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Trends in crisis hotline call rates and suicide mortality in the United States

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Abstract

Objective—Utilization of the 988 Suicide and Crisis Lifeline was analyzed in relation to suicide deaths in US states between 2007 and 2020 to identify states with potential unmet need for mental health crisis hotline services.

Methods—Annual state call rates were calculated from calls routed to Lifeline (n=13.6 million). Annual state suicide mortality rates (standardized) were calculated from suicides reported to the National Vital Statistics System (n=588,612). Call rate ratio (CRR), a measure of each state's crisis hotline utilization, and mortality rate ratio (MRR), a measure of state's suicide mortality, were estimated.

Results—A third of US states demonstrated consistently high MRR and low CRR, suggesting high suicide burden and relatively low Lifeline use. A decreasing trend in CRR heterogeneity was also observed.

Conclusions—Prioritizing states with high MRR but low CRR for messaging and outreach regarding the availability of 988 can ensure more equitable need-based access to this critical resource.

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Introduction

There were a reported 46,000 suicide deaths in the United States during 2020, representing an increase in annual mortality rate of over 35% since 2000.[1,2] Suicide has been the tenth leading cause of death for this period and the burden is especially acute among veterans[3], sexual and gender minorities[4], and tribal populations[5]. In response to this ongoing public health crisis, multiple prevention resources to identify and aid at-risk individuals have been put in place, including crisis hotline services. While program evaluations suggest that crisis hotlines play an important role in suicide prevention[6,7], little is known about the national coverage of crisis hotline services in relation to local need. With the launch of a nationwide suicide prevention and mental health crisis number (9–8-8) in July 2022, there is renewed urgency to address this knowledge gap[6,8].

In this report, we describe trends in utilization of the 988 Suicide and Crisis Lifeline (Lifeline: https://988lifeline.org/), alongside trends in suicide mortality burden. Funded by the Substance Abuse and Mental Health Services Administration, Lifeline is a large network of over 200 round-the-clock crisis call centers and is the primary telephone hotline in the US, providing confidential mental health crisis and counseling services. Calls made to Lifeline are routed to the network center closest to the caller, and rerouted to national backup centers when local centers have reached capacity. Call centers are staffed by trained counsellors and undergo a certification or licensing from an external body before becoming part of the network.

In this report, we analyzed calls routed to Lifeline during 2007–2020 in relation to state suicide mortality rates. Broadly, we hypothesize that Lifeline call rates can be correlated with the magnitude of suicidal ideation in a state and when studied alongside suicide mortality rates can serve as a measure of unmet need for suicide prevention service. We identify trends in these two measures, categorize states by their similarity in trends, and identify states which can potentially be prioritized for additional crisis centers or related mental health prevention services.

Methods

Suicide deaths reported to the National Vital Statistics System were identified using International Classification of Diseases (ICD-10) underlying cause-of-death codes (X60-X84, Y87.0, U03)[9] for years 2007–2020. To adjust for differences in age-sex-race distribution across states, standardized state mortality rates were estimated using Bridged-Race population estimates[10,11] and age, race, sex and state-of-residence of the decedents.

A state's standardized mortality rate was calculated as $\sum_k \left(\frac{d_s^k}{p_s^k} * \frac{\sum_s p_s^k}{\sum_{k,\,s} p_s^k} \right)$, where p_s^k denotes the population in group k and state s in a given year and d_s^k the corresponding suicide deaths (the time subscript was dropped for notational simplicity; all calculations are annual); hence, $\frac{d_s^k}{p_s^k}$ is the group-specific crude mortality rate in the state, and $\frac{\sum_s p_s^k}{\sum_{k,\,s} p_s^k}$ is the proportion of the national population that belongs to group k[12]. Here, $k = 72$, a stratification of each state's

population into 9 age groups (5–14 years, 15–24 years, …, 75–84 years and 85+ years), 2 sex groups and 4 racial groups (White, African American, American Indian or Alaska Native, and Asian/Pacific Islander), consistent with bridged-race grouping. (A comparison of state level crude mortality rates and standardized mortality rates is available as an online supplement).

Annual state *mortality rate ratios* (MRR_s) were calculated as $MRR_s = \left(\sum_k \left(\frac{d_s^k}{p_s^k} * \frac{\sum_s p_s^k}{\sum_{k,s} p_s^k}\right)\right) / \frac{\sum_{k,s} d_s^k}{\sum_{k,s} p_s^k}$, where the numerator is the state's standardized mortality rate and the denominator the national crude mortality rate. A $MRR_s^t > 1$ indicates a higher suicide mortality rate in state s during year t than would be expected if the state had the same age-race-sex distribution as the US overall.

Lifeline call volumes were made available to the authors under a restricted use agreement with Vibrant Emotional Health. All calls routed to one of the Lifeline centers from 2007–2020 were resolved to the origin county (inferred from the calling number) and aggregated to calculate annual national and state call volumes. For each state and year, call rates per 100,000 population and *call rate ratio (*CRR_s*)*, a measure of the state's annual per capita call rate relative to the national per capita call rate, were estimated. Analogous to mortality rates above, if c_s denotes the call volume from state s, the crude calling rate for state s is $\frac{c_s}{\sum_k p_s^k}$ and the national rate is $\frac{\sum_s c_s}{\sum_{k,s} p_s^k}$. $CRR_s = \frac{c_s}{\sum_k p_s^k} / \frac{\sum_s c_s}{\sum_{k,s} p_s^k}$ with a $CRR_s^t > 1$ indicating that residents of state s accessed Lifeline at a higher rate than the national average during year t. Unlike mortality rates, standardization of Lifeline call rates was not possible as demographic information of callers was unavailable.

As a measure of the heterogeneity in CRR and MRR, we calculated interquartile range (IQR) across states in each year of the study period. IQR is easily interpretable, is a robust measure of dispersion, and less sensitive to extreme values than standard deviation. A change in heterogeneity would result in a statistically significant monotonic trend in IQR, verified using the Mann-Kendall test. Further, to assess change in a state's CRR and MRR relative to other states' over the study period, states were grouped into octiles by their annual CRR and MRR. The number of group transitions by a state is interpreted as a measure of consistency in crisis hotline use (CRR) or suicide mortality (MRR) relative to other states.

Results

During the study period, a cumulative 13.6 million calls were routed to Lifeline call centers and the national call rate per 100,000 population increased from 151 in 2007 to 579 in 2020. The IQR of state CRRs decreased from 0.36 to 0.28, suggesting a narrowing of differences among states, and the decreasing trend was found to be statistically significant ($p < .001$) (available as online supplement). Correspondingly, the national suicide mortality rate per 100,000 population increased from 12.3 in 2007 to 14.8 in 2020 (cumulative deaths: 588,122), but no significant trend in IQR was observed (p=0.51), with IQR remaining nearly unchanged at 0.31.

Many year-to-year transitions between CRR groups were observed over the study period (available as online supplement). While a few states were consistently in the same octile group throughout the 14-year period (for example, Alaska, Massachusetts, Maine), 40 of the 50 states were in four or more octile groups during the study period (mode=4), suggesting considerable variability in hotline utilization across states relative to each other, independent of an increasing overall trend. In contrast, octiles of state MRRs remained largely unchanged with 35 of the 50 states in three or fewer groups (mode=2; see online supplement).

On examining CRR and MRR together a few broad categories of states emerged (online supplement): a) about a third of states (Arizona, Arkansas, Florida, Hawaii, Kentucky, Louisiana, Maine, Missouri, Mississippi, New Hampshire, North Dakota, Oklahoma, South Dakota, Tennessee, Vermont, Wyoming) showed consistently high MRR and low CRR, suggesting high suicide burden and relatively low Lifeline use; b) conversely, a few states (California, Illinois, Maryland and Massachusetts) exhibited low MRR and high CRR, suggesting a relatively low suicide burden, either due to or independent of high Lifeline usage; c) several southwestern states (Colorado, Nevada, New Mexico and Oregon) experienced high CRR *and* high MRR; and, d) some mid-, south-Atlantic states (Delaware, South Carolina, Pennsylvania, Virginia and West Virginia) had declining Lifeline usage over the study period.

Discussion

The difference between CRR and MRR can be interpreted as a measure of unmet need for crisis hotline services. With the recent launch of the national suicide and mental health crisis number, states consistently exhibiting low call rate ratios and high suicide mortality rate ratios should be prioritized for increased messaging and outreach. While alternative strategies based on population-level characteristics (for example, states with the highest number of suicide deaths) may yield greater reductions in number of suicide deaths, a balanced approach that integrates need-based metrics, such as those presented here, is necessary to ensure more equitable access to treatment. Additional analyses on evaluation of complementary mental health services in high need areas and modifiable barriers to these services, especially in high-risk population sub-groups, are also required.

Identifying population-level drivers to the shared patterns among states requires more detailed analyses incorporating socioeconomic indicators, state-specific policies, budgeting for mental health services, and cultural factors that could affect willingness of at-need individuals to seek help. Such analyses may help extend the categorization to states not currently grouped into any of the four categories described above. Furthermore, caution is warranted in interpreting the strength and direction of causal associations between call volumes and suicide mortality, as these are complex and difficult to discern in ecological analyses.

The current analysis also does not address individual-level drivers for differential utilization of Lifeline services, and caller demographic information (age, race, sex, employment status, etc.) and mental health history (diagnoses of major depressive disorders, anxiety, etc.) could

potentially inform in-depth analysis of barriers to access. Collecting such information in a manner respectful of caller privacy remains a challenge.

The rollout of 988 was expected to increase call volumes and test Lifeline system's capacity. Reports estimate volume to have increased by 45% during the week of transition, and encouragingly, adequately handled by the network [13]. Sustained funding will be necessary to maintain capacity, bring additional centers into the network and/or add staffing to existing centers. Continued monitoring of MRRs and CRRs may also inform decisions on which states to prioritize. For example, additional resources might be directed to states for which the gap between MRR and CRR has widened over time (e.g. Alabama, Montana, New Hampshire), suggesting growing underutilization of Lifeline.

This study has several limitations. The precise physical location of callers was not available and our use of the area code as a proxy for location did not account for relocation of cell phones outside caller county of residence. This is particularly true for younger individuals, as they are less likely to own landlines and are more likely to move away from their home county for school or work. Within state movement, however, should not have impacted the results as call volumes were aggregated by state. Information on the specific crisis center answering a call (in-state vs. backup), if available, may provide an alternative way to determine origin county.

Callers to Lifeline self-identifying as veterans are routed to call centers that are part of the Veterans Crisis network and staffed by responders specifically trained in military culture. Such calls were not included in the current analysis. Given the increasing rate of veterans suicide relative to the general population, and their heterogeneous geographical distribution in the US, exclusion of such calls has likely differentially impacted CRR estimates. Similarly, in addition to telephone services, Lifeline supports chat and text services, and a more comprehensive assessment of need for crisis services should include chat/text volumes.

Additional data on the proportion of all crisis calls that are handled by call centers that are not part of the Lifeline network, and the variance in this proportion by state and over the study period is necessary to understand the representativeness of the Lifeline dataset used here. Similarly, callers to Lifeline can include those in non-suicidal crisis, a fraction with potentially considerable spatial and temporal heterogeneity, rendering a simple aggregation of all calls irrespective of motivation, as used here, a possibly simplistic measure. Other limitations include unaccounted impact of frequent or repeat callers on call volumes[14], uncertainty in manner of death certification, and potential undercounting of suicide deaths among certain racial/ethnic minority groups[15].

Conclusions

Utilization of the Lifeline crisis hotline increased nearly four-fold between 2007 and 2020 and while a slight decrease in heterogeneity among states was observed, differences in utilization persisted. Analyzing call volumes alongside standardized suicide mortality identified specific state groupings, which in turn can inform need-based prioritization of outreach efforts for the continued effective utilization of 988 Lifeline.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Conflict of Interest

This work is funded by a grant from the National Institute of Mental Health (R01-MH121410) to Keyes and Shaman. The funder had no role in study design; collection, analysis, and interpretation of data; writing the report; and the decision to submit the report for publication.

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Highlights

- Use of 988 Suicide and Crisis Lifeline increased four-fold between 2007 and 2020 with persistent differences in utilization across states.
- We analyzed call volumes and states suicide mortality rates, and report two measures that may be used to identify states for need-based prioritization of crisis hotline services.