Suicide mortality in active-duty populations: a within- and between-country comparison

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Background

Suicide-mortality rates in the United States (US) military population have increased since 2000.[a] At present, the causes of this mortality-rate increase are unknown. One question of interest to military populations is whether this phenomenon is occurring in other countries besides the US. If the phenomenon is unique to the US military, then etiologic investigations could compare risk factors between countries to identify unique factors that contribute to the rate increase for the US military population. If, on the other hand, the phenomenon is more generalized, then historic comparisons of several military populations may improve etiologic inference.

Suicide-mortality Rates

Definition

Mortality rates (R) are generally defined as the ratio of a number of deaths (D) to an amount of time at risk (e.g., person-years). In practice, mortality rates are expressed as a proportion relating D to the number of people at risk (N).[b] Since the proportion tends to be very small, the rate is multiplied by a constant to improve interpretability. A constant used for military mortality surveillance is 100,000. This produces a rate that is interpreted as a number of deaths over a defined period of time per 100,000 population.

$$R = \frac{D}{N} \times 100{,}000$$

Rate Comparison

Overall rates take into account the size of a population. However, they are considered marginal rates. They do not take into account population composition. As such, any comparison of marginal rates, without adjustment, between two or more populations produces a comparison that is a mixture of the following things:

1. A true difference in the mortality rate between the populations,
2. A difference in the population subgroup sizes (e.g., sex) that affects the marginal rate, and
3. A difference in the population subgroup rates.

Statistical standardization or adjustment provides a mechanism to account for items 2 and 3 above. This helps to isolate any residual difference in mortality rates that is attributable to 1 above, which is usually the comparison of interest.

Standardization

Direct Method

The direct method of standardization statistically converts the population of interest into the standard population. By doing this, it alters the population composition of the population of interest to provide a better comparison. This allows for multiple mortality rates that are standardized directly to be compared to one another. This is not possible with indirect standardization. The calculation is done using the following formula:

$$R_{adj} = \frac{\sum N_{si} R_i}{\sum N_{si}}$$

This formula calculates the number of expected deaths in each subgroup of the standard population using the subgroup rates of the population of interest. Dividing the sum of the subgroup expected deaths by the total standard population derives the adjusted rate.

Method

In this study, we calculated suicide-mortality rates for the US military and the military of the United Kingdom (UK). The analysis was restricted to the Active components of each military. We used direct adjustment across age strata (17-24, 25-29, 30-34, 35-39, 40-59) to compare the rates between the countries and over time within each country. To compensate for small numbers of deaths in age strata, particularly for the UK with a smaller military population, we aggregated the data into three five-year intervals for analysis: 2002-2006, 2007-2011, and 2012-2016. Data were provided by the Armed Forces Medical Examiner Service for the US and Defence Statistics Health for the UK. For both countries, suicide deaths were classified according to ICD-10 codes for intentional self-injury. The denominator for the rate calculations was the average monthly end-strength for each military population. Additional analysis in a Poisson regression model examined the affect of rank (enlisted vs. officer), service (Army vs. not Army), and general population suicide mortality rates within age strata on the overall rate comparison. The standard population used for the analysis was the Word Health Organization standard million population for 2000-2025 (REF).

Results

Figures 1 and 2 below show the age-specific suicide-mortality rates for the US and the UK military populations in three five-year age bands.

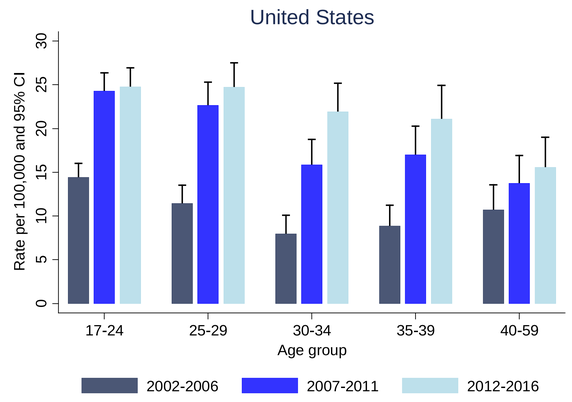

Figure 1. Age-specific suicide-mortality rates for the US military population, 2002-2016.

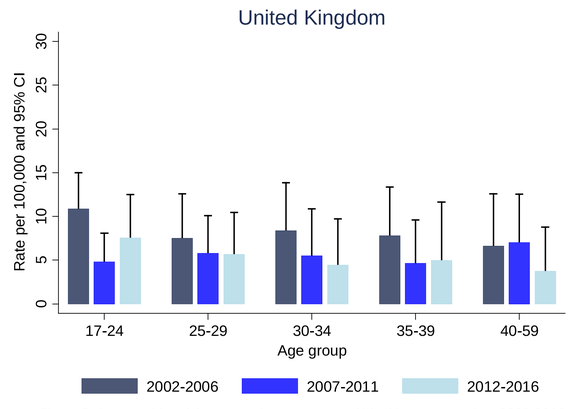

Figure 2. Age-specific suicide-mortality rates for the UK military population, 2002-2016.

Results (continued)

The age-specific suicide-mortality rates for the US military population increased for all age groups in the 2007-2011 and 2012-2016 year bands. The rates were highest for service members under 30 years of age. For the UK, the age-specific suicide-mortality rates generally decreased over time. There was not a strong distinction between age groups within the year bands. The UK suicide-mortality rates had wider confidence intervals as a function of small numbers of deaths in each age-by-year category (many less than 10). Overall, the US age-specific suicide-mortality rates, especially after 2006, are substantially higher than those for the UK.

The age-standardized suicide-mortality rates present a similar result in terms of the temporal and between-country comparisons. In figure 3, the suicide-mortality rate for the UK military decreased over time, while the rate for the US increased over time. There is also a pronounced separation between the two countries after 2006. These differences persisted after adjustment for other factors.

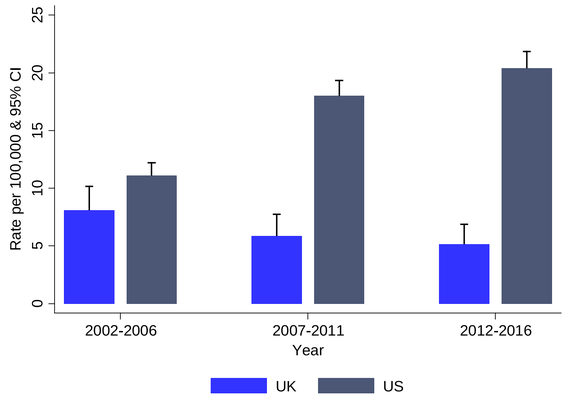

Figure 3. Age-standardized suicide-mortality rates, by year band and country.

Conclusion

The suicide-mortality rates of the US and UK militaries demonstrate different trajectories of change over time. The apparent rise in the suicide-mortality rate is unique to the US military when compare to that of the UK military. This analysis is an improvement on comparisons of raw case counts, unstandardized rates, or indirectly standardized suicide-mortality rates. One limitation of this analysis is the need to aggregate several years of data to have sufficient cases across age subgroups for stable statistical comparison. This reduces sensitivity to temporal variation over shorter durations of time. Future research should identify additional population composition factors that may explain this difference or etiologic factors that can improve suicide prevention for the US military.

References

[a]Anglemyer A, Miller M, Buttrey S, and Whitaker L. (2016). Suicide Rates and Methods in Active Duty Military Personnel 2005-2011: A Cohort Study. *Ann Intern Med.* 2016;165(3):167-174. DOI: 10.7326/M15-2785.

[b]Fleiss JL, Levin B, Paik M C. (2003). Statistical methods for rates and proportions. Third Ed. Hoboken, NJ: John Wiley & Sons.

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