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Suicide Deaths Before and During the Coronavirus Disease 2019 Pandemic

An Interrupted Time-series Study

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Introduction: With stressors that are often associated with suicide increasing during the coronavirus disease 2019 (COVID-19) pandemic, there has been concern that suicide mortality rates may also be increasing. Our objective was to determine whether suicide mortality rates increased during the COVID-19 pandemic.

Methods: We conducted an interrupted time-series study using data from January 2019 through December 2020 from 2 large integrated health care systems. The population at risk included all patients or individuals enrolled in a health plan at HealthPartners in Minnesota or Henry Ford Health System in Michigan. The primary outcome was change in suicide mortality rates, expressed as annualized crude rates of suicide death per 100,000 people in 10 months following the start of the pandemic in March 2020 compared with the 14 months prior.

Results: There were 6,434,675 people at risk in the sample, with 55% women and a diverse sample across ages, race/ethnicity, and insurance type. From January 2019 through February 2020, there was a slow increase in the suicide mortality rate, with rates then decreasing by 0.45 per 100,000 people per month from March 2020 through December 2020 (SE = 0.19, $P = 0.03$).

Conclusions: Overall suicide mortality rates did not increase with the pandemic, and in fact slightly declined from March to December 2020. Our findings should be confirmed across other settings and, when available, using final adjudicated state mortality data.

Key Words: suicide, COVID-19, pandemic

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Study activities were reviewed and approved by Institutional Review Boards at HealthPartners and Henry Ford (HealthPartners: A20-104; Henry Ford Health System: 00005846). Approval for a waiver of consent and use of these data were obtained from each participating site's Institutional Review Board.

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The authors declare no conflict of interest.

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Given increases in risk factors for suicide with the onset of the coronavirus disease 2019 (COVID-19) pandemic, including increases in social isolation, economic privation, bereavement, domestic violence, firearm and alcohol purchases, and prevalence of depression and anxiety, as well as reduced access to health care and services that support families experiencing or at risk for violence, there have been concerns that suicide rates would increase during the pandemic.^{1–3} Suicide attempt data are often more timely than suicide death data, but suicide attempts may be greatly underreported during periods when health care access and utilization decrease, which they did during the pandemic. Suicide death data are recorded by state medical examiners and are not underreported when health care utilization declines, but lags in final reporting of state mortality data can make timely assessment of trends in suicide mortality challenge.

To address the gap in understanding of the effects of the pandemic on suicide deaths, this interrupted time-series study utilized interim mortality data from patients in Michigan and Minnesota to examine changes in suicide mortality rates before and after March 2020, when the World Health Organization officially declared a pandemic and many changes in employment, school and public health policy related to the pandemic were first implemented in the United States.⁴

METHODS

The population at risk in this sample included all patients and insurance members of HealthPartners in Minneapolis and Henry Ford Health System in Detroit, and study activities were reviewed and approved by Institutional Review Boards at each site. Neighborhoods were defined using census block data. Income and education were estimated using publicly available Federal Information Processing System (FIPS) values set by the National Institute of Standards & Technology.⁵

We measured suicide deaths and not suicide attempts because changes in suicide attempts are likely confounded by changes in care-seeking that present fewer opportunities for documentation of the occurrence of suicide attempts. Decreases in care-seeking have been similarly observed for other life-threatening disorders that had previously been considered to be obligatory conditions for emergent care, including myocardial infarction or stroke.⁶ In contrast, suicide death

rates are collected and reported by state medical examiners, and the assessment of suicide deaths is not influenced by likelihood to seek care during the pandemic. We chose a static denominator based on enrollment and utilization in January 2019 to avoid inflating the suicide mortality rate as an artifact of disenrollment related to job loss or lack of care-seeking; that is, allowing reductions in the denominator would have likely inflated suicide death rates. Monthly state reported of preliminary cause of death were obtained from state vital statistics records and stored in each health care system's virtual data warehouse. Deaths were considered to be suicide deaths if they were categorized as such by the state. Preliminary cause of death was used because the adjudicated state mortality data are not typically available until 9–12 months after the end of the previous calendar year. Each state's preliminary cause of death data were obtained monthly, with a lag of 1–2 months; data for calendar years 2019 and 2020 were harvested in March 2021. Deaths were available for all people included in our denominators regardless of whether they were still enrolled in the health plan at the time of their death.

We employed an interrupted time-series design⁷ and used segmented regression⁸ to evaluate the change in annualized crude rates of suicide death per 100,000 people in 14 months before March 2020 (when COVID-19 was declared a pandemic by the World Health Organization⁴) and first 10 months of the pandemic. Consistent with standard specifications,⁸ the model included a term indexing the secular trend in time, a term for immediate change in level (intercept), and a term for the change in slope. We evaluated the presence of autocorrelation via the Durbin-Watson statistic at lags up to 12 months. All analyses were performed in SAS 9.4.⁹

RESULTS

Demographic characteristics of the 6,434,675 people at risk are summarized in Table 1 and were generally consistent with US population as a whole,¹⁰ with our sample having slightly more women and slightly fewer people who self-identify as Asian, Hawaiian/Pacific Islander, or Native American/Alaskan Native than the US general population. Overall, 54% of patients in our sample were women, and 22% were ages 0–19, 25% ages 20–39, 36% ages 40–64, and 16% over the age of 65. Fifty-seven percent of people were insured by commercial insurance, 18% by Medicaid, and 13% by Medicare. Forty-two percent of people lived in neighborhoods where <25% of residents had at least some college education. Three percent of patients were Asian, 14% Black, 54% White, and 2% Hispanic.

From January 2019 through February 2020, overall suicide mortality rates slowly increased to 14.6 per 100,000. These rates were generally consistent with national data reporting a 2019 suicide death rate of 13.9 per 100,000.¹¹ Suicide mortality rates then slowly decreased from 13.4 in March 2020 to 10.8 in December 2020 (a decrease of 0.45 per 100,000 people per month, SE = 0.19, P = 0.03; Fig. 1). The Durbin-Watson statistic was 2.49 (Pr <DW = 0.723); no lag between 1 and 12 months was statistically significant, so no autoregressive parameters were included in the model.

TABLE 1. Demographic Characteristics of the Total Population at Risk for Each Health Care System as of January 2019

Total Population at Risk	HealthPartners (N = 3,431,542) (%)	Henry Ford Health System (N = 3,003,133) (%)
Age (y)		
0–19	27.1	17.2
20–39	28.0	20.9
40–64	36.3	36.7
65+	8.6	25.3
Sex: women	52.2	57.0
Insurance		
Insurance commercial	70.3	42.2
Insurance Medicaid	16.4	19.9
Insurance Medicare	5.3	20.5
Insurance self-pay	1.7	16.6
Insurance other	6.3	0.8
Lower neighborhood income (< \$25,000)	1.3	6.8
Lower neighborhood education (< 25% of residents with at least some college)	34.2	51.9
Race/ethnicity		
Asian	3.9	2.6
Black	6.1	22.9
Hawaiian/Pacific Islander	0.2	0.1
Native American/Alaskan Native	0.6	0.4
White	48.0	60.1
Multiple/other	0.5	3.9
Unknown	38.3	10.0
Hispanic	2.4	3.4

DISCUSSION

Despite increases in many risk factors for suicide with the onset of the COVID-19 pandemic, as well as evidence that COVID-19 infection itself can increase psychiatric illness and suicidal ideation,¹² suicide mortality rates in our sample did not increase in the first 10 months of the pandemic, and in fact, slightly declined.

Studies examining suicide rates during the current COVID-19 pandemic are starting to emerge, with most similarly finding declining suicide death rates during the pandemic. One study examining leading causes of death in the United States found that suicide deaths declined by 5.6% from 2019 to 2020.¹³ Another study found that total age-adjusted suicide mortality rates decreased by 20% during the lockdown (March 10, 2020–May 20, 2020) in Connecticut compared with the previous year.¹⁴ However, in contrast to most studies reporting decreased suicide rates for general populations during the pandemic, suicide rates for non-white patients in Connecticut increased by 62% during the lockdown compared with the previous year. A third study found that the suicide death rate in Massachusetts a nonsignificant decline from 0.80 per 100,000 person-months during March to May 2019 to 0.67 per 100,000 person-months from March to May 2020 (incident rate ratio, 0.84; 95% confidence interval, 0.64–1.00).¹⁵ Finally, in contrast, a study using national observational data from Japan found that suicide mortality rates increased for the months of July through

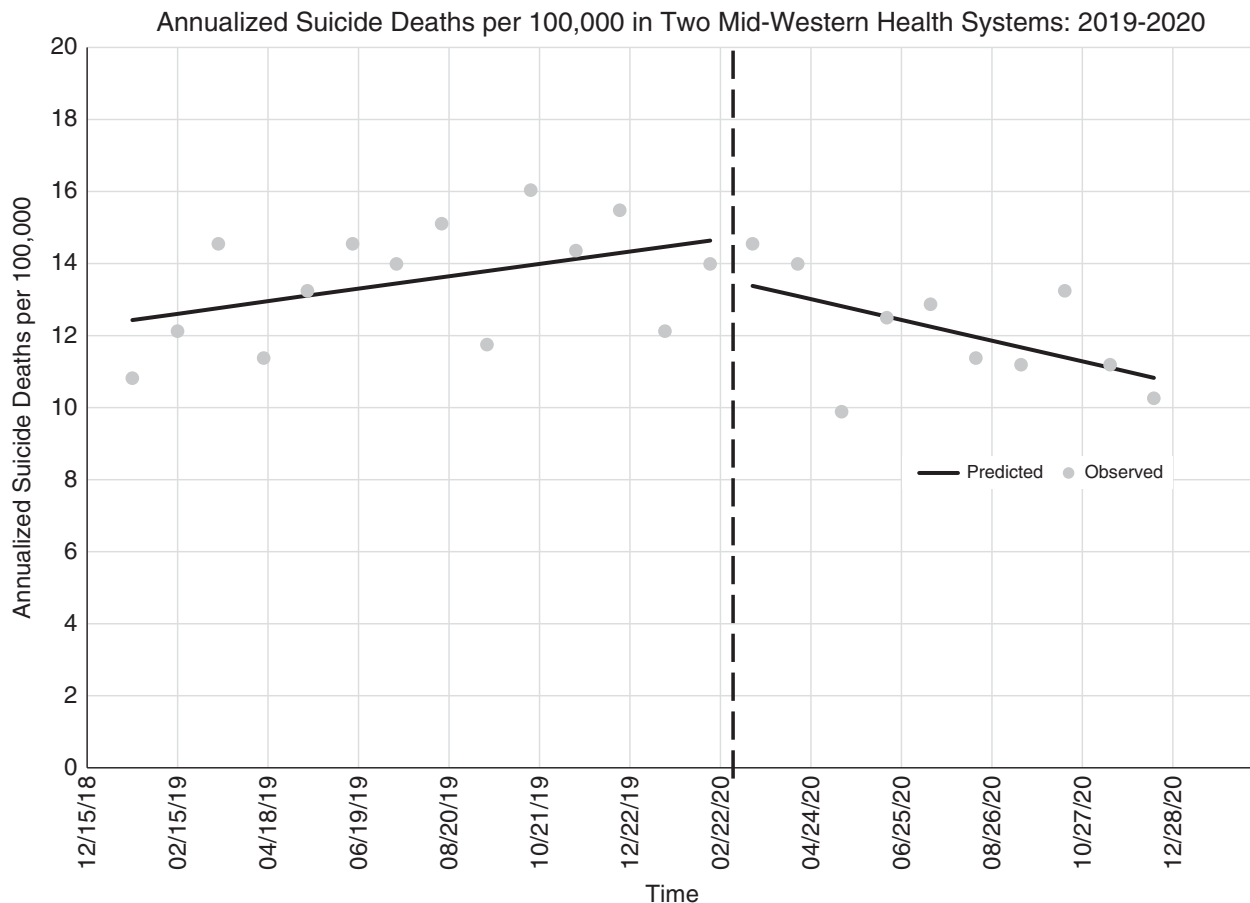


FIGURE 1. Annualized suicide deaths per 100,000 in 2 Midwestern Health Systems: 2019–2020.

November 2020 for women and in October and November 2020 for men when compared with 2016–2019 data.¹⁶ As additional suicide mortality data become available in the United States, this may help clarify some of the complex relationships between the increased stress and mental health burden many are experiencing during the pandemic and the decreased rates of suicide mortality we found in this study. It will be particularly important to examine suicide rates among potentially vulnerable populations, such as women, people of racial and ethnic minority groups, and elderly people.

Our findings were likely influenced by the context and experience of the COVID-19 pandemic in Michigan and Minnesota, the states in which are samples are based. In Michigan, COVID-19 case rates were relatively flat until an abrupt rise in cases in November 2020 through January 2021.¹⁷ COVID-19 deaths in Michigan spiked in April through May 2020 and again in December 2020 through February 2021. In Minnesota, COVID-19 case rates rose slowly from April 2020 until a fairly abrupt peak in COVID-19 cases and deaths in November and December of 2020.¹⁸ An indoor mask mandate was in place from April 26, 2020, to June 22, 2021 (423 d) in Michigan and from July 25, 2020, through May 14, 2021, in Minnesota (294 d); the duration of these mask mandates was a little higher than the norm, as state mask mandates ranged from 56 days to over 600 days

(ongoing as of December 2021) during the pandemic.¹⁹ Associations between suicide death and the pandemic may have been different in other states with different experiences of the COVID-19 pandemic.

Our findings are consistent with those reported for previous national emergencies, such as the terrorist attacks of September 11, 2001, or the 1995 Oklahoma City bombing, when there were no measurable changes in suicide rates for local communities or states directly affected by these traumas, nor were national suicide rates affected.^{20,21} However, our findings are in contrast with those associated with previous viral epidemics and quarantines, as suicide deaths increased in the United States during the 1918–1919 flu pandemic and among older adults in Hong Kong during the 2003 severe acute respiratory syndrome epidemic.^{22–24} The reasons for this juxtaposition between increased factors often associated with suicide occurring during the pandemic and a lack of increased suicide mortality rates in our study are not yet well understood. Suicide mortality rates should continue to be monitored moving forward in the context of an ongoing pandemic and the continuation of risk factors, such as extended social isolation, that may exacerbate suicide risk.

Our study has several potential limitations that should be taken into careful consideration. First, our study uses monthly state reports of preliminary cause of death rather than

the final adjudicated cause of death data; future studies should use fully adjudicated state mortality data when these are available. Second, despite having a large sample of over 6 million people, our sample was not large enough to examine changes in suicide mortality by age or race, and ethnicity. Third, data in this study are from patients receiving care in integrated health care systems in the Midwest, and therefore our study results may not generalize to other groups.

CONCLUSIONS

Suicide death rates did not increase during the first 10 months of the pandemic at 2 large integrated health care systems, and in fact, suicide mortality rates slightly declined. These findings should be confirmed across other care settings and regions, and should make use of final adjudicated state mortality data when available.

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