32); and enlisted suicide risk was greater than that of officers (HR = 1.84; 95%, C.I., 1.46–2.32). There was no difference in risk of suicide among Active component veterans when compared to Reserve/National Guard veterans, (HR = 1.03; 95%, C.I., 0.93–1.15).

Figure 1 plots crude hazard rates of suicide separately by number of years since separation for Active component veterans and number of years since their OEF/OIF/OND deployment ended for Reserve/National Guard veterans. For most time intervals examined, the risk of suicide among Active component veterans, as approximated by the hazard rates, was larger than that of Reserve/National Guard veterans. Among former Active component veterans, the largest conditional risk of suicide, 32.5 per 100,000 lives at risk, occurred within the first year of follow-up, decreasing to 31.5 the second year, 28.9 the third year, and 25.6 the fourth year. (Figure 1) For the next 2 years the hazard rate of suicide increased to 27.0 and 29.5, before decreasing again. For Reserve/National Guard veterans the hazard rate of suicide was also highest in the first year following deactivation (33.6 per 100,000 lives at risk). In the second and third year after separation the suicide hazard rate decreased to 23.7 and 23.2, before increasing to 28.1 during the fourth year. In a pattern consistent with hazard rates of suicide among Active component veterans, those for Reserve/National Guard veterans decreased again after 5 years. Results from Joinpoint regression demonstrated a statistically significant trend with an average annual percentage change of  $-4.8$  in the suicide hazard rate for Active component veterans (95%, C.I.,  $-8.6$ – $0.8$ ). While the annual average percentage change in the hazard suicide rate among Reserve/National Guard veterans was higher,  $-7.2$ , a statistically significant trend was not identified (95%, C.I.,  $-14.0$ – $0.2$ ).

Compared to the expected number of suicides based on the United States general population, adjusted for age, sex, and calendar year, both Active and Reserve/National Guard component veterans had an excess risk for suicide SMR = 1.56; 95%, C.I., 1.46–1.66 and SMR = 1.29; 95%, C.I., 1.19–1.39, respectively. Assessing risk of suicide by number of years since separation in comparison to the U.S. general population, the risk of suicide was highest in the first year after separation from military for Reserve/National Guard veterans, (SMR = 1.83, 95%, CI, 1.58–2.10) and in the 6th year for Active component veterans, SMR = 1.94, 95%, C.I., 1.53–2.42. (Table 3) Risk of suicide by number of years since end of military service was consistently higher among Active component veterans than Reserve/National Guard veterans, when they were compared separately to the U.S. population. Suicide risk among Active component veterans when compared to U.S. population remained significantly elevated after 7 years following separation from the military, while the risk among Reserve/National Guard veterans was no longer statistically significant after 4 years.

## DISCUSSION

This study assessed suicide risk among veterans deployed as part of OEF/OIF/OND through the end of 2011. Compared to the United States population, both former Active and Reserve/National Guard veterans had an overall increased risk of suicide (SMR = 1.56 and SMR = 1.29, respectively). Based on hazard rates, the overall risk for suicide over time followed a similar pattern for both Active duty and Reserve/National Guard veterans; with higher rates immediately following separation/deactivation and decreasing risk over time. However, the magnitude of decrease in suicide rates after the first year was different for members of the two groups. The rate of suicide among Active component veterans decreased by just over 3% from the first to second year of follow-up. In contrast, rates of suicide among Reserve/National Guard veterans decreased by nearly 30% during this same time period. While the relative risk of suicide among Active component veterans was not increased when compared to Reserve/National Guard veterans, the overall risk of suicide as expressed by both hazard rates in Figure 1 and the SMRs in Table 3 was greater and more persistent among former Active component veterans than those who served in the Reserve or National Guard.

A potential explanation for the greater and more lasting suicide risk, as estimated by both hazard rates and SMRs, among Active component veterans may be psychosocial correlates of the younger age at time of separation from service. The mean age at entry to follow-up for Active component veterans was 29.3 compared to 33.6 for Reserve/National Guard veterans. Research assessing suicide risk factors has suggested that higher levels of social integration are associated with lower risk of suicide (Duberstein et al., 2004; Eng, Rimm, Fitzmaurice, & Kawachi, 2002). Social integration is the extent to which a person has social ties and is part of a social network. Social ties include family, community, religious institutions, and employment. Studies examining these factors separately have found that being married, having a family, having a job, and participating in organized religion decrease the risk of suicide (Blakely, Collings, & Atkinson, 2003; Hilton, Fellingham, & Lyon, 2002; Kposowa, 2000; Thoresen, Mehlum, Roysamb, & Tønnessen, 2006). Among the Reserve/National Guard component veterans 48.5% were married compared to only 40.6% of Active component veterans. That the Reserve/National Guard component veterans in this study are older than the Active component veterans and more likely than Active component veterans to be married, may indicate they are also more likely to have a family, steady employment, or to have been employed longer and have greater pre-deployment non-military social networks than their younger Active component veteran counterparts. In general, older and therefore more socially integrated individuals may have more resources than younger and less socially integrated individuals for dealing with stress and emotional problems, such as those brought on by separating from the military and reintegrating into civilian roles. Conversely, prior to their separation Active component veterans were likely to be reliant on the military for both their social and economic support; Reserve/National Guard veterans are likely to have come from the civilian sector prior to deployment where they may have established relationships to offer social and instrumental support. Therefore, Active component veterans are more likely than Reserve/National Guard veterans to face the task of building new social and economic networks. Social integration may also decrease the risk for alcohol and drug abuse, both of which are recognized risk factors for suicide (Borges,



Walters, & Kessler, 2000; Brady, 2006; Hornig & McNally, 1995; Petronis, Samuels, Moscicki, & Anthony, 1990; Stack & Wasserman, 1995). Another potential explanation for the differential suicide risk may be related to Active component veterans separating from the military after their deployment, whereas Reserve/National Guard veterans may remain part of the Reserves or National Guard post-deployment. Continued membership in the military as part of a Reserve or National Guard unit following deployment may ease the transition into civilian life.

Among this study's limitations was the potential for misclassification and underreporting of suicide. It is not known whether there would be differential reporting of suicide for former military personnel relative to that reported among the U.S. general population. If the underreporting of suicide was greater among former military than the U.S. general population, the risk of suicide among veterans would be even larger than that reported in this study. Because this study did not have a non-deployed veteran comparison group, it is not possible to discern if deployment as part of OEF/OIF/OND specifically, or service in the military in general, is a risk factor for suicide. However, recent studies of both deployed and non-deployed OEF/OIF veterans reported that military service in general, and not OEF/OIF/OND deployment specifically, was associated with an increased risk of suicide (Kang et al., 2015; Reger et al., 2015). The potential for differences in the nature of OEF/OIF/OND deployments, especially in regards to exposure to combat trauma, should be recognized and caution should be exercised when attributing suicide risk to OEF/OIF/OND deployment. OEF/OIF/OND deployments can include service in countries other than Iraq and Afghanistan, which were more likely to be associated with high risk for combat exposure. This study also lacked data on levels of combat and trauma experienced by OEF/OIF/OND veterans while deployed, as well as number and length of deployments. Finally, some former Active component members after separating from the military may have enlisted in either the Reserve or National Guard.

That overall suicide risk among Active component veterans is similar to that of Reserve/National Guard veterans is similar may indicate that VA's suicide prevention efforts are helpful for both former Active component veterans and Reserve/National Guard component veterans. The larger decrease in suicide rates in the first 2 years post-service that was observed for Reserve/National Guard veterans compared to former Active component veterans suggests a need for additional research.

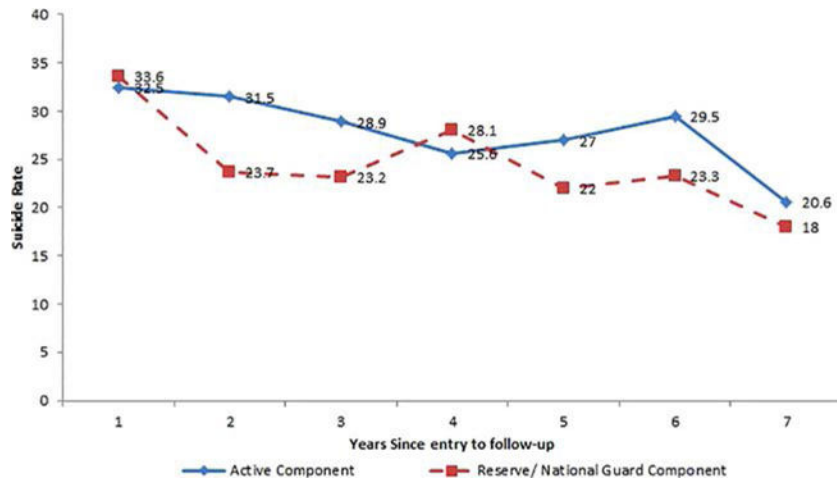
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**FIGURE 1.** Suicide rate for active vs. Reserve/National Guard components by years since entry to follow-up.

TABLE 1

Selected Demographic/Military Service Characteristics for OEF/OIF/OND Veterans, by Active vs. Reserve/  
National Guard Service

Characteristic	Active component		Reserve/National Guard component	
	Frequency (N = 782,082)	Percentage	Frequency (N = 619,300)	Percentage
Age at entry to follow-up				
17–21	31,154	4.0	40,035	6.5
22–25	323,253	41.3	129,614	20.9
26–35	256,753	32.8	199,423	32.2
36–45	131,041	16.8	162,478	26.2
46+	39,881	5.1	87,750	14.2
Mean age at entry to follow-up	29.3		33.6	
Standardized deviation	8.0		9.9	
Sex				
Male	689,604	88.2	547,445	88.4
Female	92,478	11.8	71,855	11.6
Race				
White	531,434	67.9	445,130	71.9
Black	104,462	13.4	77,773	12.6
Hispanic	80,452	10.3	54,176	8.7
Other	65,734	8.4	42,221	6.8
Marital Status				
Married	317,236	40.6	300,636	48.5
Not married	464,846	59.4	318,664	51.5
Branch of service				
Army	314,189	40.2	423,946	68.4
Marines	143,872	18.4	44,889	7.2
Air Force	129,763	16.6	107,492	17.4
Navy	192,935	24.6	41,286	6.7
Coast Guard	1,323	0.2	1,687	0.3
Rank				
Officer	63,931	8.2	75,644	12.2
Warrant Officer	6,449	0.8	7,157	1.2
Enlisted	71,1702	91.0	536,499	86.6

Note. OEF/OIF/OND refers to veterans of Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn.

**TABLE 2**  
**Risk of Suicide Among OEF/OIF/OND Veterans by Demographic/Military Service Characteristics**

Characteristic	# of Suicides	Person Years Risk	Rate	HR	95%C.I.
Race: White	1,252	3942545.0	31.7	1.60	1.43–1.80
Sex: Male	1,553	5161430.8	30.1	3.26	2.53–4.20
Marital status: Single	534	2619215.9	20.4	1.39	1.24–1.56
Ground troop (served in Army or Marines)	1,142	3773654.4	30.3	1.18	1.05–1.32
Rank: Enlisted	1,533	5232823.6	29.3	1.84	1.46–2.32
Duty type: Active component	951	3274061.1	29.0	1.03	0.93–1.15

*Note.* OEF/OIF/OND refers to veterans of Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn. HR = Hazard Ratio derived from Cox Model, adjusted for age at entry to follow-up and covariates presented in table. C.I. = confidence interval.

**TABLE 3**

Suicide Rate among OEF/OIF/OND Veterans Compared to that of U.S. General Population, by Number of Years Since Entry to Follow-up<sup>3</sup>

# Years since entry to follow-up	Active component # of suicides	Active component suicide rate	Active component SMR (95% C.I.)	Reserve/National Guard component # of suicides	Reserve/National Guard component suicide rate	Reserve National Guard component SMR (95% C.I.)
1	237	34.9	1.86 (1.63–2.11)	195	36.0	1.83 (1.58–2.10)
2	198	34.0	1.82 (1.57–2.09)	114	25.9	1.30 (1.07–1.56)
3	154	31.2	1.68 (1.43–1.97)	93	25.4	1.27 (1.03–1.56)
4	115	28.2	1.54 (1.27–1.85)	94	31.6	1.58 (1.27–1.93)
5	97	30.9	1.69 (1.37–2.06)	59	23.6	1.18 (0.90–1.52)
6	78	35.5	1.94 (1.53–2.42)	52	26.1	1.30 (0.97–1.71)
7	36	27.2	1.48 (1.04–2.06)	28	23.9	1.22 (0.81–1.76)

Note. OEF/OIF/OND refers to veterans of Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn. Rate = Rate of suicides per 100,000 Person Years Risk. SMR = Standardized Mortality Ratio, expressed as observed to expected, adjusted for age, race, sex, and calendar year. C.I. = confidence interval.