INSTITUTE FOR DEFENSE ANALYSES

Geographical Variation in Army National Guard Suicide: Is the Guard Like the General Population?

James Bishop
Michael Guggisberg
Susan Clark-Sestak
Jacqueline Du Bois
David Graham
Nate Latshaw
Allen Wang

September 2018
Approved for public release; distribution is unlimited.
IDA Paper P-9229
Log: H 18-000342

INSTITUTE FOR DEFENSE ANALYSES
4850 Mark Center Drive
Alexandria, Virginia 22311-1882

The Institute for Defense Analyses is a non-profit corporation that operates three federally funded research and development centers to provide objective analyses of national security issues, particularly those requiring scientific and technical expertise, and conduct related research on other national challenges.

About This Publication

This work was conducted by the Institute for Defense Analyses (IDA) under contract HQ0034-14-D-0001, project DZ-6-4295 "Army National Guard Suicide Rates Based on Geographic Profiles," for the National Guard Bureau. The views, opinions, and findings should not be construed as representing the official position of either the Department of Defense or the sponsoring organization.

For More Information:

Dr. David R. Graham, Project Leader
dgraham@ida.org, 703-845-2358
ADM John C. Harvey, Jr. USN (Ret), Director, SFRD
jharvey@ida.org, 703-575-4530

Acknowledgments

The authors would like to thank the IDA technical reviewers, Dr. Brian Rieksts and Dr. Allison Abbe, for their review and thoughtful contributions to this publication.

INSTITUTE FOR DEFENSE ANALYSES

IDA Paper P-9229

Geographical Variation in Army National Guard Suicide: Is the Guard Like the General Population?

James Bishop
Michael Guggisberg
Susan Clark-Sestak
Jacqueline Du Bois
David Graham
Nate Latshaw
Allen Wang

This page is intentionally blank.

Executive Summary

The Army National Guard (ARNG) provides funding and guidance to each of the 50 U.S. states, Guam, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia for suicide prevention (SP). The ARNG must decide how to allocate SP funds across the states and territories and what guidance to give to the states and territories related to SP. The National Guard Bureau (NGB) asked the Institute for Defense Analyses (IDA) to identify and document factors that explain state and local variations in ARNG suicide rates to help determine whether SP policies and programs can be strengthened and resources can be better targeted. To satisfy this request, IDA conducted a variety of quantitative analyses of suicide rates in the ARNG and general population (GP), collected information from states and territories on their ARNG SP programs, and provided recommendations on resource allocation methods, data collection, and further research.

ARNG members are uniquely situated at the intersection of civilian and military communities and are therefore exposed to a wide range of risk and protective factors for suicide. For SP, ARNG members, predominantly living in civilian communities and holding civilian employment, may be similar to members of the GP. Alternatively, ARNG members may be fundamentally different from the GP in one or more ways that warrant an ARNG-specific approach to SP.

Using data from 2010 through 2016, we find that, while the ARNG suicide rate was significantly higher than the GP suicide rate, the greater shares of young and male individuals in the ARNG explain most of the difference. Without accounting for age and sex population shares, ARNG membership was associated with a 76% higher odds of dying by suicide. After accounting for age and sex shares, ARNG membership was associated with a 24% higher odds of dying by suicide. Accounting for how individuals distribute themselves geographically, in addition to accounting for age and sex shares, reduces those odds to 17%.

We further find that ARNG and GP suicide followed similar patterns in geographical variation, spatial correlation, and partial correlation with a large and diverse set of geographically varying factors. In the manner in which suicide risk varies across space, the ARNG is like the GP. First, mapping suicide risk estimates at the county level reveals the same geographic patterns for the ARNG and GP. Second, among seven candidate models of how county proximity is related to similarity in suicide risk, the same model fit the data best for the ARNG and the GP. Third, among 68 factors for suicide and their spatial lags, all factors that were correlated with ARNG- and GP-estimated suicide risk were correlated

in the same direction, and among 16 additional ARNG-specific factors, such as median number of deployments, none were significantly correlated with estimated ARNG suicide risk. Based on the similarities we observe in patterns of estimated ARNG and GP suicide risk, we recommend that the ARNG consider SP programs that have evidence of success in the GP, even if they have not previously been considered in a military context.

We do, however, find some evidence of differences between the ARNG and GP. Suicide rates among males aged 34 and younger were significantly higher in the ARNG than the GP. ARNG suicide rates among males trended down with age, which is opposite the trend in the GP. We therefore recommend that the ARNG seek to better understand and address ARNG-specific risk factors for suicide among young males. Geographically, the counties with the highest suicide risk tended to be the counties where ARNG suicide risk was closer to or even below GP risk. This finding means that ARNG suicide risk varies less across space than GP suicide risk. This relatively small variation, combined with the rarity of suicide and the similarity in geographical patterns between ARNG and GP suicide rates, means that we do not find specific areas in special need of additional ARNG SP resources.

To understand how states and territories conduct their ARNG SP programs, we sent a request for information to each ARNG SP program office, to which 50 of the 54 states and territories responded. The request covered guidance and policy, personnel and financial resources, training, and individual programs, and assessments of those programs. We found variation across SP programs along many dimensions. Because we collected this information after the period of the suicide data, we were unable to evaluate causal effects of program characteristics on suicide rates. However, we have laid the groundwork for a future such evaluation. To facilitate such an evaluation and to increase knowledge about state SP programs, we recommend that the ARNG continue to gather program information on a yearly or other regular basis.

In the absence of knowing the causal effects of program characteristics, including the intensity of resources, the ARNG must still decide how to allocate resources across states and territories. To address this allocation problem while balancing concerns for resource efficiency, equity across states, and stability over time, we propose an algorithm from the marketing literature adapted to the SP context. The algorithm would allocate a customizable portion of the SP budget in proportion to the expected marginal effects of those resources in each state, which can be estimated using previous years' allocations and suicide rates. We provide a Microsoft Excel tool that requires only manual data input to implement the algorithm. We do not report results of the algorithm but provide the tool to the ARNG for use in the current and future years.

The ARNG data that facilitated this study hold promising potential for future research. These data have been reliably recorded since 2010 and will grow in value as these data

continue to be reliably and promptly recorded. Although we aggregated the data to geographic levels to support the requested analyses, the data are at the individual level. This individual-level data, combined with existing administrative data on all Guardsmen, would facilitate an analysis of individual suicide risk factors similar to recent Army Studies to Assess Risk and Resilience in Servicemembers (STARRS) on the Regular Army. By applying cutting-edge predictive analytics methods, the ARNG has the potential to become a leader in quantitative suicide research.

This page is intentionally blank.

Contents

1. Introduction

A. Background

The Army National Guard (ARNG) provides funding and guidance to each of the 50 U.S. states, 3 territories (Guam, Puerto Rico, and the U.S. Virgin Islands), and the District of Columbia for suicide prevention (SP). The ARNG must decide how to allocate SP funds across the states and territories and what guidance to give the states and territories related to SP. Each state and territory uses SP funding and guidance differently. Better understanding of these differences would better inform ARNG decision making.

Rates of suicide among ARNG members also vary across states and territories. While the purpose of SP programs and policies is to decrease suicide rates, measurement of these causal effects is complicated and confounded by many issues. The ARNG has improved its capability in overcoming one of these issues—availability of suicide data—in the past decade. This improved capability provides a foundation for overcoming other issues, such as the confounding effects of socioeconomic differences across states and territories that transcend the ARNG.

ARNG members are uniquely situated at the intersection of civilian and military communities and are therefore exposed to an especially wide range of risk and protective factors. For SP, ARNG members, who predominantly live in civilian communities and hold civilian employment, may be similar to members of the general population (GP). Alternatively, ARNG members may also be fundamentally different from the GP in one or more ways that warrant an ARNG-specific approach to SP.

The National Guard Bureau (NGB) asked the Institute for Defense Analyses (IDA) to identify and document factors that explain state and local variations in ARNG suicide rates. As part of that assessment, the NGB requested that IDA investigate how the suicide rates in a given location compare to the suicide rates among a similar civilian demographic group in that location. This investigation will help to determine whether SP policies and programs can be strengthened and whether resources can be better targeted.

B. Previous Literature

This research complements Dr. James Griffith's work on characterizing ARNG suicide. Griffith analyzed ARNG suicides from 2007 through 2010 and found that being under 25 years of age, white, and male were the factors with the greatest statistical association for suicide among Guardsmen, as opposed to military-specific factors such as prior service,

having a combat Military Occupational Specialty (MOS), and having been deployed.[1] Griffith found that ARNG suicide events were appropriately categorized into two clusters: younger, lower rank "first-termers" and older, higher rank "careerists."[2] In a follow-up study that added ARNG suicide data from 2011 and 2012, he found results on risk factors that were similar in the previous study. Cluster analyses for 2011 and 2012 revealed a third cluster—"re-up Soldiers"—that fell between the first-termers and careerists in age and rank.[3] In another follow-up study on ARNG suicide data from 2007–2014, Griffith found the same most important demographic factors and clusters as in the 2007–2010 study.[4] His research extends into many other ARNG suicide subtopics outside the scope of the research presented in this paper, including analysis of life and career circumstances preceding suicide among Guardsmen.

Other analyses have identified suicide risk factors for the Army more broadly.[5] Black et al. associate individual characteristics with suicide risk for all Regular Army, Army Reserve, and ARNG Soldiers from 2001–2009.[6] They found significantly higher suicide risk for men but not for younger or more junior personnel. As part of the Army Study to Assess Risk and Resilience in Servicemembers (STARRS), researchers conducted similar analyses for only Regular Army Soldiers from 2004–2009. A preliminary analysis found higher suicide risk associated with being male, white, and junior enlisted, among many

---

1 James Griffith, "Suicide in the Army National Guard: An Empirical Inquiry," *Suicide and Life□Threatening Behavior* 42, no. 1 (February 2012): 104–119. https://doi.org/10.1111/j.1943-278X.2011.00075.x.

2 Ibid.

3 James Griffith, "Suicide Risk Among Army National Guard (ARNG) Soldiers: Analysis of the CY2007–2012 ARNG Suicides," unpublished paper delivered to the ARNG January 2, 2014.

4 James Griffith. "Suicide Risk Among Army National Guard (ARNG) Soldiers: Analysis of the CY2007–2014 ARNG Suicides," unpublished paper delivered to the ARNG March 3, 2015, and updated May 4, 2015.

5 The ARNG suicide rate was higher than the Regular Army and Army Reserve suicide rates in each year from 2011–2016, except that is was lower than the Regular Army rate in 2014. 2011 was the first year that the Department of Defense (DOD) recorded suicides among Guardsmen who were not on active duty in a manner comparable to suicides among Regular Army Soldiers. See the 2013 and 2016 DoDSER Annual Reports published by the Defense Suicide Prevention Office: Department of Defense, *DoDSER: Department of Defense Suicide Event Report: Calendar Year 2013 Annual Report* (Alexandria VA: Defense Human Resources Activity Headquarters, 2013), http://www.dspo.mil/Portals/113/Documents/2013-DoDSER-Annual-Report.pdf; Department of Defense, *DoDSER: Department of Defense Suicide Event Report: Calendar Year 2016 Annual Report* (Washington, DC: Defense Health Agency, Psychological Health Center for Excellence (PHCoE), 2018), http://www.dspo.mil/Portals/113/Documents/DoDSER%20CY%202016%20Annual%20Report_For%20Public%20Release.pdf?ver=2018-07-02-104254-717.

6 Sandra A. Black et al., "Prevalence and Risk Factors Associated with Suicides of Army Soldiers 2001–2009," *Military Psychology* 23, no. 4 (2011): 433–451, https://doi.org/10.1080/08995605.2011.590409.

other bivariate (i.e., unconditional, not partial) correlations.[7] A later, more sophisticated analysis that focused on enlisted personnel found higher suicide risk among junior personnel deployed in their first year of service and junior personnel with less-than-expected rank based on time in service.[8] Griffith adapted this analysis to ARNG data (officers and enlisted) from 2007–2014 and found that being young, male, white, and residing in the Western United States were risk factors and that being in training was a protective factor.[9]

While we are not aware of previous research that analyzes geographic patterns in ARNG suicide, researchers have long recognized that GP suicide rates are higher in the Intermountain West compared to other areas of the United States. Authors have proposed many factors in attempts to explain this observation, including firearm ownership, social isolation, race, access to mental health services, and altitude.[10] Because each of these factors are correlated with location in the Intermountain West and with each other, it is difficult to identify their effects separately.

C. Objective

This research seeks to identify and document factors that explain geographical variation in suicide rates among ARNG members. These factors fall into four broad categories: (1) shares of basic demographic factors, such as sex and age, (2) state-level implementation of ARNG SP policies and programs, (3) Soldier characteristics, such as deployment experience, and (4) characteristics of geographical areas that are not ARNG specific, such as unemployment and firearms policies.

To accomplish the stated objective, this research addresses the following issues:

- The availability and reliability of suicide data, which differ between the ARNG and the GP and over time;

---

7 Michael Schoenbaum et al., "Predictors of Suicide and Accident Death in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS): Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)," *JAMA Psychiatry* 71, no. 5 (2014): 493–503, https://doi.org/10.1001/jamapsychiatry.2013.4417.

8 S. E. Gilman et al., "Sociodemographic and Career History Predictors of Suicide Mortality in the United States Army 2004–2009," *Psychological Medicine* 44, no. 12 (September 2014): 2579–2592, https://doi.org/10.1017/S003329171400018X.

9 Griffith. "Suicide Risk Among Army National Guard (ARNG) Soldiers: Analysis of the CY2007–2012 ARNG Suicides."

10 Gopal K. Singh and Mohammad Siahpush, "Increasing Rural–Urban Gradients in US Suicide Mortality, 1970–1997," *American Journal of Public Health* 92, no. 7 (July 2002): 1161–1167, https://doi.org/10.2105/AJPH.92.7.1161; Leonardo Tondo et al., "Suicide Rates in Relation to Health Care Access in the United States: An Ecological Study," *The Journal of Clinical Psychiatry* 67, no. 4 (April 2006): 517–523, https://www.ncbi.nlm.nih.gov/pubmed/16669716; Namkug Kim et al., "Altitude, Gun Ownership, Rural Areas, and Suicide," *American Journal of Psychiatry* 168, no. 1 (2011): 49–54, https://doi.org/10.1176/appi.ajp.2010.10020289.

- The sparsity of suicide data, which offers limited power for statistical analyses;
- Stark demographic differences between the ARNG and the GP;
- The vast set of geographically varying potential factors, the effects of which are difficult to disentangle;
- Availability of information on state-level implementation of SP policies and programs;
- Reverse causality between ARNG suicide rates and implementation choices, whereby observed suicide rates influence how SP programs operate, which influences future suicide rates; and
- Individual characteristics.

Resolving these issues is not binary but a matter of degree. This paper overcomes most of these issues to a degree that enables novel analyses and policy recommendations. For other issues, it discusses how further work could better resolve those issues.

D. Summary of Analysis

The remainder of this paper comprises diverse efforts in information collection and quantitative analysis. These efforts are organized into three chapters.

Chapter 2 compares ARNG and GP suicide in the period 2010–2016, incrementally accounting for population sizes, demographic shares, geographic distribution of populations, the rarity of suicide events, and spatial correlation. The chapter begins with simple comparisons at the national level. We find that age and sex differences explain most of the difference between ARNG and GP suicide rates. We find that male suicide risk falls with age in the ARNG, unlike the GP. We then consider comparisons at the county level, where the rarity of suicide precludes statistically meaningful simple comparisons. To overcome this issue, we employ a hierarchical Bayes method to estimate suicide risk at the county level. We find similar geographical patterns in ARNG and GP suicide and a higher overall risk of suicide in the ARNG. However, in geographic areas where the suicide risk is high, ARNG suicide risk is closer to or less than GP risk.

Chapter 3 examines how geographically varying factors, including state-level implementation of SP programs and policies, are related to the county-level suicide risk estimates we obtain in the previous chapter. To enable this analysis, we sent a request for information (RFI) to the ARNG SP program office in each state and territory. We find substantial variation across states and territories that cannot be adequately characterized by a few distinct groups. We also assemble a county-level dataset of GP factors from a variety of publicly available sources and ARNG-specific factors from ARNG data. We find that ARNG and GP suicide risk estimates are similarly correlated with the GP factors, while none of the

ARNG-specific factors are strongly partially correlated with our ARNG suicide risk estimates. In other words, we find evidence that the ARNG is like the GP.

Chapter 4 translates the analysis in the previous chapters into recommendations for the ARNG on how to allocate SP resources and provide SP guidance. Direct to the topic of resource allocation, we recommend an algorithm adapted from the marketing literature, whereby a portion of the SP budget is allocated in proportion to the estimated marginal effects of resources on each state's suicide rate. Based on the similarities that we observe in patterns of estimated ARNG and GP suicide risk, we recommend that the ARNG consider SP programs that have evidence of success in the GP, even if these programs have not previously been considered in a military context. We also recommend that the ARNG continue its suicide data collection efforts, continue gathering program information on a yearly or other regular basis, quantitatively evaluate SP programs, and fund a study to uncover individual suicide risk factors among Guardsmen.

This page is intentionally blank.

2. Comparison of ARNG and GP Suicide Rates

In this chapter, we estimate the relative suicide risk associated with ARNG membership, how that relative risk varies demographically and geographically, and the extent to which demographic and geographic distribution explain that relative risk. We compare ARNG suicide rates to GP suicide rates at the national, state, and county levels.[11] The rarity of suicides and correlation in suicide rates among nearby geographic locations introduce statistical problems that we address.

We find a higher rate of suicide among ARNG members, most of which is explained by the high proportion and high suicide rate of young males in the ARNG. Geographical distribution also explains a small part of the higher risk of suicide in the ARNG. Across geography, we observe that ARNG and GP suicide rates are highly correlated, both being higher in the Intermountain West. We also observe that the estimated relative suicide risk associated with ARNG membership tends to be lower where suicide rates are higher. These results suggest that the ARNG and GP populations share suicide risk factors that vary geographically.

A. Data

1. ARNG Suicide Data

We obtained event-level data on ARNG suicide from 2010–2016 from the ARNG Critical Incident Management System (CIMS). The CIMS data identified each decedent's zip code of residence, sex, and age. We used a crosswalk from the Department of Housing and Urban Development (HUD) to aggregate the data to the county level.[12] In the minority of cases where a zip code overlapped multiple counties, we allotted events according to the fraction of the zip code's addresses in each county and rounded county results to the nearest integer.[13] Aggregating to the county level is necessary for compatibility with GP suicide

---

[11] The term "suicide rate" refers to an empirical observation of a number of suicides in a population divided by the population's size. When associated with a characteristic such as ARNG membership, the term "suicide risk" refers to an OR comparing those with the characteristic to those without it. The term "underlying suicide risk" refers to the probability of suicide of a member of a population with defined characteristics, as opposed to an empirical value. Underlying suicide risk is a statistical parameter that is fundamentally unknowable. A suicide rate may serve as an estimate of underlying suicide risk.

[12] At the time of writing, the crosswalk is available at Office of Policy Development and Research (PD&R), U.S. Department of Housing and Urban Development, "HUD USPS Zip Code Crosswalk Files," https://www.huduser.gov/portal/datasets/usps_crosswalk.html.

[13] The percentage of zip codes that overlapped multiple counties was 23.2%. Of those zip codes, 59.1% had 90% or more of their addresses in a single county.

data, described in the next section. Rounding is necessary for compatibility with the modeling described later in this chapter (see Subsection 2.C.2). We also excluded observations from U.S. territories since these observations were not available in the GP data. Our sponsor also provided ARNG population counts by year, sex, age bin, and zip code, which we aggregated to the county level using the HUD crosswalk. The age bins were 17–24, 25–34, 35–44, 45–54, and 55 and older. After this exclusion, we observed 729 ARNG suicides and a total of approximately 2.46 million ARNG person-years.[14]

2. GP Suicide Data

We obtained 2010–2016 GP suicide counts by county, sex, and age bin for the 50 states and the District of Columbia from the Centers for Disease Control and Prevention (CDC).[15] We include only individuals between 17 and 64 years of age, inclusive. We observe approximately 235,000 GP suicides. The CDC also provided county person-years by county, sex, and age bin for a total of approximately 1.41 billion GP person-years. The GP data include individuals in the ARNG, which is consistent with a comprehensive and intuitive definition of "general population." Because the ARNG is a small share of the GP (0.17% in our data), this inclusion (as opposed to subtracting ARNG suicide and population counts from GP suicide and population counts, respectively) has a negligible result on the estimates.

B. National-level Suicide Rates and Risk

From 2010 through 2016, the ARNG suicide rate was 29.7 per 100,000 person-years. The GP suicide rate was 16.6 per 100,000 person-years. These rates entail an odds ratio (OR) of 1.78, with a 95% confidence interval of [1.66, 1.92].[16] The OR indicates that during this period, ARNG membership was associated with 78% greater odds of dying by suicide.

---

[14] We use "person-years" as the unit of analysis because not all individuals are present in a population for a subset of the observed years, and a person's risk of dying by suicide in a period depends on the duration of the period.

[15] Centers for Disease Control and Prevention (CDC), "About Underlying Cause of Death, 1999–2016," CDC WONDER Online Database, (2017). https://wonder.cdc.gov/ucd-icd10.html. *Note:* Data are compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program (VSCP).

[16] Formally, the OR is $\frac{\text{Probability of Suicide in ARNG}}{1-\text{Probability of Suicide in ARNG}} \Big/ \frac{\text{Probability of Suicide in GP}}{1-\text{Probability of Suicide in GP}}$. If the OR is greater than 1, then the odds are greater in the ARNG. If the OR is less than 1, then the odds of suicide are greater in the GP. The p-value that the odds of suicide are equal in the ARNG and GP is less than 2.2×10^{-16}.

Figure 1 illustrates how ARNG and GP suicide rates have changed from 2010 through 2016. The bars in the figure represent 95% confidence intervals and are much wider for the ARNG due to the smaller population. In every year, the ARNG confidence interval is entirely above the GP confidence interval. This observation indicates that despite a dip in the ARNG suicide rate in 2014 and a slight upward trend in GP suicide rates, ARNG membership was associated with a higher risk of suicide throughout the period of our data.

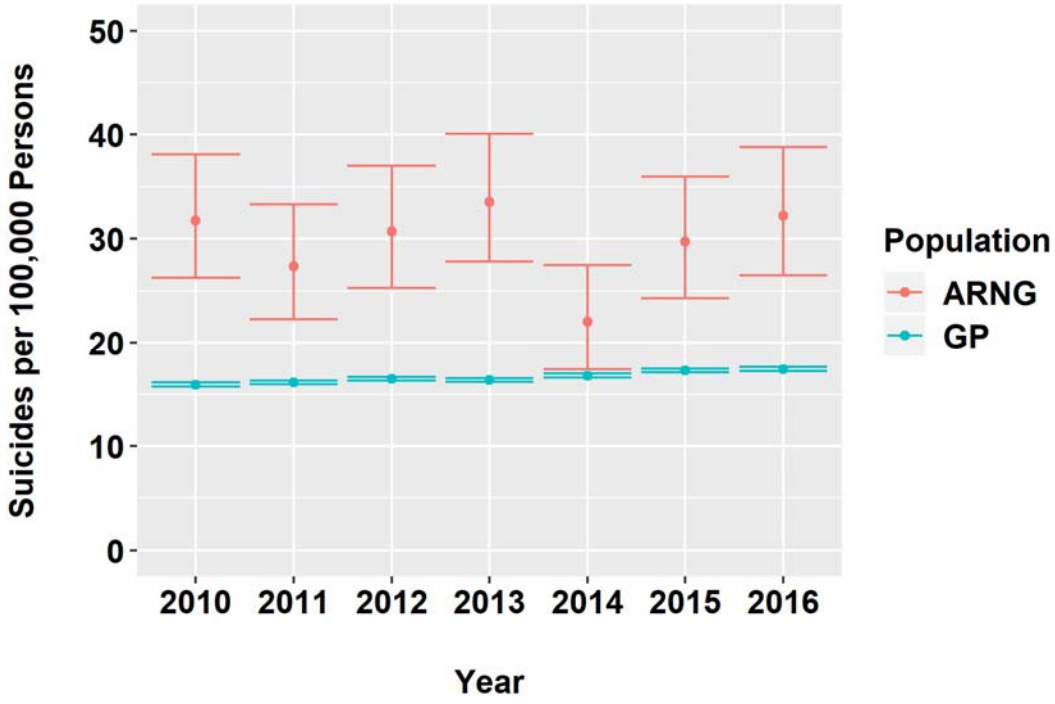


Figure 1. ARNG and GP Suicide Rates by Year, 2010–2016

Many factors could explain the difference in ARNG and GP suicide rates. In this section, we consider two factors: (1) demographic differences and (2) geographic population distribution. First, we observe that the ARNG is younger and more male than the GP. We also observe that ARNG suicide rates are highest among young males. We find that these two observations explain most of the difference between ARNG and GP suicide rates. Second, we observe that counties with high shares of the population in the ARNG tend to have higher ARNG suicide rates. We find that this observation explains a small amount of the difference between ARNG and GP suicide rates.

1. Accounting for Demographic Differences

In accounting for demographic differences, we seek to answer the question, "what would the ARNG suicide rate be if it had the same demographic shares as the GP?" Our

data offer age bin and sex as demographic factors.[17] We define the set of "demographic cells" to be the Cartesian product of these factors—females 17–24, males 17–24, females 25–34, and so forth. Two potential values for sex and 5 potential values for age bin entail 10 cells.

The ARNG suicide rate is equivalent to the mean of the suicide rates among all demographic cells, weighted by the number of ARNG person-years observed for each cell. To account for demographic differences, we use a rate standardization method whereby this mean is instead weighted using each cell's GP person-years. We then compare the standardized ARNG suicide rate to the GP suicide rate. The only difference between the two rates is due to differences in rates specific to each demographic cell. We also compare the cell-specific rates directly.

Figure 2 shows the number of observed person-years by demographic cell for the ARNG and GP. The GP has roughly equal person-years in each cell. The ARNG is disproportionally male and young.

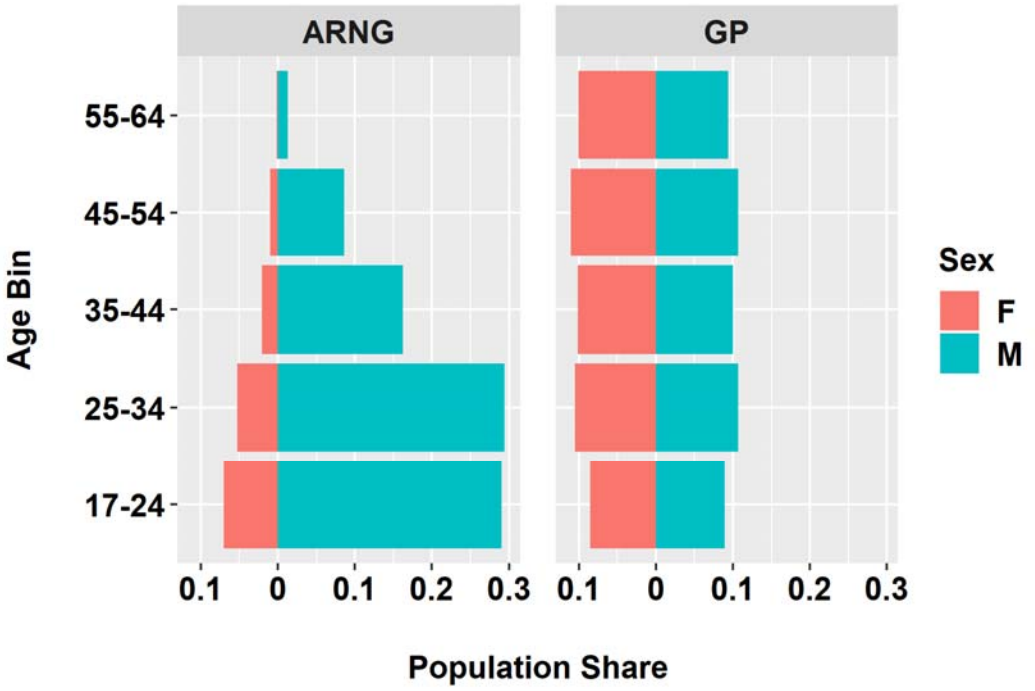
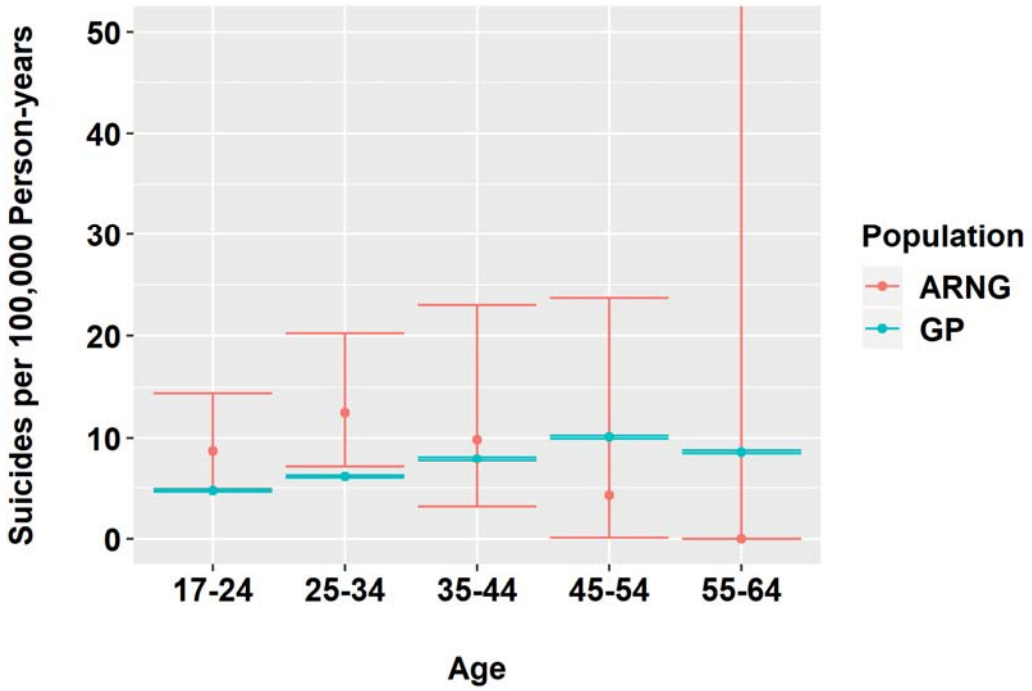


Figure 2. ARNG and GP Population Share by Sex and Age Bin

[17] Across multiple studies, Griffith found age, sex, and race factors to be those most strongly correlated with suicide risk in the ARNG (see Section 1.B). Each additional factor multiplies the demographic cells and diminishes the number of person-years in each cell. Therefore, choosing the number of demographic factors to include presents a tradeoff between specificity and precision. We navigate this tradeoff by including age bin and sex, but not race, in our rate comparisons. We later include county-level race shares in our partial correlation analysis in Section 3.C.2.

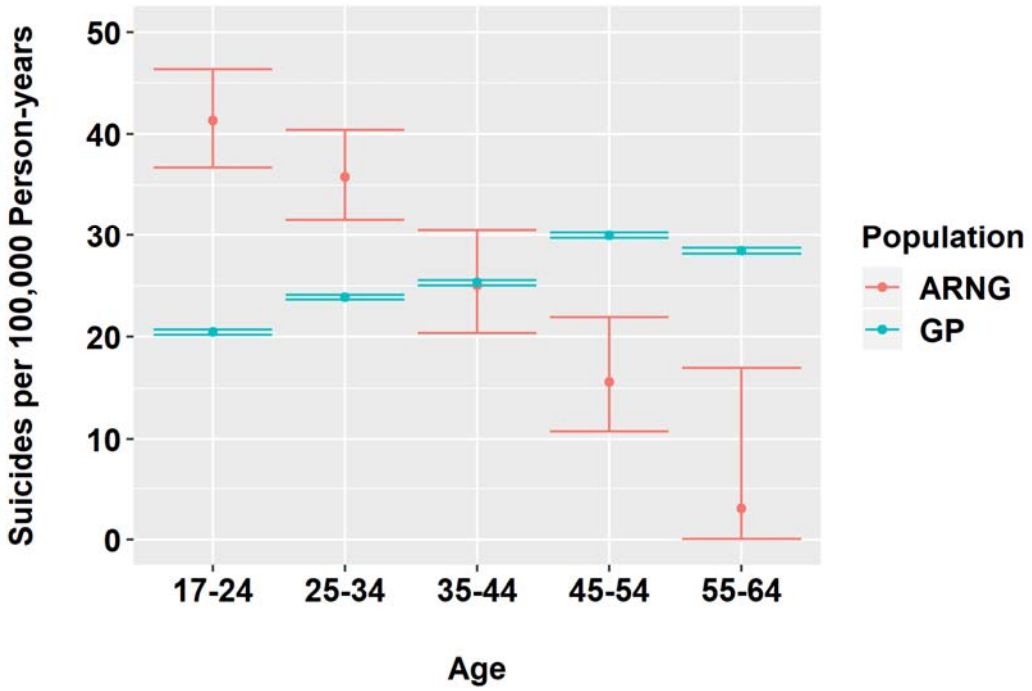
Figure 3 and 4 depict ARNG and GP suicide rates by age bin for females and males, respectively. Each rate is accompanied by error bars that bound a 95% confidence interval. The width of each confidence interval shrinks with the number of person-years; hence, the ARNG confidence intervals are smaller for the young and male cells, and the GP confidence intervals are miniscule for all cells. The narrow GP confidence intervals allow for the distinction of clear patterns. First, the male GP suicide rate is higher than the female GP suicide rate for all age bins. Second, for both sexes, the suicide rate is highest for the 45–54 age bin and decreases with distance from that age bin.



Note: Error bars represent exact 95% confidence intervals. The upper error bar for ARNG females 55–64, not shown in the figure, is at 104.9 suicides per 100,000 person-years.

Figure 3. Female Suicide Rates by Age Bin, 2010–2016

For females in the ARNG, we do not have enough observations over our 7 years of data to statistically distinguish differences in suicide rates between demographic cells. However, we can distinguish differences between the ARNG and GP for some age bins. Under the null hypothesis that the ARNG and GP suicide rates are the same among females aged 17–24, a difference as extreme as the one we observe would occur with 3.20% probability. For the 25–34 age bin, this probability, "p," is 1.04%. Therefore, we have statistical evidence that from 2010–2016, ARNG membership was associated with greater risk of suicide for females aged 17–34. We do not observe sufficient evidence to claim a statistical difference between ARNG and GP rates among older females.



Note: Error bars represent exact 95% confidence intervals.

Figure 4. Male Suicide Rates by Age Bin, 2010–2016

For males in the ARNG, we observe a negative relationship between age and suicide rate that we do not observe in the GP. ARNG membership was associated with a higher suicide rate for males aged 17–34 but a lower risk for males 45–64. The ARNG and GP suicide rates were nearly identical for males 35–44. For each of the three youngest age bins, suicide rates for ARNG members were significantly higher ($p < 0.05$) for males than for females. For the two oldest age bins, we do not observe sufficient evidence to claim a statistical difference in suicide risk between males and females in the ARNG.

Having computed suicide rates specific to each demographic cell, we can account for demographic differences in our calculation of the ARNG suicide rate and calculate the portion of the difference in ARNG-GP suicide rates that demographic differences explain. After accounting for sex and age bin shares by standardization, we estimate an ARNG suicide rate over all 10 demographic cells of 15.6 deaths per 100,000 person-years and an ARNG-GP OR of 0.94. Therefore, differences in demographic shares over the 10 demographic cells explain 108% of the increased risk of suicide associated with ARNG membership.[18]

[18] Differences in the 10 demographic shares explain more than 100% of the increased risk associated with ARNG membership because accounting for them causes ARNG membership to be associated with not just no additional risk of suicide, but a decreased risk of suicide. The ARNG-GP OR below 1.0 reflects this decreased risk.

Because rate standardization uses cell-specific suicide rates, it is more reliable with larger cell populations. The suicide data for females older than 44 and males older than 54 are especially scarce, which leads to large uncertainty in suicide rates for the corresponding three demographic cells. Therefore, we are more confident in standardized rates associated with only the remaining seven demographic cells with the greatest ARNG populations. However, we will report results for both specifications.

Restricting our analysis to these seven demographic cells yields a raw ARNG suicide rate of 30.3 deaths per 100,000 person-years, a raw GP suicide rate of 17.2 deaths per 100,000 person-years, and an ARNG-GP OR of 1.76. Standardizing the ARNG rate for demographic shares yields an ARNG rate over the seven demographic cells of 21.4 deaths per 100,000 person-years and an ARNG-GP OR of 1.24. Therefore, differences in demographic shares over the seven demographic cells explain 68% of the increased risk of suicide associated with ARNG membership.

C. County-Level Suicide Rates and Relative Risk

1. Geographic Distribution

Geographic distribution refers to how individuals in a population are distributed across space. Some places have large populations of GP members, and some have small populations of GP members. The same goes for the ARNG. Keeping suicide rates in each place constant, the national suicide rate will be lower to the extent that populations tend to be large where suicide rates are low. If this tendency is stronger for the GP than for the ARNG, then geographic distribution explains some portion of the greater odds of suicide in the ARNG.

Figure 5 depicts the ARNG share of the 2010–2016 population aged 17–64 at the county level, calculated for each county as the number of ARNG person-years divided by the number of GP person-years. Variance in ARNG population share means that the ARNG does not have the same geographic distribution as the GP. While Guardsmen represent 0.17% of the U.S. population aged 17–64 over the period that we studied, 23 counties have an ARNG population share of over 1%.

To measure the tendency for populations to be large where suicide rates are low, we calculate the correlation between population size (number of person-years) and suicide rate at the county level. Correlation ranges between -1 (perfectly negatively correlated) and 1 (perfectly positively correlated). For the GP, the correlation between county-level population and suicide rate is -0.13 with a 95% confidence interval of (-0.165, -0.096), which indicates that the population size is significantly negatively correlated with the GP suicide rate. For the ARNG, this correlation is -0.001 with a 95% confidence interval of

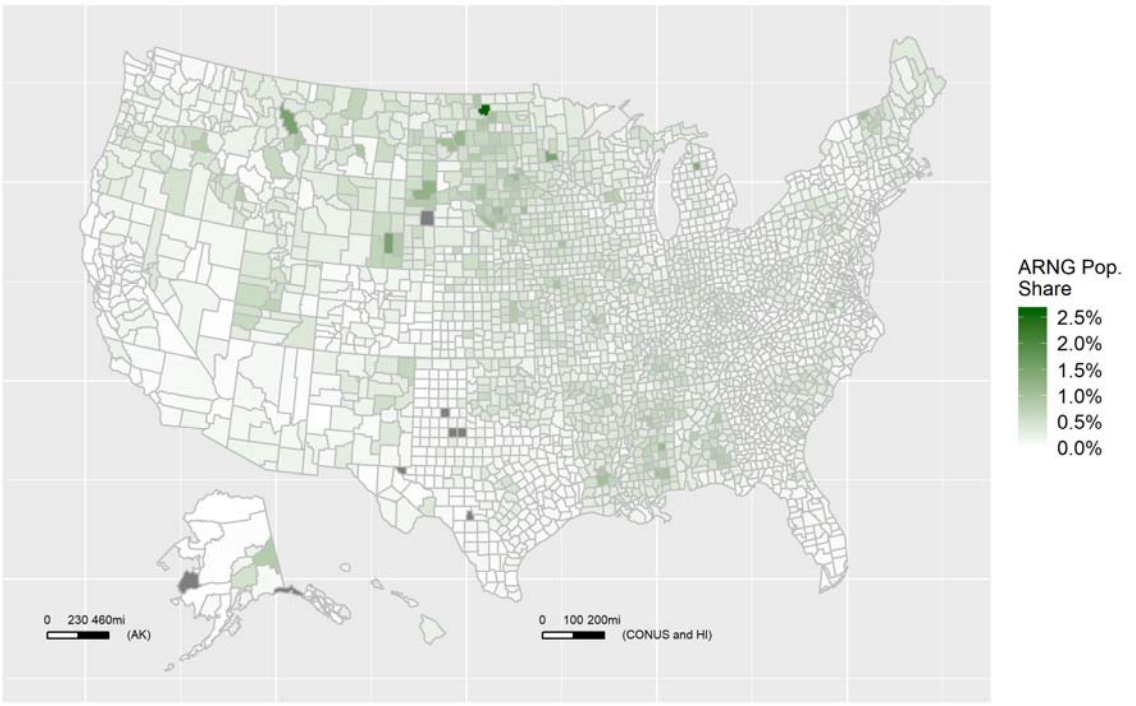


Figure 5. ARNG share of GP by County, 2010–2016

(-0.036, 0.033), which indicates that there is practically no correlation between ARNG population size and ARNG suicide rate. Therefore geographic distribution (i.e., variation in population size across counties) brings down the GP suicide rates but not the ARNG suicide rates, thereby widening the gap between them.

To account for geographic distribution and to measure the portion of the difference between ARNG and GP suicide rates that it explains, we adapt the standardization method applied to demographic shares in Subsection 2.B.1 to county populations. The ARNG suicide rate is equivalent to the mean of the suicide rates among all counties, weighted by the number of ARNG person-years observed for each county. To account for geographic distribution, we instead weight the mean by each county's GP person-years. This methodology allows us to answer the question, "what would the ARNG suicide rate be if it had the same geographic distribution as the GP?"

Using GP county population weights and data over all 10 demographic cells yields an ARNG suicide rate of 27.9 deaths per 100,000 person-years and an ARNG-GP OR of 1.68. Therefore, geographic distribution explains 16% of the increased suicide risk associated with ARNG membership. Restricting the data to only the seven demographic cells with the greatest ARNG populations yields an ARNG suicide rate of 28.3 deaths per 100,000 person-years and ARNG-GP OR of 1.64. Over the seven demographic cells, geographic distribution explains 18% of the increased suicide risk associated with ARNG membership.

Standardizing all at once for age, sex, and geographic distribution over all 10 demographic cells yields an ARNG suicide rate of 14.6 per 100,000 person-years and an ARNG-GP OR of 0.88. Over the seven demographic cells with the greatest ARNG populations, standardizing for age, sex, and geographic distribution yields an ARNG suicide rate of 20.2 per 100,000 person-years and an ARNG-GP OR of 1.17. Age, sex, and geographic distribution combined explain 115% of the increased suicide risk associated with ARNG membership over all 10 demographic cells and 77% over the 7 cells with the greatest ARNG populations.

Table 1 summarizes our findings for national-level ARNG-GP ORs. Each entry in Table 1 can be interpreted as the multiplier to an individual's odds of dying by suicide associated with ARNG membership. As mentioned in Section 2.B, we prefer the estimates based on the smaller number of demographic cells, represented by the first row of Table 1, because these estimates are based on the cells with a more statistically meaningful number of suicides and person-years per cell.

Table 1. ARNG-GP Suicide ORs for Different Stages of Standardization

Population	Unstandardized	Standardized for Age and Sex	Standardized for Age, Sex, and Geographic Distribution
Males age 17–54 and females age 17–44	1.76	1.24	1.17
Males and females age 17–64	1.78	0.94	0.88

2. Hierarchical Bayes

a. Motivation: The rare events problem

Rare events are events that occur a low number of times relative to a large number of trials. Suicide is a rare event, having occurred in fewer than 0.03% of ARNG person-years from 2010 through 2016. In a county in which we observe 1,000 ARNG person-years, a single suicide would imply an ARNG rate of 0.10%—more than three times the overall rate. However, this observation would be unlikely to be sufficient to claim that the underlying suicide risk in such a county is high relative to either ARNG populations in other counties or the GP in the same county. This population size is typical among counties in our data. We observe a total of 2,457,823 ARNG person-years over 3,217 counties, entailing a mean of 764 person-years per county.

On the other hand, most of the counties in our sample had zero ARNG suicides from 2010 through 2016, which is a necessary consequence of observing a total of 729 ARNG suicides over 3,217 counties. These counties had a suicide rate of 0.00%, but that does not mean that we can claim that these counties have low underlying suicide risk.

Thus, a given county's suicide rates generally do not provide sufficient information about the underlying suicide risk associated with residence in that county for comparison between the ARNG and GP. However, we have additional information in the form of suicide rates for other counties. At one modeling extreme, we could assume that all counties have the same underlying suicide risk and that variation in suicide rates across counties only represents random variation that will not persist over time. This "complete pooling" assumption would not only be indefensible, but it would defeat the purpose of comparing suicide rates across counties.

The opposite extreme would be to assume that the overall suicide rate in other counties is not at all informative of the underlying suicide risk in a given county. This "no pooling" assumption is dubious in a way that can be described using the concept of "regression to the mean." Suppose six counties had suicide rates of 15, 18, 20, 22, 25, and 45 per 100,000 person-years, respectively. The county with 45 deaths per 100,000 person-years is an outlier. There is some probability that this outlier is genuine (i.e., that it represents a true higher underlying suicide risk unique to the associated county). The "complete pooling" assumption assumes that this probability is zero, while the "no pooling" assumption assumes that this probability is one. Alternatively, there is some probability that this outlier is due in full or in part to random chance, and, therefore, there is a high probability that the same county will exhibit a lower suicide rate when observed in a subsequent period. "Regression to the mean" refers to the high probability of an outlier exhibiting a less extreme value in a subsequent observation.

To judiciously recognize the possibility of genuine outliers but also the possibility of regression to the mean, we must implement "partial pooling," whereby information from each county is considered somewhat informative about each other county. The appropriate amount of pooling will depend on the population size of each county and the certainty of each county-specific estimate. The hierarchical Bayesian method we employ achieves the appropriate amount of partial pooling given these characteristics of the data. Thus, we are effectively able to maximize the information available to us to address the rare events problem and provide reasonable suicide risk estimates at the county level. For a technical exposition of the hierarchical Bayes models we employ, see Appendix A.

b. Results

Table 2 shows the ARNG-GP ORs over all counties estimated by hierarchical Bayes methods. The shared OR point estimates in the third column are accompanied by two types of 95% confidence intervals in the fourth and fifth columns. The shared OR is the average OR that all counties share. The idiosyncratic OR is the shared OR plus the county-specific OR. Because county-specific ORs vary widely, the idiosyncratic OR confidence intervals are wider than the shared confidence intervals.

Table 2. ARNG-GP ORs Estimated by Hierarchical Bayes Method at County Level

Specification				
Demographic Controls	**Partial Pooling**	**Shared OR Estimate**	**Shared OR 95% Interval**	**Idiosyncratic OR 95% Interval**
No	No	1.78	[1.64,1.92]	[0.40,8.69]
Yes	No	1.49	[1.37,1.60]	[0.33,7.34]
No	Yes	1.51	[1.38,1.65]	[1.23,1.99]
Yes	Yes	1.27	[1.16,1.38]	[1.03,1.63]

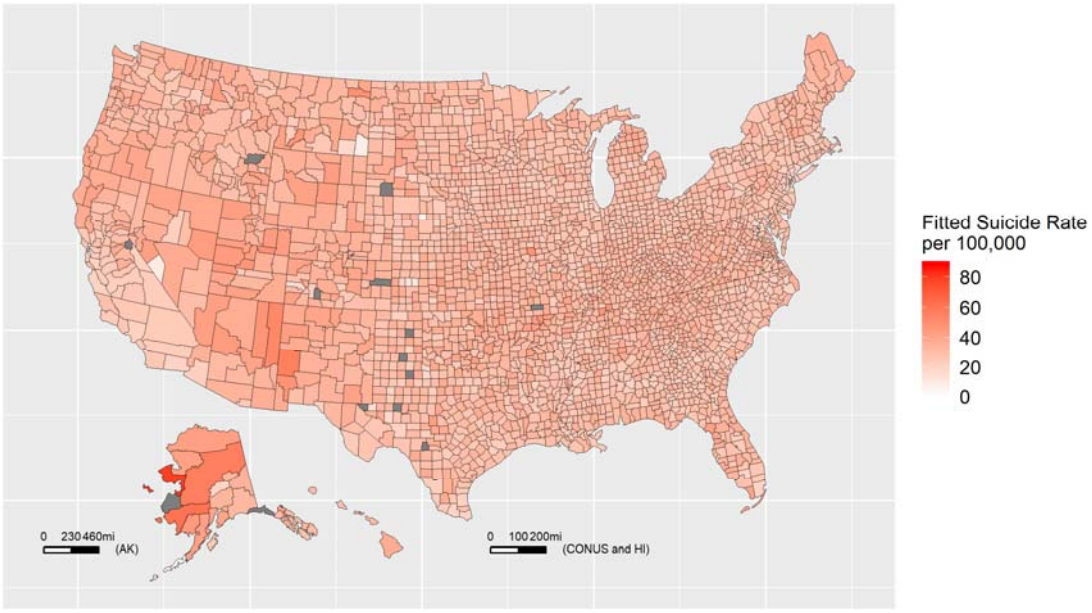
Table 2 presents four specifications, each of which occupies a row of Table 2. The second and fourth specifications each control for demographic cell effects, and the third and fourth specifications each implement partial pooling. The first specification neither controls for demographic effects nor implements partial pooling. The fourth specification is our preferred specification because it controls for demographic cell effects and implements partial pooling.

We can interpret the results of our preferred specification as follows, moving from left to right across the bottom row of Table 2. When controlling for demographics and allowing for partial pooling of information, being in the ARNG is associated with an overall 27% greater odds of dying by suicide, with a 95% confidence interval from 16% to 38%. However, when we also take into account that the relative risk associated with ARNG membership varies across counties, we estimate that 95% of counties have a relative risk between 3% and 63%.

Figure 6 and Figure 7 illustrate the ARNG and GP suicide rates, respectively, that we would expect in each county given the county-specific suicide risks estimated by our preferred hierarchical Bayes method. These rates are “fitted rates” in the sense that they are the rates obtained by entering county characteristics into the fitted model. Fitted rates reflect the model’s best individual guess at the underlying suicide risk in each county.

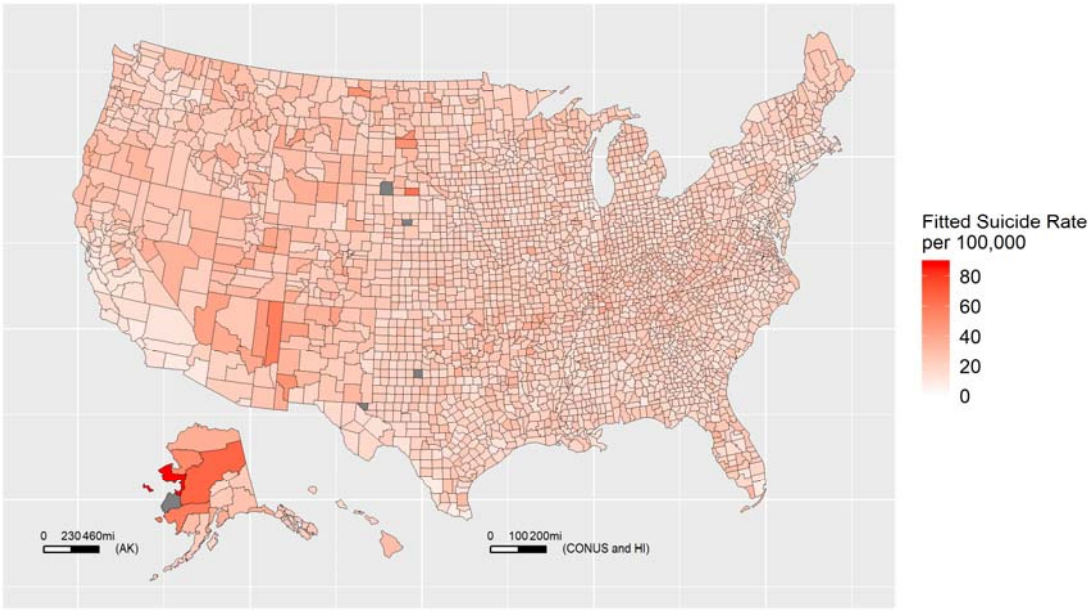
Figure 6 and Figure 7 each reveal the higher suicide risk in the Intermountain West that was documented in previous literature (see Section 1.B). The similarities in geographic patterns between the ARNG and GP are not limited to this phenomenon but are pervasive across the United States. Although ARNG suicide rates are generally higher than GP suicide rates, the counties that have relatively high ARNG rates tend to be the same counties that have relatively high GP rates. The ARNG is like the GP in how its suicide rates vary across space.

Figure 8 illustrates county-level ARNG-GP ORs. Red counties are where the ARNG odds of suicide are higher than the GP odds of suicide, and blue counties are where the GP odds of suicide are higher than the ARNG odds of suicide. Most counties are red, consistent with the overall higher risk of suicide associated with ARNG membership. Comparing



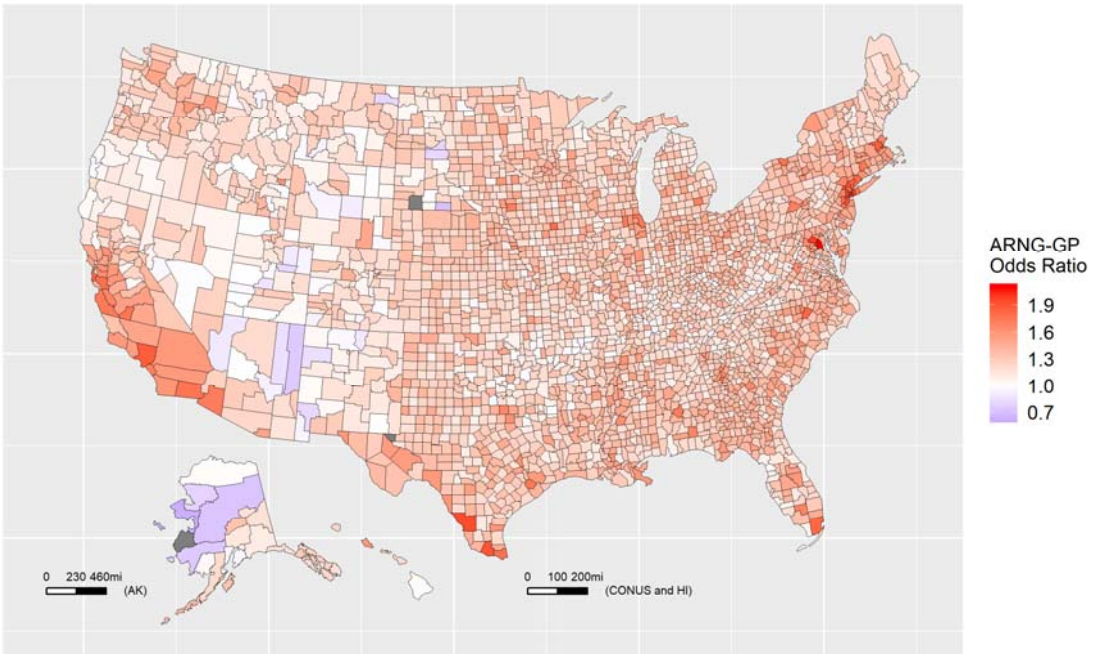
Note: Grey counties lacked sufficient population for analysis.

Figure 6. Fitted ARNG Suicide Rates by County



Note: Grey counties lacked sufficient population for analysis.

Figure 7. Fitted GP Suicide Rates by County



Note: Grey counties lacked sufficient population for analysis.

Figure 8. ARNG-GP ORs by County

Figure 8 with Figure 6 and Figure 7 reveals that ARNG-GP ORs tend to be higher where suicide rates (in the ARNG and the GP) are lower. In other words, the relative risk associated with ARNG membership tends to be lower where suicide rates are higher—most conspicuously in the Intermountain West.

One possible explanation for this observation is that GP suicide risk varies more across space than ARNG risk because GP individuals vary more than Guardsmen. In other words, the ARNG is a more homogenous population than the GP, which causes ARNG suicide risk to be more homogenous than GP suicide risk across space. Another possible explanation is that high ARNG suicide rates induce or inspire greater SP efforts, which creates a negative feedback loop. A third possible explanation is that partial pooling attenuates our estimates and does so to a greater extent for the ARNG, for which we have fewer observations. These explanations are not exhaustive nor are they mutually exclusive. Identifying the relative contributions of the possible explanatory phenomena is a topic for further research.

It is also important to assess the probability that the ARNG suicide risk was lower than GP suicide risk, not just the expected value of that relative risk. In applying the hierarchical Bayes method, we simulate a distribution of potential outcomes. The probability that the ARNG suicide risk is lower than the GP suicide risk is the proportion of these simulations for which the OR is less than one. This probability can be measured nationally and a county by county basis. The national probability that the ARNG rate is lower than

the GP rate is 0.025%. To compare counties, we first estimate the probability that the ARNG rate is less than the GP rate for each county. We then count the number of counties where that probability is greater than 0.5. This effectively counts the number of counties where the ARNG rate is probably lower than the GP rate. There are 57 counties where the probability is greater than 0.5 that the ARNG rate is lower than the GP rate. That is, 1.7% of counties fall above this probability threshold. Table 3 shows the alternative specifications. The shares of counties where the ARNG risk is likely lower than the GP risk are greater than 87% with no pooling. The magnitude of these shares is an artifact of the rare events problem. ARNG members are rare (compared to GP), and suicides are even rarer. Thus, many counties will have no ARNG suicides but will have some GP suicides. However, the ARNG population count is also low, making those counties "low information" counties and thus without pooling, we cannot get an accurate estimate of the suicide rate for the ARNG.

Table 3. Share of Counties Where ARNG Rate is Likely Below GP Rate

Specification				
Demographic Controls	**Partial Pooling**	**Share**	**Number**	**Total**
No	No	88.5%	2,812	3,209
Yes	No	87.6%	2,840	3,209
No	Yes	0.3%	11	3,225
Yes	Yes	1.7%	57	3,225

c. State-level results

We can conduct the same hierarchical Bayes analysis at the state level (as opposed to the county level). The level of geography represents a tradeoff between specificity and sufficiency of data. At the county level, we can allow suicide risk to vary within states, but we rely on a small amount of data to inform us on how that risk varies. At the state level, we alleviate the rare events problem but are more limited in our ability to observe geographic patterns. Therefore, our primary goal in conducting a state-level analysis is to observe the sensitivity of our nationwide OR estimates to the rare events problem as opposed to observing geographic patterns, which are illustrated at greater definition in Figure 6 and Figure 7. The estimates in Table 4 are similar to those in Table 2, indicating that our OR estimates are not sensitive to the rare events problem. In other words, the scarcity of observations at the county level does not preclude us from obtaining reasonable OR estimates.

Table 4. ARNG-GP ORs Estimated by Hierarchical Bayes Method at State Level

Specification				
Demographic Controls	**Partial Pooling**	**Shared OR Estimate**	**Shared OR 95% Interval**	**Idiosyncratic OR 95% Interval**
No	No	1.79	[1.65,1.92]	[0.77,3.75]
Yes	No	1.42	[1.32,1.53]	[0.61,2.99]
No	Yes	1.63	[1.46,1.80]	[1.32,2.18]
Yes	Yes	1.29	[1.15,1.42]	[1.02,1.74]

d. Spatial relationship

Figure 6 and Figure 7 illustrate pervasive similarity in geographic patterns between ARNG and GP county suicide rates. They also show that these patterns exhibit positive spatial correlation. Counties that are closer together tend to have more similar suicide risk estimates. In this section, we select a "spatial model" to quantify this spatial correlation. This model informs us about the relationship that we should anticipate between two counties based on their geographic dispersion.

Spatial methods characterize the degree of similarity of county suicides over spatial distance. Spatial distances can be abstractly defined as the weight assigned between two counties. The spatial weights decide how much weight proximal counties are given for determining a given county's suicide rate. We specify seven different weight models and let the data decide which one is most appropriate to characterize all counties. Six of the models are based on the distance between county centers.[19] The last model indicates counties that have touching borders. The first two models (W1a,W1b) are "radial distance" weights, where all counties within a certain distance are given the same weight. The next two weight models (W2a,W2b) are exponential decay weights, where the weight between two counties decays at an exponential rate that is proportional to the distance of the two counties. The next weight model (W3) is the inverse distance weight, where the weight between two counties decays at a rate proportional to the inverse distance of the two counties. The next weight model (W4) is the "double-power distance" weight, where the rate of decay is a function of distance that is bell shaped in which it is slow at first but accelerates quickly. The last weight model (W5) is the "touching" weight that assigns equal weight to all bordering counties. All weights equal zero for any distances over 500 miles. The weights as a function of distance are presented mathematically below and graphically in Figure 9. Neither include W5 since it is not a function of distance. "c" is a parameter that represents how quickly the spatial correlation dissipates with distance from a given county.

[19] County distances are great-circle distances calculated using the Haversine formula based on internal points (as calculated by the Census Bureau) in the geographic area.

For model W1a, c =200; for model W1b, c =500; for models W2a and W3, c =75; for model W2b, c =150; and for model W4, c =500.

$$W1 = \begin{cases} 1, & 0 \le d_{ij} < c \\ 0, & d_{ij} \ge c \end{cases},$$

$$W2 = \exp\left(-\frac{d_{ij}}{c}\right),$$

$$W3 = \left(\frac{\mathrm{d_{ij}}}{c}\right)^{-1},$$

$$W4 = \left[1 - \left(\frac{d_{ij}}{c}\right)^2\right]^2.$$

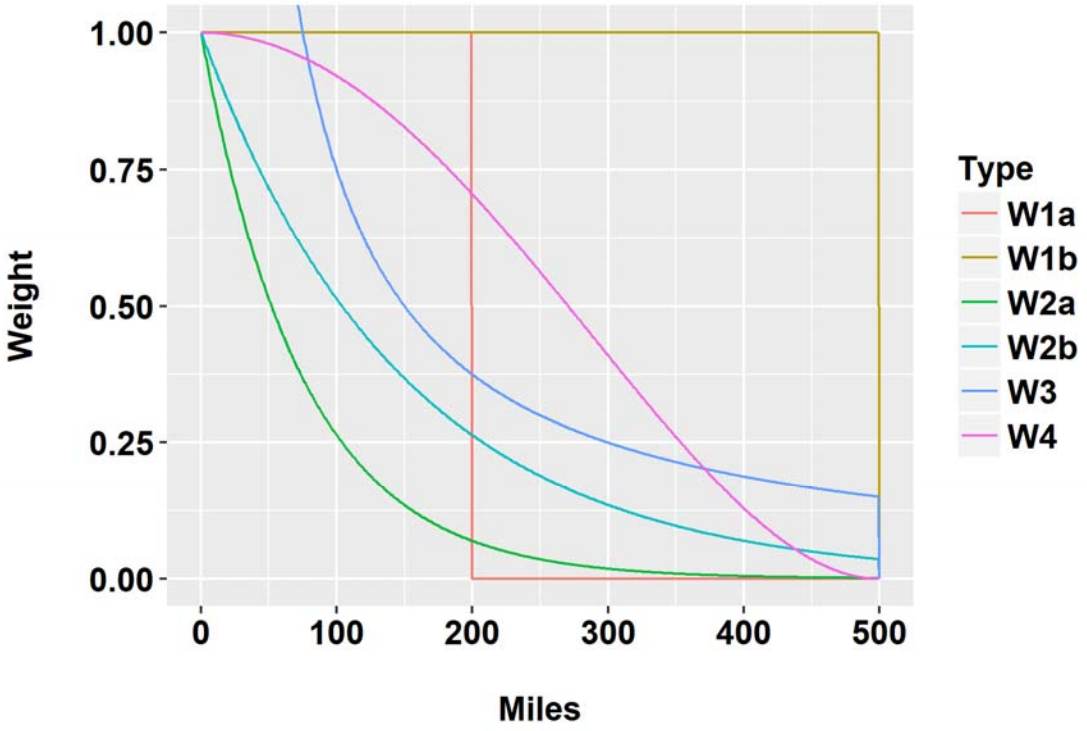


Figure 9. Illustration of Different Spatial Weight Models

For each of three county-level outcomes (GP suicide risk estimate, ARNG suicide risk estimate, and the estimated ARNG-GP suicide OR, each log-transformed), we fit each of the spatial error models described previously. For a given outcome, we assess and compare the models using a measure derived from information theory called Akaike Information Criterion (AIC). The AIC measure is a common measure used for model

comparison. It assigns a value to how well the model fits and then penalizes that value for the complexity of the model. A smaller (or more negative) AIC reflects better model performance on a given dataset. AIC can be thought of as a quantitative measure of Occam's Razor in that it weighs explanatory power against complexity. Table 5 shows the AIC values of the spatial error models estimated with the different spatial weight schemes. The model with the lowest AIC measure (i.e., greatest in the negative direction) is the preferred one. Thus, the exponential decay weight scheme, W2a, is the most preferred for all three outcomes. The fact that estimated ARNG and GP suicide risk (as well as their OR) share the same preferred spatial weight model is not a natural consequence of the method. Rather, it is further evidence that geographic patterns in suicide are similar for both populations. Note that AIC values can only be compared within a column (i.e., across models applied to the same outcome), not across columns.

Table 5. Spatial Model Fit by Outcome and Weight Scheme

	AIC		
Weight Scheme	**Log of Estimated GP Risk**	**Log of Estimated ARNG Risk**	**Log of Estimated ARNG-GP OR**
W1a	-901	-4226	-5554
W1b	-409	-3735	-5080
W2a	-1004	-4328	-5656
W2b	-760	-4084	-5422
W3	-767	-4092	-5429
W4	-682	-4007	-5346
W5	-913	-4225	-5575

As an example, consider Fairfax County, Virginia, which is 55 miles from Baltimore County, Maryland, and 316 miles from Franklin County, Ohio. Using the preferred model W2a, the spatial weights that Fairfax County has with Baltimore and Franklin Counties are $\exp\left(-\frac{55}{75}\right)$, which equals 0.48, and $\exp\left(-\frac{316}{75}\right)$, which equals 0.01, respectively. This means that the estimated suicide risk in Baltimore County can be expected to be 48 times more predictive than the estimated suicide risk in Franklin County of the estimated suicide risk in Fairfax County. Each other county similarly receives a weight based on its distance from Fairfax County. These weights are then each divided by their sum over all counties so that their sum is normalized to one. This normalization allows each county's weight to be interpreted as the share of the spatial relation with Fairfax County attributed to that county. This process of calculating weights is simultaneously performed for all counties besides Fairfax County.

e. Concentration of risk

Concentration of risk is a measure of how concentrated or distributed the risk of suicide is with respect to some grouping. Groups that contain a higher portion of the risk of suicide are considered to be higher concentrations of risk. For example, we already found that risk of suicide is concentrated in younger, male ARNG populations.

This measure can be useful for verification of model accuracy. If we stratify fitted suicide rates by nine equally sized bins, the bins that the model estimates to have a higher probability of suicide should have a higher relative proportion of suicides in the observed data.

Table 6 displays the concentration of risk for suicides binned by nine equally spaced quantiles. The quantile bins for the first row are constructed by sorting the counties based on their estimated ARNG suicide risk over all demographic groups. The quantile bins in the second row are sorted by estimated GP suicide risk over all demographic groups. The quantile bins in the remainder of the rows are sorted by the associated population (ARNG or GP) and demographic cell. If there was no concentration of risk, then the concentration numbers should match the quantile bin they are in. The concentration numbers should be higher than the associated quantile bin to the extent that the model is able to distinguish individuals according to their suicide risk. The model performs about equally well for the GP and ARNG and for most demographic bins. An example of interpretation for the top left entry is “The counties with the highest estimated suicide risk containing 10% of the ARNG population accounted for 18% of ARNG suicides.” For the ARNG, males 55–64 and females 35–44, 45–54, and 55–64 are not shown because there were fewer than 10 suicides in each demographic cell.

Table 6. Concentration of Suicide Risk by Population and Demographic Cell

			Quantile Bin								
ARNG/GP	**Sex**	**Age**	**0.10**	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
ARNG	Both	17–64	0.18	0.32	0.44	0.53	0.63	0.71	0.80	0.87	0.93
GP	Both	17–64	0.17	0.31	0.43	0.54	0.64	0.73	0.81	0.89	0.95
GP	M	17–24	0.18	0.31	0.43	0.54	0.64	0.73	0.81	0.88	0.95
GP	M	25–34	0.18	0.32	0.45	0.56	0.66	0.75	0.83	0.90	0.97
GP	M	35–44	0.18	0.32	0.44	0.55	0.65	0.74	0.82	0.90	0.97
GP	M	45–54	0.17	0.30	0.43	0.53	0.63	0.73	0.80	0.88	0.95
GP	F	17–24	0.18	0.31	0.42	0.52	0.61	0.70	0.78	0.86	0.93
GP	F	25–34	0.18	0.32	0.44	0.54	0.64	0.73	0.81	0.89	0.96
GP	F	35–44	0.19	0.33	0.45	0.56	0.66	0.75	0.82	0.90	0.97
GP	F	45–54	0.17	0.31	0.43	0.54	0.64	0.73	0.81	0.89	0.95
GP	F	55–64	0.17	0.29	0.42	0.52	0.61	0.7	0.79	0.87	0.94
ARNG	M	17–24	0.16	0.30	0.38	0.47	0.58	0.69	0.78	0.85	0.93
ARNG	M	25–34	0.16	0.30	0.43	0.51	0.59	0.68	0.74	0.84	0.90
ARNG	M	35–44	0.16	0.31	0.46	0.55	0.63	0.74	0.82	0.92	0.98
ARNG	M	45–54	0.12	0.33	0.45	0.52	0.55	0.64	0.73	0.82	0.97
ARNG	M	55–64	0	0	0	0	0	0	1	1	1
ARNG	F	17–24	0.19	0.38	0.56	0.62	0.69	0.69	0.81	0.88	0.88
ARNG	F	25–34	0.38	0.50	0.62	0.69	0.69	0.88	0.94	1	1

D. Summary of Results

This chapter offers five primary findings:

- Age, sex, and geographic distribution explain 77% of the difference between ARNG and GP suicide rates.
- Male suicide rates in the ARNG were higher for younger age groups, which is opposite the trend in the GP.
- Estimated ARNG and GP suicide risk exhibited similar geographic patterns, being higher in the Intermountain West.
- Estimated ARNG risk tended to be higher than GP risk, but the difference tended to be smaller where suicide risk was higher.
- The preceding two findings entail that there tended not to be areas where ARNG suicide risk was high relative to the ARNG in other counties and relative to the GP in the same county, so we do not find sufficient evidence to identify specific areas in special need of additional ARNG SP resources.

This page is intentionally blank.

3. Relationships between Estimated Suicide Risk and Geographically Varying Factors

A. Objective

In the previous chapter, we estimated and compared underlying suicide risk at the county level for the ARNG and GP and observed patterns in the estimates across space. Spatial location is only one of a vast number of factors that vary across states and counties and that could be related to suicide risk. In this chapter, we combine state- and county-level data from a variety of sources into a dataset of potentially related factors. We then use a spatial econometric model to estimate the statistical relationships between those factors and the suicide risk estimates while accounting for the spatial patterns we observed in the previous chapter. We find evidence to reinforce our finding that the ARNG is like the GP.

We also devote special attention to the characteristics of ARNG state and territory SP programs. We collect responses from these programs on these characteristics and correlate them with our suicide risk estimates. Because our suicide risk estimates predate the responses, we are unable to estimate the causal effect of program characteristics on suicide rates. However, with our initial collection of program responses, we have laid the groundwork for the ARNG to conduct such a causal analysis in the future.

B. Data

Having accounted for the basic demographic factors of age and sex in calculating our county-level estimates of suicide risk, we consider three additional categories of potential factors: (1) ARNG SP policies and programs related to SP, (2) GP socioeconomic and additional demographic factors, and (3) ARNG-specific population factors.

1. ARNG Policies and Programs

Each of the 54 states and territories (the 50 states plus Guam, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia) operates its own SP program for its Guardsmen. States and territories vary in what policies and programs they implement, how they fund, implement, and assess them, what SP guidance they follow, their staffing, and their perspectives on specific challenges and opportunities. In coordination with the sponsor, IDA designed an RFI on these characteristics and distributed it to the SP programs of each of the 54 states and territories. The RFI design involved iterative drafting by the project team and review by IDA project reviewers, the sponsor, and two state SP program offices. The RFI document is in Appendix B. IDA collected program responses from October 2017 to March 2018. Fifty of the 54 states and territories responded. In a briefing as part of this

project, IDA provided the sponsor an analysis of the program responses, including recommendations, and a flat file containing the responses in their entirety.

Because the RFI was conducted following the period of our suicide data, we are not able to observe causal effects of state program characteristics on suicide rates. We are, however, able to associate 2017–2018 program characteristics with suicide rates from 2010–2016, and we do so in Subsection 0. With the collection of ARNG suicide data in future years, a causal analysis of state program characteristics on suicide rates will be possible. Regular updating of the program responses would greatly improve such an analysis.

IDA performed cluster analyses of the program responses. Cluster analyses attempt to categorize observations (in this case, states) into a small number of distinct groups in which members of a group are more similar to each other than they are to members of other groups. A cluster analysis is useful for succinctly describing the types of observations in the data. All else being equal, greater within-group similarity and less across-group similarity make a cluster analysis more useful. The usefulness of a cluster analysis, therefore, depends on the data. IDA found that the program response data were not conducive to a useful cluster analysis. While a small number of groups could be identified, these groups exhibited substantial within-group variation and meager across-group variation. This finding was the case for cluster analyses of individual sections of the responses and for the responses in total. The fact that states did not fit into a small number of distinguishable groups and instead varied irreducibly along many dimensions is an important finding for resource allocation and for program evaluation, as discussed in Chapter 4.

An alternative method of succinctly describing the program responses is to develop a metric that is based on a selection of questions. Compared to cluster analysis, this method has the advantage of being simple to calculate and understand but the disadvantage of relying on the judgment of the researcher. Based on knowledge gained from prior work on military SP programs and the RFI review and revision process, IDA selected 11 RFI questions to indicate of the quality of a state/territory program. IDA measured program quality as the number of these questions answered preferably. These questions and their respective preferred responses are tabulated in Table 7. Nine states and territories responded preferably to 7 or more of the 11 questions (with a maximum of 9 preferable responses), while 18 states and territories responded preferably to 3 or fewer questions. The mean number of preferable responses was 4.25.

Table 7. Selected Elements of State SP Program Quality

Question	Preferred Response	Share of Responses Preferred
Is there an established state policy for post-hospitalization "buddy system/warm hand-off" following a suicide attempt or suicidal crisis?	Yes	42%
Are there local ARNG firearm policies in place (e.g., program to temporarily lock up guns for those determined to be at risk, training on firearms safety as it pertains to suicide)?	Yes	28%
What guidance documents do you use for your SP program?	At least two among AR 600-63, DA PAM 600-24, and an ALARACT	50%
Is the SPPM qualified in resilience training (sometimes referred to as mindfulness training)?	Yes	50%
Are there specific educational or work experience requirements for filling the R3SP/SPPM and/or SIO positions?	Yes	38%
Is there currently an SIO at each unit in your state/territory?	Yes	44%
Does your Joint Force HQ have memorandum(s) of agreement with state and county mental health organizations to provide services to geographically dispersed ARNG members and their families?	Yes	20%
What percentage of personnel in your state/territory have completed SP/intervention training in the last 12 months?	At least 75%	24%
Do the Family Assistance Centers (FACs) provide SP information and support? If so, have FAC employees received SP training?	Yes to both	56%
Do family members receive SP training?	Yes	32%
Have there been any assessments of the effectiveness of SP programs (either NGB-provided or locally developed)?	Yes	46%

Note: ALARACT = All Army Activity; JFHQ = Joint Force Headquarters; R3SP = Resilience, Risk Reduction, and Suicide Prevention; SIO = Suicide Intervention Officer; SP = Suicide Prevention; SPPM = Suicide Prevention Program Manager.

Note: AR 600-63 = United States Army, "Army Health Promotion," Army Regulation 600-63 (Washington, DC: Headquarters, Department of the Army, 14 April 2015). https://www.army.mil/e2/downloads/rv7/r2/policydocs/r600_63.pdf; DA PAM 600-24 = United States Army, "Health Promotion, Risk Reduction, and Suicide Prevention," Department of the Army Pamphlet 600-24 (Washington, DC: Headquarters, Department of the Army, 14 April 2015). https://www.army.mil/e2/downloads/rv7/r2/policydocs/p600_24.pdf.

2. GP Population Factors

To further assess geographic differences, we assembled a set of potential county-level factors from a variety of publicly available data sources. From the U.S. Census Bureau American Community Survey 2010–2014 5-year estimates, we obtained the shares of the county population between the ages of 18 and 64, older than 64, with income below the federal poverty line, with and without military veteran status, and disabled, as well as the intersections of these categories, the labor force participation rate, the unemployment rate, median earnings, and shares by race and education.[20] From the U.S. Census Bureau 2010 County Business Patterns data, we obtained numbers of establishments related to drinking, gambling, and health care, which we converted to per capita values. From the U.S. Bureau of Alcohol, Tobacco, Firearms, and Explosives January 2015 Listing of Federal Firearms Licensees, we obtained the numbers of federally licensed manufacturers, importers, and dealers of firearms, ammunition, and other destructive devices, which we converted to per capita values. Using the RAND State Firearm Law Database,[21] we calculated the share of the time from 2010 through 2016 that each state had in effect four types of firearms control laws. From the U.S. Census Bureau 2010 Census, we obtained population per square mile of land area and population per housing unit. Using 2010 Census county centers of population, a list of ARNG Family Assistance Center (FAC) addresses, and geocoding services, we calculated the distance from each county's center of population to the nearest FAC. From the 2010 U.S. Religion Census, we obtained numbers of congregations in total and by denomination, which we converted to per capita values, as well as shares of the population adherent to a religion in total and by denomination. We also used county assignment to each of the nine contiguous (where possible) U.S. Census Divisions as an indicator of regional location.[22] Table C-1 in Appendix C describes each factor and associates it with its abbreviated name used in the results table in this chapter (see Table 8).

3. ARNG Population Factors

We used ARNG Uniformed Personnel data provided by the ARNG Program Analysis and Evaluation Division, along with the HUD crosswalk introduced in Subsection 2.A.1, to calculate characteristics of county-level ARNG populations. These characteristics concerned medical and dental readiness, education, deployments, prior service, and pay grade. To obtain factors at the county level, we calculated medians, shares, or counts for each characteristic as appropriate.

---

[20] Some category intersections were excluded due to linear dependence.

[21] At the time of writing, the RAND State Firearm Law Database is available at Samantha Cherney, Andrew R. Morral, and Terry L. Schnell, *RAND stated Firearm Law Database*, Document No. TL-283-RC (Santa Monica, CA: RAND Corporation, 2018), https://www.rand.org/pubs/tools/TL283.html.

[22] The East South Central Division is excluded due to linear dependence and therefore serves as the reference category against which the estimates for each other Census Division can be compared.

C. Investigating Relationships

1. Methodologies

We use logistic regression to measure the relationship between county estimated suicide risk and the state RFI responses. Logistic regression is a statistical model that estimates a relationship between a binary outcome and some factor.

We use the spatial error Durbin model to measure the relationship between county factors and estimated suicide risk. The spatial error Durbin model is a statistical model that estimates the relationship between each factor and a continuous outcome as well as the spillover effects from neighboring counties' factors. The errors from the model are allowed to be flexibly related to the spatial relation between counties. The spatial weights chosen for this model are the exponential decay weights W2a selected by the analysis in Subsection 2.C.2.d.

2. Suicide Rates and Differences

Below are the results from the spatial error Durbin model, where we used county-specific factors to see which factors were strong factors for the GP suicide risk estimate, the ARNG suicide risk estimate, and the ARNG-GP OR. These three outcomes are the same outcomes used to select spatial models in Subsection 2.C.2.d. Table 8 shows the results from estimation. The left column numbers the factors, the "Factor" column provides the names of the factors, and the next three columns provide the results for partial correlations with the GP suicide risk estimates, the ARNG suicide risk estimates, and the ARNG-GP OR, respectively. By partial correlations, we mean correlations between the dependent variable and a given factor after having accounted for correlations with all other included factors.[23] All three dependent variables are log-transformed. The GP, ARNG, and ARNG-GP OR columns can have five different values: (blank), -, -*,+ and +*. If the cell is blank, then the factor was not statistically significant at the 5% level. If the cell contains a "-," then the factor is a significant negative factor for the outcome at the 5% level. If the cell contains a "+," then the factor is a significant positive factor for the outcome at the 5% level. If the cell also contains a "*," then the factor is also significant at the 1% level. The first 84 rows of the table measure the correlation between a county's factor and the value of the dependent variable in that county. The next 84 rows measure the correlation between neighboring counties' factors and the value of the dependent variable in the given county.

---

[23] This statement means that the partial correlations must be interpreted in terms of the other factors that we have included. For example, the partial correlation associated with requiring a waiting period to purchase firearms assumes that the number of arms dealers per capita is fixed. Therefore, partial correlations would not capture an effect of firearms control laws on the number of arms dealers per capita, which, in turn, affects suicide risk.

Sixteen factors are ARNG specific (e.g., median Armed Forces Qualification Test (AFQT) score) and therefore not used in the GP model.

Table 8. Partial Correlations Between Fitted Suicide Rates/Ratios and Geographically Varying Factors

Number	Factor	GP	ARNG	ARNG-GP OR
1	Pop18to64	+*	+*	-*
2	Vets18to64	+*	+*	-*
3	Vets18to64Pov			
4	Vets18to64PovDis			
5	Vets18to64nonPovDis			-*
6	NonVets18to64Pov			
7	NonVets18to64PovDis			
8	NonVets18to64nonPovDis			
9	PopOver64			
10	VetsOver64			
11	VetsOver64Pov			
12	VetsOver64PovDis			
13	VetsOver64nonPovDis			
14	NonVetsOver64Pov			
15	NonVetsOver64PovDis			
16	NonVetsOver64nonPovDis			
17	AmmoMakers			
18	ArmsDealers	+*	+*	-*
19	ArmsImporters			
20	ArmsMakers			
21	ArmsPawns			
22	DDeviceDealers			
23	DDeviceImporters			
24	DDeviceMakers			
25	LaborForcePart			
26	UnempRate	+*	+*	-*
27	DistToFAC			
28	PopPerSqMile			
29	PopPerHousingUnit	-*	-*	+*
30	Bars			
31	CasinoHotels			
32	Casinos			
33	GeneralHospitals	+*	+*	-*

Number	Factor	GP	ARNG	ARNG-GP OR
34	LiquorStores	+*	+	
35	OtherGambling	+	+	
36	PsychHospitals			+
37	PsychOffices	+*	+*	-*
38	Census_DistrictEast.North.Central	-*	-*	+*
39	Census_DistrictMiddle.Atlantic			
40	Census_DistrictMountain			
41	Census_DistrictNew.England			
42	Census_DistrictPacific			
43	Census_DistrictSouth.Atlantic			
44	Census_DistrictWest.North.Central		-*	
45	Census_DistrictWest.South.Central	-*	-*	+*
46	BackgroundChecksDealer			
47	BackgroundChecksPrivate	+		-*
48	WaitingPeriod			
49	RegisterFirearm			
50	OneGunPerMonth			
51	MinimumAgePurchase	-*	-*	+
52	AnyReligion			
53	EvangelicalProtestant			
54	BlackProtestant			
55	MainlineProtestant			
56	Catholic			
57	Orthodox			
58	OtherReligion			
59	White	-*	-*	+*
60	Black	-*	-*	+*
61	AIAN	+*	+*	-*
62	Asian			
63	NHOPI			
64	OtherRace			
65	MultiRace	-*	-*	+
66	HighSchoolDegree	+*	+*	-*
67	BachelorsDegree	-*	-*	+*
68	MedianEarnings			
69	AFQTScore_median	NA		
70	MoreThanHighSchool_share	NA		

Number	Factor	GP	ARNG	ARNG-GP OR
71	NumDeployedTours_median	NA		
72	NonDeployableMedical_share	NA		
73	AnyPhysicalLimitation_share	NA		
74	Enlisted_share	NA		
75	E5orBelow_share	NA	+	-*
76	PULHES34_share	NA		
77	MRC34_share	NA		
78	DRC34_share	NA		
79	YearsOfService_median	NA		
80	PriorService_share	NA		
81	PriorActiveService_share	NA		
82	TraditionalGuardsmen_share	NA		+
83	CountyManMonthCount	NA		
84	CountyUniqueIndividuals	NA		
85	lag.Pop18to64			
86	lag.Vets18to64	-*	-*	+
87	lag.Vets18to64Pov	+*	+*	-*
88	lag.Vets18to64PovDis			
89	lag.Vets18to64nonPovDis			
90	lag.NonVets18to64Pov			
91	lag.NonVets18to64PovDis	-*		
92	lag.NonVets18to64nonPovDis			
93	lag.PopOver64		-*	+*
94	lag.VetsOver64	+	+*	-*
95	lag.VetsOver64Pov			
96	lag.VetsOver64PovDis			
97	lag.VetsOver64nonPovDis	-*	-*	+
98	lag.NonVetsOver64Pov			
99	lag.NonVetsOver64PovDis			
100	lag.NonVetsOver64nonPovDis	+*	+*	-*
101	lag.AmmoMakers			
102	lag.ArmsDealers			
103	lag.ArmsImporters			
104	lag.ArmsMakers		-*	+*
105	lag.ArmsPawns			
106	lag.DDeviceDealers			
107	lag.DDeviceImporters			

Number	Factor	GP	ARNG	ARNG-GP OR
108	lag.DDeviceMakers	+		
109	lag.LaborForcePart			
110	lag.UnempRate		+*	-*
111	lag.DistToFAC			-*
112	lag.PopPerSqMile			
113	lag.PopPerHousingUnit			
114	lag.Bars	-*	-*	+*
115	lag.CasinoHotels			
116	lag.Casinos		+	
117	lag.GeneralHospitals		+*	-*
118	lag.LiquorStores			
119	lag.OtherGambling			
120	lag.PsychHospitals			
121	lag.PsychOffices	+*	+*	-*
122	lag.Census_DistrictEast.North.Central			
123	lag.Census_DistrictMiddle.Atlantic			
124	lag.Census_DistrictMountain			+
125	lag.Census_DistrictNew.England		-*	+
126	lag.Census_DistrictPacific			
127	lag.Census_DistrictSouth.Atlantic			
128	lag.Census_DistrictWest.North.Central			
129	lag.Census_DistrictWest.South.Central			
130	lag.BackgroundChecksDealer			
131	lag.BackgroundChecksPrivate			
132	lag.WaitingPeriod		-*	+*
133	lag.RegisterFirearm			
134	lag.OneGunPerMonth			
135	lag.MinimumAgePurchase			
136	lag.AnyReligion			
137	lag.EvangelicalProtestant			
138	lag.BlackProtestant			
139	lag.MainlineProtestant			
140	lag.Catholic			
141	lag.Orthodox			
142	lag.OtherReligion			
143	lag.White			-*
144	lag.Black	-*	-*	+*
145	lag.AIAN			

Number	Factor	GP	ARNG	ARNG-GP OR
146	lag.Asian			
147	lag.NHOPI	+	+	-*
148	lag.OtherRace			
149	lag.MultiRace	-*	-*	+
150	lag.HighSchoolDegree		+*	-*
151	lag.BachelorsDegree			
152	lag.MedianEarnings		+	-*
153	lag.AFQTScore_median	NA	-*	+*
154	lag.MoreThanHighSchool_share	NA	+	-*
155	lag.NumDeployedTours_median	NA	-*	+*
156	lag.NonDeployableMedical_share	NA		
157	lag.AnyPhysicalLimitation_share	NA		
158	lag.Enlisted_share	NA	-*	+
159	lag.E5orBelow_share	NA	+*	-*
160	lag.PULHES34_share	NA		
161	lag.MRC34_share	NA		
162	lag.DRC34_share	NA	-*	+*
163	lag.YearsOfService_median	NA	+*	-*
164	lag.PriorService_share	NA	-*	+
165	lag.PriorActiveService_share	NA		
166	lag.TraditionalGuardsmen_share	NA	+	-*
167	lag.CountyManMonthCount	NA		
168	lag.CountyUniqueIndividuals	NA		

As an example of interpretation, the row corresponding to factor 1, Pop18to64, shows that a higher percentage of individuals aged 18 to 64 in a county is correlated with a higher suicide risk estimate for both the GP and the ARNG but a lower ARNG-GP OR, keeping all other variables constant. Each of the three effects is significant at the $p < 0.01$ level. The interpretation for row 86, lag.Pop18to64, is that a higher percentage of individuals aged 18 to 64 in neighboring counties is not significantly correlated with the given county's estimated GP suicide risk, ARNG suicide risk, or ARNG-GP OR. County neighbors are weighted according to the W2a weight selected by the analysis Subsection 2.C.2.d.

This exercise is purely correlational and not causal, which means that we cannot claim that changing any of the factors would change or would have changed suicide rates. Indeed, some of the partial correlations that we estimate, such as positive partial correlations between suicide risk and the number of general hospitals per capita, are indefensible as causal and likely represent other factors that vary geographically. Alternatively, any given

factor that lacks a true underlying correlation with our suicide risk estimates has a chance of appearing correlated due to random noise in our data, and including so many different factors all but guarantees some number of such "false positives." [24] However, we are able to observe similar patterns in partial correlations across GP and ARNG suicide risk estimates. None of the 68 factors included in both models or any of their 68 respective spatial lags are significantly correlated in opposite directions with suicide risk estimates for the two populations (i.e., no row has a "-" under GP but a "+" under ARNG, or vice versa). Factors strongly positively partially correlated with both GP- and ARNG-estimated suicide risk include population shares of veterans, firearms dealers per capita, and unemployment rate. Factors strongly negatively correlated with the GP and the ARNG estimated suicide risk include population per housing unit, state policies that individuals under a specified age may not purchase a firearm, and share of individuals with a bachelor's degree. We find no ARNG-specific factors to be strongly partially correlated with our ARNG suicide risk estimates.

With the ARNG-GP OR as the dependent variable, we generally observe that variables that are correlated with suicide rates and ORs are correlated with each in the opposite direction. For example, the share of individuals with a bachelor's degree is negatively correlated with GP and ARNG suicide rates but is positively correlated with the ARNG-GP OR. Unemployment rate is positively correlated with GP and ARNG suicide rates but is negatively correlated with the ARNG-GP OR. This general observation of opposite partial correlation patterns across suicide rates and ORs echoes the observation in Subsection 2.C.2.b of opposite spatial patterns across suicide rates and ORs (compare Figure 6 and Figure 7 to Figure 8). The same non-exhaustive set of potential explanations applies to both observations, as discussed in the referenced section: the ARNG being a more homogeneous population, feedback loops in SP effort and outcomes, and consequences of the modeling procedure. Independent of the true explanation(s), Table 8 provides further evidence that the ARNG is like the GP but with less variation in suicide risk across different counties.

3. State-Level ARNG SP Programs and Policies

Since the suicide data covers the time period from 2010 to 2016 (before the RFI), we can use suicide rates to investigate correlations between suicide rates and the program responses. Table 9. shows the sign of correlation of the fitted county ARNG hierarchical Bayes suicide rate regressed on various responses to individual RFI questions.[25] The first

---

[24] Because our goal with this analysis is to observe patterns in relative significance as opposed to testing factor-specific hypotheses or numerically measuring the strength of individual relationships, we do not adjust the estimates for the testing of multiple hypotheses. Such an adjustment would effectively impose stricter criteria for statistical significance.

[25] All correlations are significant at the 1% level.

column identifies the RFI question, the second column identifies the odds of interest and the third column identifies the sign of the correlation with fitted county ARNG suicide rates. For example, an interpretation of the first row would be "Counties in states that responded 'yes' to 'Have CHPC [Community Health Promotion Council] recommendations helped lower risk within your state?' tended to have a lower ARNG suicide rate from 2010 through 2016." This finding could show that states with a high ARNG suicide rate tended to think that CHPC recommendations did not help lower risk within their state. It is important to stress that this does NOT mean that CHPC recommendations did not lower risk within their state. This exercise is purely correlational and not causal and is subject to the judgment of the respondents. This same interpretation structure holds for all entries in Table 9. Note the last line compares "Yes" to "not Yes." The "not Yes" contains "No," "Not Sure" and missing responses.

Table 9. Directions of Correlation Between Suicide Rates and SP Program Responses

Question	Response	Sign
Have CHPC Recommendations helped lower risk within your state?	Yes/No	-
Do existing SP programs generally meet the needs of personnel in your state/territory?	Yes/No	-
Have you developed supplemental (or different) programs specifically tailored to your state/territory?	Yes/No	-
Do you have the necessary personnel staffing to address SP in your state/territory?	Yes/No	+
Excluding the SPPM position in your state/territory, do you have other personnel who work solely on SP?	Yes/No	-
How has the fill rate for SIO positions changed since 2010?	Inc/Dec	-
Is SP training adequate to address the needs in your state/territory?	Yes/No	-
Do you have the necessary financial resources to address SP in your state/territory?	Yes/No	+
In the last 5 years, has the SP budget increased, decreased or stayed the same?	Inc/Dec	-
Have there been any assessments of the effectiveness of your SP programs?	Yes/NotYes	-

Counties in states that developed tailored programs, had personnel other than the SPPM working solely on SP, increased their SIO fill rate, and had one or more program assessments tended to have lower estimated suicide risk. Counties also tended to have lower estimated suicide risk in states in which the respondent felt that CHPC recommendations had lowered suicide risk, existing programs generally met personnel needs, and SP training is adequate. Counties in states where the respondents felt that they had the necessary personnel staffing and financial resources to address SP had higher estimated suicide risk, which may reflect recent adjustments in resource allocation in response to differences in suicide rates. Estimated suicide risk tended to be higher in states that had memorandums

of agreement with state and county mental health organizations to provide services to geographically dispersed ARNG members and their families, which may reflect higher suicide risk in geographically dispersed regions and a recognized need to provide such services (as opposed to effects of the memoranda themselves).

Using the metric defined in Subsection 3.B.1, we can correlate our heuristic measure of states' SP program quality in late 2017/early 2018 with county suicide rates from 2010 through 2016. We obtain this correlation by regressing the number of preferred responses to the 11 selected questions (as defined in Table 9) on the county fitted suicide rate. The resulting estimate says that counties that have a 10% higher fitted ARNG suicide rate have an estimated 0.068 lesser number of preferred responses (out of 11) with a 95% CI of [0.028, 0.108].

D. Summary of Results

This chapter offers four primary findings:

- State SP programs do not fit into a small number of distinguishable groups but instead vary irreducibly along many dimensions.
- Many socioeconomic and demographic factors are significantly correlated with suicide risk estimates at the county level, with similar correlation patterns for GP and ARNG estimates.
- ARNG career factors (aggregated at the county level) are not significantly correlated with our suicide risk estimates.
- State ARNG SP program characteristics are correlated with 2010–2016 suicide rates in plausible but not causally interpretable ways.

This page is intentionally blank.

4. Recommendations

In the preceding chapters, we find that ARNG and GP suicide risk vary in similar ways over many factors. We find that age, sex, and geographic distribution were particularly important suicide risk factors for explaining differences between ARNG and GP suicide rates. In particular, we find one way in which the ARNG is different from the GP: suicide risk is higher in the ARNG than in the GP among younger, but not older males. In this chapter, we translate these findings into recommendations on how the ARNG should choose, fund, record, and evaluate its SP efforts. Our analysis is geographic and demographic, not clinical, and correlative, not causal, so we do not prescribe a specific reallocation of SP resources either across states or across specific SP initiatives. Rather, we recognize the uncertainty inherent in allocating resources to prevent rare future events and make recommendations to mitigate, manage, and operate within that uncertainty.

A. Geographic Allocation of Resources

1. Consider Programs with Evidence of Success in the GP

We observe a similar geographic pattern of suicide rates and a similar pattern of correlations with many other factors across the ARNG and GP. This similarity indicates that the ARNG and GP share some risk and protective factors. This observation is consistent with that of Griffith, who, in an investigation of the association between stressful life events and suicide among Guardsmen, states that "it seems that suicide risk in the military is not uniquely different from that observed in civilian populations."[26] Therefore, the ARNG should not limit its consideration of new programs or policies to those with evidence of success in the National Guard or a military context. The ARNG's adoption of Applied Suicide Intervention Skills Training (ASIST), a 2-day workshop with evidence of improving personal resilience in the GP,[27] aligns with this approach. Program responses were generally favorable toward ASIST and called for the expansion of ASIST and ASIST Training for Trainers (T4T).

On the other hand, we find some evidence that Griffith's statement that "the higher prevalence of suicides in the military likely has to do with proportionally more individuals

[26] James Griffith, "Suicide in the U.S. Army: Stressor-Strain Hypothesis Among Deployed and Non-deployed Army National Guard Soldiers," *Journal of Aggression, Conflict and Peace Research* 7, no. 3 (2015): 187–198, https://doi.org/10.1108/JACPR-05-2014-0125.

[27] Suicide Prevention Resource Center, "Applied Suicide Intervention Skills Training (ASIST)," (2007), https://www.sprc.org/resources-programs/applied-suicide-intervention-skills-training-asist.

who have historically shown to be at risk for suicide, namely, young males"[28] does not fully explain the increased suicide risk associated with ARNG membership. Within the category of young males, suicide risk is significantly higher among Guardsmen than members of the GP. The difference, therefore, is not entirely due to the higher proportion of young males, but also to their higher risk in the ARNG. The ARNG should seek to understand risk and protective factors for suicide specific to its young male population and seek programs and policies that address risk factors and promote protective factors. This recommendation aligns with one from a recent National Guard SP symposium hosted at IDA: the need to better understand what resonates with the younger members of the Guard population and what promotes their greater connectedness.[29] Such an assessment can apply equally to the GP and Guard. Unless and until the ARNG finds that the primary risk factors are military specific, these programs and policies should not be limited to those with evidence in a military context. Eschewing such a limitation unlocks a vast amount of academic literature that can inform the ARNG on preventing suicide among young males.[30]

2. Adopt a Suicide Minimization Algorithm

Each year, the ARNG must choose how to allocate SP resources across states, with the goal of minimizing the ARNG suicide rate. If the ARNG knew the relationship between each state's suicide rate and its level of SP resources, the allocation decision could be solved by optimization that is subject to the nationwide budget constraint. However, these relationships are not known. In the absence of the information necessary to perform optimization, the ARNG must adopt some heuristic algorithm for resource allocation.

One allocation algorithm is to provide an amount of resources to each state proportional to that state's ARNG population. This algorithm has the advantages of being straightforward to implement, avoiding perverse incentives, and imparting a basic philosophy of equality across states. It has a disadvantage of failing to provide the ARNG a mechanism to adjust resource allocation to reduce suicide. In general, equality in resources will not minimize the national ARNG suicide rate. Given equal resources per Soldier, the marginal effect of SP resources (i.e., the number of suicides prevented per additional dollar) would likely vary across states. This variance could arise due to differences in program implementation, staff skills, and population risk factors. By allocating more resources per Soldier

---

[28] Griffith, "Suicide in the U.S. Army: Stressor-Strain Hypothesis."

[29] Dina Eliezer, "Memorandum for the Record: National Guard Bureau Suicide Prevention Symposium Summary Report," (25 June 2018).

[30] The Suicide Prevention Resource Center maintains a database of evidenced-based suicide prevention programs and practices. At the time of writing, a list of programs and practices with evidence of success for individuals aged 18 to 25, including ASIST, is available at Suicide Prevention Resource Center, "Resources and Programs," https://www.sprc.org/resources-programs?type=All&program_evidence[0]=1&populations=138&settings=All&problem=All&planning=All&strategies=All&state=All.

to states with higher marginal effects, the ARNG would reduce the number of suicides over all states.

Note that higher marginal effects are not equivalent to higher suicide rates. A given increase in resources per Soldier may or may not have a larger marginal effect in a state with a low suicide rate than a state with a high suicide rate. Providing resources in proportion to each state's recent (say, over the last 7 years) suicide rate presents additional disadvantages. First, it provides a perverse incentive to SP offices—those that do the best jobs of preventing suicide (due to efficiency, innovation, and/or effort) are "rewarded" in subsequent years with decreased resources relative to other states. Second, it risks "chasing the noise"—allocating resources based on random variation in recent suicide rates as opposed to actual differences in underlying suicide risk across states and time. The rare events problem exacerbates the noise in suicide rates—observing 2 suicides out of 10,000 people in one year and 6 out of 10,000 people the next year represents a tripling of the suicide rate but not a statistically significant change, or, in other words, represents a change that could be plausibly attributed entirely to random variation.[31]

Marginal effects refer to changes in rates as a result of small changes in resources. The ARNG must implement small changes in resources to estimate marginal effects. Such estimation can then inform future resource changes, which, in turn, inform further future resource changes. Roughly, the ARNG should increase resources where marginal effects are estimated to be high and decrease resources where marginal effects are estimated to be low. While we are not aware of any academic literature on this dynamic resource allocation problem in the context of SP, a recent paper by Gahler and Hruschka in the context of marketing is analogous and adaptable to the ARNG situation.[32] The paper considers the problem of dividing a given budget among sales units to maximize total sales. This problem is mathematically analogous to dividing a given budget among states and territories to minimize the number of suicides. The authors compare the performance of four algorithms over a variety of simulations of noisy processes, finding one algorithm to vastly outperform the others. Appendix B of Gahler and Hruschka's paper offers a pseudocode exposition of the algorithm, which we translate into prose, adapt to the SP context, and summarize below.

The allocator first records the resource allocation and suicide rates in year 0. The allocator decides on a constant share of each future year's budget (the "adaptable budget") that will be allowed to be reallocated according to marginal effect estimates. The remainder

---

[31] The p-value associated with a Fisher exact test on the null hypothesis that the underlying risk is identical across the 2 years is 0.289.

[32] Daniel Gahler and Harald Hruschka, "Resource Allocation Heuristics for Unknown Sales Response Functions with Additive Disturbances," *Regensburger Diskussionsbeiträge zur Wirtschaftswissenschaft* 488 (2016), Working Paper, Regensburg, https://epub.uni-regensburg.de/34818.

of the budget will be allocated in proportion to each state's population. The allocator then allocates the adaptable budget for year 1 in some way that changes each state's total budget relative to year 0 and records state suicide rates in year 1. The allocator then estimates each state's elasticity of suicide rate to resources by taking the ratio of its respective percentage changes between years 0 and 1 multiplied by negative one. The allocator sets elasticities below 0.01 to 0.01 and sets elasticities above 0.5 to 0.5.[33] For year 2, the allocator sets each state's share of the adaptable budget allocation in proportion to its elasticity estimate multiplied by its most recent year's suicide rate and its expected population in year 2 (year 1 population can be used as a proxy for expected year 2 population). The allocator then records state suicide rates in year 2. The allocator estimates each state's elasticity between years 1 and 2 and then takes a weighted average of that elasticity and the elasticity between years 0 and 1 to obtain a new elasticity estimate. Once again, the allocator sets elasticities below 0.01 to 0.01 and sets elasticities above 0.5 to 0.5. For year 3, the allocator once again sets each state's share of the adaptable budget allocation in proportion to its elasticity estimate multiplied by its most recent year's suicide rate and its expected year 3 population. The allocator estimates each state's elasticity between years 2 and 3 and then takes a weighted average of that elasticity and the most recently used elasticity estimate, using the same weight as before. The allocator repeats adjusting elasticities, allocating the adaptable budget, recording new suicide rates, and estimating new elasticities as described.[34]

IDA developed a tool in the form of a Microsoft Excel file that implements this algorithm. The tool requires the input of state-level suicide counts, populations, prior budget allocations, and total budget to be allocated. The tool performs all required calculations based on the input and displays the resulting adaptable budget allocation for the upcoming year. The tool also allows the user to set parameters for the weight on the most recent elasticity and the adaptable budget share.

---

[33] This bounding of the estimated elasticities by positive values implements an assumption that greater SP resources reduce suicide. With data as would be recorded through the method described, this assumption is testable by observing whether the mean estimated elasticity is statistically greater than zero. Finding a broad violation of this assumption would be surprising and present an existential threat to ARNG SP programs. Finding support for this assumption would provide existential validation for ARNG SP programs.

[34] The Gahler and Hruschka algorithm ceases the described process after a data-driven number of years. The number of years depends on the variance in the data and the time horizon of the problem (but is at least 10 years). In each subsequent year, a quadratic function for each state is fitted to the data collected over all prior years, and resource allocation is optimized using the fitted functions. This method assumes that (1) quadratic functions are a reasonable representation of the unknown relationship between suicide rates and prevention resources and (2) that this relationship is approximately time invariant. We do not have strong evidence to support or dispute these assumptions. Variance in suicide data is high, and the time horizon for the ARNG's purposes is practically infinite, implying a large number of years before a transition to function-fitting and optimization is appropriate. Given that the transition decision does not need to be made in advance and does not need to occur at all, we recommend that the ARNG defer such a transition indefinitely.

A higher weight on the most recent elasticity represents greater importance of the most recent elasticity estimate as opposed to less recent elasticity estimates. A higher such weight is a recognition that more recent data are more informative about future outcomes. In the extreme case of the weight being zero, the original elasticity estimate is trusted as the elasticity estimate in all future periods. In the opposite extreme of the weight being one, the most recent elasticity estimate is the only estimate used to determine a given period's budget. We follow Gahler and Hruschka in setting a default value of 0.85, with the weight on the less recent elasticity necessarily being one minus that value.

A higher adaptable budget share allows greater variation in state SP resources over time, which has advantages and disadvantages. A higher adaptable budget share allows the ARNG to more aggressively reallocate resources to minimize the ARNG suicide rate but is more likely to result in allocations that states consider unfair or capricious. Therefore, the optimal adaptable budget share depends on the relative preferences of the ARNG for resource efficiency in reducing suicide, resource equity across states, and resource stability over time. In the extreme case of the adaptable budget share being zero, the recommended allocation is in proportion to each state's expected population. In the extreme case of the adaptable budget share being one, the recommended allocation is in proportion to each state's expected marginal effect. In the Excel tool, we specify a default adaptable budget share of 0.2.

The allocation method that we propose recognizes that optimizing the allocation of resources is an iterative process informed by noisy data. Even with a high adaptable budget share, the allocator cannot expect to approach optimality (equivalent marginal effects) in just a few years. Even with a high weight on the most recent elasticity estimate, the allocator cannot expect the method to anticipate future changes to the marginal effects of resources. This limitation is not unique to the method, but follows from the marginal effects of resources being unknowable at the time those resources are allocated. The described method for allocate resources across states and territories in the current and future years is experimentally validated, data driven, and self-improving. However, like any other method consistent with the allocator's natural limitations, it is not quick and does not provide instant validation.

3. Focus Recruiting on Low-Rate Areas and Groups

There are clear geographic patterns in ARNG suicide that match patterns in GP suicide. Therefore, people living in low-rate areas are likely to have low rates independent of their ARNG status, which means that increasing the share of the ARNG population that resides in low-rate areas—broadly, Central and Southern California and east of the Mississippi River—would decrease the ARNG suicide rate. Similarly, increasing the share of women in the ARNG would likely decrease the ARNG suicide rate (although not the

standardized rate). Raising the age of the ARNG may reduce the ARNG suicide rate, as suggested by Note: Error bars represent exact 95% confidence intervals.

However, age among Guardsmen is likely positively correlated with length of ARNG service and prior Active Component service. It is possible that age and suicide rate are not negatively correlated conditional on these two variables, which would mean that recruiting older non-prior-Service individuals would not decrease the ARNG suicide rate. A causal analysis of individual suicide risk and protective factors among Guardsmen remains a topic for future research (see Subsection 4.C.1).

Many other objectives guide how the ARNG chooses whom and how to recruit. We do not recommend that the ARNG shift recruiting to decrease its suicide rate at the expense of any of those objectives. We do recommend that the ARNG acknowledge that demographic or geographic shifts in recruiting are likely to change the ARNG suicide rate and that some of those changes are predictable. We recommend that the ARNG incorporate this knowledge in how it decides to weigh its objectives. The ARNG should also acknowledge that geographic or demographic shifts in recruiting are not likely to decrease suicide overall, but rather to shift suicide risk from the ARNG to the GP.

B. Data Collection

1. Comprehensively Record ARNG Suicide

The CIMS database has recorded ARNG suicide since 2001 but has only been a comprehensively populated database since 2010. It is updated continually. The quick access to recent and historical ARNG suicide data provided by the CIMS database is invaluable to the ARNG for statistical reporting, resource allocation, and supporting additional research such as this paper. The value of the database will grow as it integrates future years of data. The ARNG should continue to maintain the CIMS database as a comprehensive and up-to-date record of ARNG suicide.

2. Regularly Record Information on State-Level Programs

Program responses to IDA's RFI established a baseline record of state SP policies and programs. Evaluating the effects of these policy and program choices will require observing changes in these policies and programs and the associated suicide rates over time. We recommend that the ARNG continue to gather program information on a yearly or other regular basis to spread information across the ARNG and to support research. Revision or reduction of the RFI may be acceptable to facilitate information gathering, but the ARNG should preserve the comparability of responses across years as much as possible. Sharing selected responses or summaries of responses, such as innovative initiatives or descriptive statistics, with the states and territories would be a concise way to familiarize states and territories with options for improving their SP policies and programs.

C. Future Research

1. Individual-Level Prediction of Suicide Risk

Identifying individual-level suicide risk factors would help the ARNG to target programs to high-risk individuals and to tailor the characteristics of those programs to increase their expected effectiveness. We recommend that the ARNG fund a study to use predictive analytics to identify individual-level risk factors for suicide among Guardsmen. Such a study would be analogous in objective to the 2014 Army STARRS studies by Schoenbaum et al. and Gilman et al., who used administrative data from 2004 through 2009 to identify suicide risk factors for the Regular Army, but not the Reserve Components, and Griffith's adaptation of the Schoenbaum et al. method to ARNG data.[35] However, it would employ more advanced predictive methods than the iterative variable selection and logistic regression methods employed by Army STARRS researchers. More advanced methods would improve precision in predicted suicide risk at the aggregate and the individual level by allowing for more flexible relationships between risk factors and by performing hyperparameter optimization (i.e., choosing the best model from among many candidates) and validation (i.e., estimating how well the model would perform on new data). A study using such methods would require individual-level data on Guardsmen who died by suicide and on those who did not and have not died by suicide. The quality of the study would increase with the following:

- The number and relevance of the available factors, to include demographic and family characteristics, career events (e.g., promotion, activation, judicial and non-judicial punishment), and geographic location (which allows the inclusion of many other factors, as shown in this paper);
- The frequency of the data (e.g., monthly observations of individuals);
- The size and recentness of the data time frame; and
- The appropriateness and sophistication of the analysis method.

2. Quantitatively Evaluate Programs

We recommend that the ARNG quantitatively evaluate SP programs and implement programs in ways that facilitate quantitative evaluation. The essential quantitative evaluation of a program is the calculation of the suicide OR associated with exposure to the program. The rare events problem discussed in this paper necessitates that programs be large in scale, in terms of a combination of geography and time, to produce useful ORs. The need

---

[35] Schoenbaum et al., "Predictors of Suicide and Accident Death in the Army Study"; Gilman et al., "Sociodemographic and Career History Predictors of Suicide Mortality"; Griffith. "Suicide Risk Among Army National Guard (ARNG) Soldiers: Analysis of the CY2007–2012 ARNG Suicides."

for a control group (which informs the bottom half of the OR) further increases the necessary scale. These issues imply that quantitative program evaluation in the ARNG is likely to require collaboration across states and consistency over time.

Academic literature offers multiple forms of assistance to the ARNG as it chooses what programs to implement and how. First, many SP programs for the GP have been evaluated by experimental and quasi-experimental methods. The similarity in geographic patterns and other correlates of suicide rates between the ARNG and GP indicates that programs that are effective for the GP and adaptable to the ARNG are likely to be effective for Guardsmen. While direct evidence that a program is effective for Guardsmen or Service members in general is valuable, the ARNG should not limit itself to such programs. Second, the field of experimental design has established methods to calculate the sample sizes necessary to obtain ORs of a given level of precision while accounting for various population and policy differences. Our finding that state SP programs vary along many dimensions implies that using data from multiple states to evaluate a program will require expert research support to apply these methods prior to and during program implementation.

Appendix A.
Quantitative Methodologies

Preliminaries

Denote $Y \sim Bin(n, p)$ to mean that Y follows a binomial distribution with n trials and probability of suicide p. Denote $Z \sim N(\mu, \sigma)$ to mean that Z is a distributed univariate normal with mean μ and standard deviation σ. Denote $Z \sim N_p(\mu, \Sigma)$ to mean that Z follows a multivariate normal distribution of dimension p with mean vector μ and covariance matrix Σ. Let X_{ijk} be the number of suicides in county i, age sex bin j and ARNG if $k = 2$ and GP if $k = 1$. Let the total number of counties be I and total number of age sex bins J.

Logistic Binomial

Suppose X is the number of independent flips of a coin landing on heads, where n is the total number of flips and the probability of heads is p. Then $\sim Bin(n, p)$. Let the probability of heads be parameterized as $p = g(\eta) = {}^{1}/_{1 + e^{-\eta}}$. The function g is called the "Logistic" function, and it ensures that probability estimates are between 0 and 1.

Hierarchical Bayesian Logistic Binomial

The binomial model with no pooling assumes $X_{ijk} \sim Bin(n_{ijk}, p_{ijk})$, where $p_{ijk} = g(\gamma + \alpha_0 + \beta_0 1(k = 2) + \alpha_i + \beta_i 1(k = 2) + \delta_j)$ for $i = 1, \dots, I - 1$. If demographics are not included, then all δ_j are degenerate at zero. The prior distributions for the slope γ is $N(0,10)$ and all other parameters are independent $N(0,2.5)$.

The binomial model with partial pooling assumes $X_{ijk} \sim Bin(n_{ijk}, p_{ijk})$, where $p_{ijk} = g(\gamma + \alpha_0 + \beta_0 1(k = 2) + \alpha_i + \beta_i 1(k = 2) + \delta_j)$ for all i where $(\alpha_i, \beta_i) \sim N_2(0, \Sigma)$. In this model α_i and β_i are county idiosyncratic parameters. If demographics are not included, then all δ_j are degenerate at zero. The priors on $\gamma, \alpha_0, \beta_0, \delta_1, \dots, \delta_J$ are independent $N(0,2.5)$. The prior on Σ is complicated but can be best described as a decomposition into a correlation matrix and variances. The prior on the correlation matrix is set to be uniform over all correlation matrices. Then, the normalized variances prior is jointly uniform over the space of simplex vectors. Lastly, the variance normalization is a gamma distribution with shape and scale 1.

The binomial model with full pooling assumes $X_{ijk} \sim Bin(n_{ijk}, p_{ijk})$, where $p_{ijk} = g(\gamma + \alpha + \beta 1(k = 2) + \delta_j)$. If demographics are not included, then all δ_j are degenerate at zero. The prior distribution for the slope γ is $N(0,10)$ and all other parameters are independent $N(0,2.5)$.

Spatial Error Durbin Model

The spatial error Durbin model assumes $Y_i = \beta_0 + \beta_1 X + \beta_2 WX + u$, where $u = \lambda Wu + \epsilon$. The matrix W is a spatial weight matrix, where W_{ij} is the spatial weight that county i receives from county j. The diagonal elements of W must equal 0 for identification purposes (i.e. $W_{ii} = 0$).

Appendix B.
IDA Request for Information

The Institute for Defense Analyses (IDA) requested the following information from each state and territory Army National Guard (ARNG) suicide prevention (SP) program. Most responses were obtained through an online interface implemented by IDA. Other responses were obtained by email correspondence using the form below.

First Name: Click here to enter text. Last Name: Click here to enter text.

Organization: Click here to enter text.

Installation Name: Click here to enter text.

Installation Address: Click here to enter text.

City: Click here to enter text. State: Click here to enter text.

Zip Code: Click here to enter text.

Telephone Number: Click here to enter text.

Rank/Position: Click here to enter text.

E-Mail Address: Click here to enter text.

GUIDANCE AND POLICY

1. From which organizations do you receive guidance on suicide prevention (SP) programs?

   (check all that apply):

   State leadership ☐

   Community Health Promotion Council (CHPC) recommendations ☐

   Other (please specify): Click here to enter text.

   - Have CHPC recommendations helped lower risk within your state?

     Yes ☐ No ☐ Not Sure ☐

     - If yes, please explain: Click here to enter text.

2. What guidance documents do you use for your SP program?

   (please specify): Click here to enter text.

3. Do existing SP programs generally meet the needs of personnel in your state/territory?

   Yes ☐ No ☐ Not Sure ☐

   - Have you identified specific gaps or deficiencies in existing SP programs?

     Yes ☐ No ☐(if yes, please respond to the sub-bullets below)

     - Would addressing these gaps require a change in policy?

       Yes ☐ No ☐ Not Sure ☐

     - Would these changes require additional federal resources?

       Yes ☐ No ☐ Not Sure ☐

     - Would these changes require additional resources from the state/territory level? Yes ☐ No ☐ Not Sure ☐

     - What other actions would be needed to implement the proposed changes (e.g., more personnel, more training, more funding, etc.)? Click here to enter text.

4. Have you developed supplemental (or different) programs specifically tailored to your state/territory? Yes ☐ No ☐ (if yes, please respond to the sub-bullets below)

   - Please briefly describe the specific programs (e.g., enhanced interactive training; brochures/pamphlets, memorandum of agreement with state/local agencies). If readily available, please provide a link or attach a separate document with more detailed information: Click here to enter text.

- What was the motivation for their development? Click here to enter text.
- Where and when have they been applied (e.g., during drill time, at Family Assistance Centers (FACs))? Click here to enter text.

5. Are there local ARNG firearm policies in place (e.g., program to temporarily lock up guns for those determined to be at risk, training on firearms safety as it pertains to suicide)?

   Yes ☐ No ☒ Not Sure ☐

   - If yes, briefly describe: Click here to enter text.

6. Is there an established state policy for a post-hospitalization "buddy system/warm hand-off" following a suicide attempt or suicidal crisis?

   Yes ☐ No ☒ Not Sure ☐

   - If yes, please describe: Click here to enter text.

PERSONNEL RESOURCES

1. Do you have the necessary personnel staffing to address SP in your state/territory?

   Yes ☐ No ☐ Not Sure ☐

   - If no, what is the nature of the deficiency? Click here to enter text.

2. Is the Director of Psychological Health (DPH) position currently filled in your state/territory?

   Yes ☐ No ☐

   - If no, (approximately) how long has the position been unfilled? Click here to enter text.

AT THE STATE LEVEL:

1. Is the Suicide Prevention Program Manager (SPPM) qualified in resilience training (sometimes referred to as mindfulness training)? Yes ☐ No ☐ Not Sure ☐

2. Excluding the SPPM position in your state/territory, do you have other personnel who work solely on suicide prevention? Yes ☐ No ☐

   - If yes, how many positions? Click here to enter text.
   - If yes, is the position(s) currently filled?

     Yes ☐ No ☐ Partially ☐ Not Sure ☐

   - If no, is there a Resilience, Risk Reduction and Suicide Prevention (R3SP) program manager? Yes ☐ No ☐
   - If no, is the R3SP position currently filled? Yes ☐ No ☐ Partially ☐ Not Sure ☐

3. How has the fill rate changed for SPPM/R3SP positions since 2010? Position can either have been military or contractor.

   SPPM: Increased ☐ Decreased ☐ Not Sure ☐

   R3SP: Increased ☐ Decreased ☐ Not Sure ☐

4. Where are the SPPM/R3SPs located (e.g., Joint Force HQ, battalion HQ)? Click here to enter text.

5. Regarding SPPM/R3SP(s) responsibilities and expertise:

   - Does the SPPM/R3SP provide SP services to personnel in addition to issuing policy and guidance? Yes ☐ No ☐ It varies ☐

- If yes, approximately how many personnel is the SPPM/R3SP responsible for serving? Click here to enter text.

- Is the R3SP position an additional duty?

  R3SP: Yes ☐ No ☐ It varies ☐

- Is it staffed with "traditional" or "full-time" personnel?

  R3SP: Traditional ☐ Full-time ☐ Not Sure ☐

- Are there specific educational or work experience requirements for filling the position?

  R3SP: Yes ☐ No ☐ Not Sure ☐

  - If yes, what are they (e.g., licensed clinical social worker, X number of years' experience in mental health field)? Click here to enter text.

6. If there is no dedicated R3SP, who is considered the "responsible official" for SP (e.g., chaplain)? Click here to enter text.
7. What percentage of personnel in your state/territory have completed SP/intervention training in the last 12 months? Click here to enter text.
   - If available, what is the percentage for the previous year(s) (up to 5 years)? Click here to enter text.
8. Does your Joint Force HQ have memorandum(s) of agreement with state and county mental health organizations to provide services to geographically dispersed ARNG members and their families?

   Yes ☐ No ☐ Not Sure ☐

   - If yes, are the services provided free of charge? ☐ On a sliding fee scale? ☐
   - Is the frequency of use of these memorandum(s) of agreement tracked?

     Yes ☐ No ☐ Not Sure ☐

9. Has the Yellow Ribbon Program been implemented in your state/territory for all phases of the deployment cycle? Yes ☐ No ☐ Not Sure ☐
10. How many FACs are located in your state/territory?

    Click here to enter text.
11. Do the FACs provide SP information and support? Yes ☐ No ☐ Not Sure ☐
    - If yes, have FAC employees received SP training? Yes ☐ No ☐ Not Sure ☐
12. On average, how far away are units in your state/territory from a FAC?

    Less than 10 miles ☐ 11–50 miles ☐ 51–99 miles ☐ More than 100 miles ☐
13. Have any FACs in your state participated in the Building Healthy Military Communities (BHMC) pilot study that began in 2016? Yes ☐ No ☐ Not Sure ☐
    - If yes, can you please provide a contact with whom we could discuss this initiative in more detail? Click here to enter text.

AT THE LOCAL UNIT LEVEL (e.g., Company or Battalion)

1. Is there currently a Suicide Intervention Officer (SIO) at each unit in your state/territory?

   Yes ☐ No ☐ Not Sure ☐
2. How has the fill rate changed for SIO positions since 2010?

   Increased ☐ Decreased ☐ Not Sure ☐
3. Approximately how many personnel is the SIO responsible for serving? Click here to enter text.
4. Regarding SIO responsibilities and expertise:
    - Is the SIO position an additional duty? Yes ☐ No ☐ It varies ☐

- Is the SIO position staffed with "traditional" or "full-time" personnel?

  Traditional ☐ Full-time ☐ It varies ☐ Not Sure ☐

- Are there specific educational or work experience requirements for filling the position(s)? Yes ☐ No ☐ Not Sure ☐

  - If so, what are they? Click here to enter text.

5. If there is no dedicated SIO, who is considered the "responsible official" for SP (e.g., chaplain)? Click here to enter text.

TRAINING

1. Is SP training adequate to address the needs in your state/territory?

   Yes ☐ No ☐ Not sure ☐

   - If no, what is the nature of the deficiency? Click here to enter text.

2. Does SP training affect unit readiness and training?

   Yes ☐ No ☐ Not sure ☐

   - If yes, is the effect positive or negative? Click here to enter text.

3. How many personnel in your state/territory have been certified in the following:

   - Master Resiliency Trainer (MST) (number): Click here to enter text.
   - Applied Suicide Intervention Skills Training (ASIST) Click here to enter text.
   - ASIST Train for Trainers (ASIST T4T): Click here to enter text.
   - Peer Intervention Training: Click here to enter text.
   - Ask, Care, and Escort Suicide Intervention (ACE-SI): Click here to enter text.
   - SafeTalk: Click here to enter text.
   - Other Initiatives: Click here to enter text.

4. Regarding who receives SP training:

Personnel	Do they receive SP training? Yes, No, Not Sure	Number of hours of SP training (on annual basis)	Type of training (e.g., video, PowerPoint, interactive), include name of training, if available (e.g., ACE, ASIST, ASIST T4T) List all types	Is SP part of other training (e.g., wellness, reducing risk)?
All personnel on Title 32 status				
Primary Gatekeepers (e.g., chaplains, medical professionals, Family Advocacy Program workers)				
Secondary Gatekeepers (e.g., first-line supervisors, police, DOD school counselors)				
Family members (spouses and dependents)				
FAC staff				
Other (please specify):				

FINANCIAL RESOURCES

1. Do you have the necessary financial resources to address SP in your state/territory?

   Yes ☐ No ☐ Not sure ☐

   - If no, what is the nature of the deficiency? Click here to enter text.

2. Does the NGB budget for your state/territory specifically have a line dedicated to SP?

   Yes ☐ No ☐ Not Sure ☐ (If yes, please respond to the sub-bullets below)

   - What is the annual average budget? Click here to enter text.
   - Do you have historical knowledge about the SP budget in the last 5 years?

     Yes ☐ No ☐

     - If yes, has it increased, decreased, or stayed about the same?

       Click here to enter text.

   - If the SP budget is part of a larger initiative (e.g., resiliency), is it possible to estimate approximately how much is devoted to SP? Yes ☐ No ☐

     - If yes, approximately how much? Click here to enter text.

3. What are the main funding sources for SP on which your state/territory relies?

   Click here to enter text.

4. How are funds allocated? (i.e., what are the 3–5 most expensive elements of the SP program?)

   Most expensive element #1: Click here to enter text.

   Most expensive element #2: Click here to enter text.

   Most expensive element #3: Click here to enter text.

   Most expensive element #4: Click here to enter text.

   Most expensive element #5: Click here to enter text.

PROGRAMS

1. Please fill out each box in the table below by indicating whether that population currently receives the specified type of SP services or care with a **yes**, **no**, or **not sure**.

Population	Title 32	Family Members
Type of Services or Care		
Individual Counseling (FACs, Chaplains, etc.)		
Crisis Hotline/Intervention Services		
Confidentiality/Privacy Provisions/Stigma Reduction		
Screening/Periodic Interviews		
Buddy System		
Clinical Services (in-patient, out-patient)		
Prescriptions		
Firearm Management Services		
Postvention Services		
Other Programs/Services		

PROGRAM ASSESSMENTS

1. Do you have the necessary tools to assess the effectiveness of your SP program?

   Yes ☐ No ☐ Not sure ☐

   - If no, what is the nature of the deficiency? Click here to enter text.

2. Have there been any assessments of the effectiveness of SP programs (either NGB-provided or locally developed)?

   Yes ☐ No ☐ Not Sure ☐ (If yes, please respond to the sub-bullets below)

   - What is the frequency of the assessment?

     Once (indicate year completed) ☐ Click here to enter text.

Recurring (annually, quarterly, etc.) ☐ Periodic ad hoc ☐

- What type of assessment(s) was made (e.g., surveys following training; external review)? Click here to enter text.
    - What were the key findings? Click here to enter text.
    - Were changes to programs recommended as a result? If so, were these changes implemented and when? Click here to enter text.

3. What are the biggest challenges for the SP program? (e.g., finding time during drills for the training, insufficient counseling resources, knowing how best to conduct outreach to families, constraints on access to mental health care)

   Click here to enter text.

4. What improvements, if any, would you like to see made?
    - To national-level SP guidance: Click here to enter text.
    - To SP programs in your state/territory: Click here to enter text.
    - Other: Click here to enter text.

ADDITIONAL INFORMATION, IF AVAILABLE

1. Please identify 3 to 10 individuals at the battalion or company levels who would be able to answer a short list of questions about suicide prevention at the level of their respective local units.

   Click here to enter text.

2. What things that you think are working particularly well for you could usefully be applied elsewhere (in other locations)?

   Click here to enter text.

3. Based on the questions above (Personnel Resources, State Level, Q5 and Q8; Personnel Resources, Unit Level, Q4; and Program Assessments, Q2), if you would have documents pertaining to any of the following and could send those to IDA (email: nlatshaw@ida.org), they would be very helpful for gaining a fuller picture of your program.

    - Position descriptions for SPPM, R3SP, and SIO
    - Memorandum(s) of agreement between Joint Forces HQ and state/county mental health organizations and any data kept about them
    - Results of any program assessments conducted on SP program

Appendix C.
Factor Descriptions

Table C-1. Descriptions of County-level Factors Included in Analysis

Number	Factor	Description
1	Pop18to64	Population aged 18 to 64
2	Vets18to64	Population veteran and aged 18 to 64
3	Vets18to64Pov	Population veteran, aged 18 to 64, and income over last 12 months below poverty level
4	Vets18to64PovDis	Population veteran, aged 18 to 64, income over last 12 months below poverty level, and disabled
5	Vets18to64nonPovDis	Population veteran, aged 18 to 64, income over last 12 months above poverty level, and disabled
6	NonVets18to64Pov	Population non-veteran, aged 18 to 64, and income over last 12 months below poverty level
7	NonVets18to64PovDis	Population non-veteran, aged 18 to 64, income over last 12 months below poverty level, and disabled
8	NonVets18to64nonPovDis	Population non-veteran, aged 18 to 64, income over last 12 months above poverty level, and disabled
9	PopOver64	Population aged 65 and older
10	VetsOver64	Population veteran and aged 65 and older
11	VetsOver64Pov	Population veteran, aged 65 and older, and income over last 12 months below poverty level
12	VetsOver64PovDis	Population veteran, aged 65 and older, income over last 12 months below poverty level, and disabled
13	VetsOver64nonPovDis	Population veteran, aged 65 and older, income over last 12 months above poverty level, and disabled
14	NonVetsOver64Pov	Population non-veteran, aged 65 and older, and income over last 12 months below poverty level
15	NonVetsOver64PovDis	Population non-veteran, aged 65 and older, income over last 12 months below poverty level, and disabled
16	NonVetsOver64nonPovDis	Population non-veteran, aged 65 and older, income over last 12 months above poverty level, and disabled
17	AmmoMakers	Number of federally licensed manufacturers of ammunition for firearms per capita
18	ArmsDealers	Number of federally licensed dealers in firearms other than destructive devices (includes gunsmiths) per capita
19	ArmsImporters	Number of federally licensed importers of firearms other than destructive devices per capita
20	ArmsMakers	Number of federally licensed manufacturers of firearms other than destructive devices per capita

Number	Factor	Description
21	ArmsPawns	Number of federally licensed pawnbrokers in firearms other than destructive devices per capita
22	DDeviceDealers	Number of federally licensed dealers in destructive devices per capita
23	DDeviceImporters	Number of federally licensed importers of destructive devices per capita
24	DDeviceMakers	Number of federally licensed manufacturers of destructive devices per capita
25	LaborForcePart	Share of population in the labor force
26	UnempRate	Share of population unemployed
27	DistToFAC	Number of meters to drive from center of population to nearest Family Assistance Center
28	PopPerSqMile	Population per square mile of land area
29	PopPerHousingUnit	Population per number of housing units
30	Bars	Number of establishments categorized as "drinking places" (North American Industry Classification System (NAICS) Code 722410)
31	CasinoHotels	Number of establishments categorized as "casino hotels" (NAICS Code 721120)
32	Casinos	Number of establishments categorized as "casinos (except casino hotels)" (NAICS Code 713210) per capita
33	GeneralHospitals	Number of establishments categorized as "general medical and surgical hospitals" (NAICS Code 622110) per capita
34	LiquorStores	Number of establishments categorized as "beer, wine, and liquor stores" (NAICS Code 445310) per capita
35	OtherGambling	Number of establishments categorized as "other gambling industries" (NAICS Code 713290) per capita
36	PsychHospitals	Number of establishments categorized as "psychiatric and substance abuse hospitals" (NAICS Code 622210) per capita
37	PsychOffices	Number of establishments categorized as "offices of mental health practitioners (except physicians)" (NAICS Code 621330) per capita
38	Census_DivisionEast.North.Central	County is a member of the East North Central Census Division
39	Census_DivisionMiddle.Atlantic	County is a member of the Middle Atlantic Census Division
40	Census_DivisionMountain	County is a member of the Mountain Census Division
41	Census_DivisionNew.England	County is a member of the New England Census Division
42	Census_DivisionPacific	County is a member of the Pacific Census Division

Number	Factor	Description
43	Census_DivisionSouth.Atlantic	County is a member of the South Atlantic Census Division
44	Census_DivisionWest.North.Central	County is a member of the West North Central Census Division
45	Census_DivisionWest.South.Central	County is a member of the West South Central Census Division
46	BackgroundChecksDealer	Share of time between 2010–2016 that purchasing a firearm from a dealer required a background check
47	BackgroundChecksPrivate	Share of time between 2010–2016 that purchasing a firearm from a private owner required a background check
48	WaitingPeriod	Share of time between 2010–2016 that a firearm may not be delivered after some waiting period by state law
49	RegisterFirearm	Share of time between 2010–2016 that a firearm must be registered by state law
50	OneGunPerMonth	Share of time between 2010–2016 that individuals may not purchase more than one firearm in a month by state law
51	MinimumAgePurchase	Share of time between 2010–2016 that individuals younger than a specified age may not purchase a firearm by state law
52	AnyReligion	Share of population adherent to any religion
53	EvangelicalProtestant	Share of population Evangelical Protestant
54	BlackProtestant	Share of population Black Protestant
55	MainlineProtestant	Share of population Mainline Protestant
56	Catholic	Share of population Catholic
57	Orthodox	Share of population Orthodox
58	OtherReligion	Share adherent to a religion other than the five above
59	White	Share White
60	Black	Share Black
61	AIAN	Share American Indian or Alaska Native
62	Asian	Share Asian
63	NHOPI	Share Native Hawaiian or Other Pacific Islander
64	OtherRace	Share of individuals reporting a race other than the five above
65	MultiRace	Share of individuals reporting more than one race
66	HighSchoolDegree	Share of individuals 25 or older with a high school degree or higher
67	BachelorsDegree	Share of individuals 25 or older with a bachelor's degree or higher
68	MedianEarnings	Median earnings among those with reported earnings
69	AFQTScore_median	Median Armed Forces Qualification Test score

Number	Factor	Description
70	MoreThanHighSchool_share	Share of Guardsmen with some college education
71	NumDeployedTours_median	Median number of deployment tours
72	NonDeployableMedical_share	Share of Guardsmen not deployable
73	AnyPhysicalLimitation_share	Share of Guardsmen with a physical limitation
74	Enlisted_share	Share of Guardsmen enlisted
75	E5orBelow_share	Share of Guardsmen with pay grade E5 or below
76	PULHES34_share	Share of Guardsmen with a grade of 3 or 4 (indicating significant limitation) among the medical categories of physical capacity/stamina, upper body, lower body, hearing, eyes, and psychiatric
77	MRC34_share	Share of Guardsmen with medical readiness grade of 3 or 4 (indicating deficiencies that cannot be resolved within 72 hours)
78	DRC34_share	Share of Guardsmen with dental readiness grade of 3 or 4 (indicating deficiencies that cannot be resolved within 72 hours)
79	YearsOfService_median	Median years of ARNG service
80	PriorService_share	Share of Guardsmen with prior military service
81	PriorActiveService_share	Share of Guardsmen with prior active military service
82	TraditionalGuardsmen_share	Share of Guardsmen in traditional drill status
83	CountyManMonthCount	Number of Guardsmen person-months observed
84	CountyUniqueIndividuals	Number of unique Guardsmen observed

Appendix D.
Illustrations

Figures

Tables

This page is intentionally blank.

Appendix E.
References

Black, Sandra A., M. Shayne Gallaway, Michael R. Bell, and Elspeth C. Ritchie. "Prevalence and Risk Factors Associated with Suicides of Army Soldiers 2001–2009." *Military Psychology* 23, no. 4 (2011): 433–451. https://doi.org/10.1080/08995605.2011.590409.

Centers for Disease Control and Prevention (CDC). "About Underlying Cause of Death, 1999–2016." CDC WONDER Online Database, 2017. https://wonder.cdc.gov/ucd-icd10.html.

Cherney, Samantha, Andrew R. Morral, and Terry L. Schnell. *RAND stated Firearm Law Database*. Document No. TL-283-RC. Santa Monica, CA: RAND Corporation, 2018. https://www.rand.org/pubs/tools/TL283.html.

Department of Defense. *DoDSER: Department of Defense Suicide Event Report: Calendar Year 2013 Annual Report*. Alexandria VA: Defense Human Resources Activity Headquarters, 2013. http://www.dspo.mil/Portals/113/Documents/2013-DoDSER-Annual-Report.pdf.

Department of Defense. *DoDSER: Department of Defense Suicide Event Report: Calendar Year 2016 Annual Report*. Washington, DC: Defense Health Agency, Psychological Health Center for Excellence (PHCoE), 2018. http://www.dspo.mil/Portals/113/Documents/DoDSER%20CY%202016%20Annual%20Report_For%20Public%20Release.pdf?ver=2018-07-02-104254-717.

Eliezer, Dina. "Memorandum for the Record: National Guard Bureau Suicide Prevention Symposium Summary Report." 25 June 2018.

Gahler, Daniel, and Harald Hruschka. "Resource Allocation Heuristics for Unknown Sales Response Functions with Additive Disturbances." *Regensburger Diskussionsbeiträge zur Wirtschaftswissenschaft* 488 (2016). Working Paper, Regensburg. https://epub.uni-regensburg.de/34818.

Gilman, S. E., E. J. Bromet, K. L. Cox, L. J. Colpe, C. S. Fullerton, M. J. Gruber, S. G. Heeringa, et al. "Sociodemographic and Career History Predictors of Suicide Mortality in the United States Army 2004–2009." *Psychological Medicine* 44, no. 12 (Septrember 2014): 2579–2592. https://doi.org/10.1017/S003329171400018X.

Griffith, James. "Suicide in the Army National Guard: An Empirical Inquiry." *Suicide and Life- Threatening Behavior* 42, no. 1 (February 2012): 104–119. https://doi.org/10.1111/j.1943-278X.2011.00075.x.

Griffith, James. “Suicide Risk Among Army National Guard (ARNG) Soldiers: Analysis of the CY2007–2012 ARNG Suicides.” Unpublished paper delivered to the ARNG January 2, 2014.

Griffith, James. “Suicide Risk Among Army National Guard (ARNG) Soldiers: Analysis of the CY2007–2014 ARNG Suicides.” Unpublished paper delivered to the ARNG March 3, 2015, and updated May 4, 2015.

Griffith, James. “Suicide in the U.S. Army: Stressor-Strain Hypothesis Among Deployed and Nondeployed Army National Guard Soldiers.” *Journal of Aggression, Conflict and Peace Research* 7, no. 3 (2015): 187–198. https://doi.org/10.1108/JACPR-05-2014-0125.

Kim, Namkug, Jennie B. Mickelson, Barry E. Brenner, Charlotte A. Haws, Deborah A. Yurgelun-Todd, and Perry F. Renshaw. “Altitude, Gun Ownership, Rural Areas, and Suicide.” *American Journal of Psychiatry* 168, no. 1 (2011): 49–54. https://doi.org/10.1176/appi.ajp.2010.10020289.

Office of Policy Development and Research (PD&R), U.S. Department of Housing and Urban Development. “HUD USPS Zip Code Crosswalk Files.” https://www.huduser.gov/portal/datasets/usps_crosswalk.html.

Schoenbaum, Michael, Ronald C. Kessler, Stephen E. Gilman, Lisa J. Colpe, Steven G. Heeringa, Murray B. Stein, Robert J. Ursano, and Kenneth L. Cox. “Predictors of Suicide and Accident Death in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS): Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS).” *JAMA Psychiatry* 71, no. 5 (2014): 493–503. https://doi.org/10.1001/jamapsychiatry.2013.4417.

Singh, Gopal K., and Mohammad Siahpush. “Increasing Rural–Urban Gradients in US Suicide Mortality, 1970–1997.” *American Journal of Public Health* 92, no. 7 (July 2002): 1161–1167. https://doi.org/10.2105/AJPH.92.7.1161.

Suicide Prevention Resource Center. “Applied Suicide Intervention Skills Training (ASIST).” 2007. https://www.sprc.org/resources-programs/applied-suicide-intervention-skills-training-asist.

Suicide Prevention Resource Center. “Resources and Programs.” https://www.sprc.org/resources-programs?type=All&program_evidence[0]=1&populations=138&settings=All&problem=All&planning=All&strategies=All&state=All.

Tondo, Leonardo, Matthew J. Albert, and Ross J. Baldessarini. “Suicide Rates in Relation to Health Care Access in the United States: An Ecological Study.” *The Journal of Clinical Psychiatry* 67, no. 4 (April 2006): 517–523. https://www.ncbi.nlm.nih.gov/pubmed/16669716.

Appendix F.
Abbreviations

ACE-SI	Ask, Care, and Escort Suicide Intervention
AFQT	Armed Forces Qualification Test
AIC	Akaike Information Criterion
ALARACT	All Army Activity
AR	Army Regulation
ARNG	Army National Guard
ASIST	Applied Suicide Intervention Skills Training
ASIST T4T	ASIST Training for Trainers
BHMC	Building Healthy Military Communities
CDC	Centers for Disease Control and Prevention
CHPC	Community Health Promotion Council
CIMS	Critical Incident Management System
DA PAM	Department of the Army Pamphlet
DOD	Department of Defense
DoDSER	Department of Defense Suicide Event Report
DPH	Director of Psychological Health
FAC	Family Assistance Center
GP	General Populations
HQ	headquarters
HUD	Department of Housing and Urban Development
IDA	Institute for Defense Analyses
JFHQ	Joint Force Headquarters
MOS	Military Occupational Specialty
MST	Master Resiliency Trainer
NAICS	North American Industry Classification System
NGB	National Guard Bureau
OR	odds ratio
PHCoE	Psychological Health Center for Excellence
R3SP	Resilience, Risk Reduction, and Suicide Prevention
RFI	request for information
SIO	Suicide Intervention Officer
SP	Suicide Prevention
SPPM	Suicide Prevention Program Manager
STARRS	Study to Assess Risk and Resilience in Servicemembers
T4T	Training for Trainers
VSCP	Vital Statistics Cooperative Program

This page is intentionally blank.

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From – To)
XX-09-2018	Final	

4. TITLE AND SUBTITLE	5a. CONTRACT NO.
Geographical Variation in Army National Guard Suicide: Is the Guard Like the General Population?	HQ0034-14-D-0001
	5b. GRANT NO.
	5c. PROGRAM ELEMENT NO(S).

6. AUTHOR(S)	5d. PROJECT NO.
James Bishop Michael Guggisberg Susan Clark-Sestak Jacqueline Du Bois David Graham Nate Latshaw Allen Wang	5e. TASK NO. DZ-6-4295
	5f. WORK UNIT NO.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NO.
Institute for Defense Analyses Strategy, Forces and Resources Division 4850 Mark Center Drive Alexandria, VA 22311-1882	IDA Paper P-9229 Log: H 18-000342

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR'S / MONITOR'S ACRONYM(S)
Army National Guard National Guard Bureau 111 S. George Mason Drive Arlington, VA 22204	ARNGB
	11. SPONSOR'S / MONITOR'S REPORT NO(S).

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

For the purpose of suicide prevention, Army National Guard (ARNG) members, predominantly living in civilian communities and holding civilian employment, may be similar to members of the general population (GP). Alternatively, ARNG members may be fundamentally different from the GP in one or more ways that warrant an ARNG specific approach to suicide prevention. This publication examines those similarities and differences and a county level. The ARNG must decide how to allocate suicide prevention funds across the states and territories and what guidance to give to the states and territories related to suicide prevention. Each state and territory uses suicide prevention funding and guidance differently; better understanding of the variation in suicide rates would better inform ARNG decision-making on its future suicide prevention policies and programs.

15. SUBJECT TERMS

suicide rates; Army National Guard; geographic differences; civilian-Guard differences in suicides; suicide prevention policies

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NO. OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			CPT Sean Brocato
U	U	U	U	86	19b. TELEPHONE NUMBER (Include Area Code) (703) 604-8087

This page is intentionally blank.