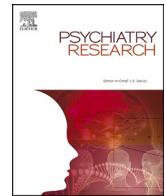




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Short communication

Suicide rates during the COVID-19 pandemic in Japan from April 2020 to December 2021



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ARTICLE INFO

Keywords:

Alcohol
COVID-19
Japan
Suicide
Unemployment

ABSTRACT

This study estimated the excess suicidal mortality during the COVID-19 pandemic in Japan. A Poisson regression model was used to assess the association between unemployment rates, expenditure for alcohol, eating out, and suicide, from January 2008 to March 2020. The excess suicidal mortality was assessed by applying the identified model to data from April 2020 to December 2021. The number of estimated excess deaths during COVID-19 was 3397 in men and 2390 in women. COVID-19 may have caused unprecedented psychological distress among people, owing to restricted social gatherings and prolonged uncertainties.

1. Introduction

New waves of coronavirus 2019 (COVID-19) (hereinafter referred to as the pandemic) outbreaks continuously re-emerged worldwide. Thus, to contain the pandemic, governments have implemented public health and social measures, such as social distancing, economic lockdowns, and temporary restructuring of the health system. The stress caused thereby adversely affected people's mental health (Niederkröthaler et al., 2020). Moreover, they may have also led to an increase in suicide rates (Niederkröthaler et al., 2020). Studies in the early months of the pandemic showed no indication of an increase in suicide rates in Australia (Leske et al., 2021), Germany (Radeloff et al., 2021), the United States (Faust et al., 2021), and 21 other countries (Pirkis et al., 2021). However, there has been an increase in suicide rates in Japan, from July 2020 until September 2021 (Nomura et al., 2021; Sakamoto et al., 2021; Tanaka and Okamoto, 2021; Horita and Moriguchi, 2022; Watanabe and Tanaka, 2022). Japan has had relatively high suicide rates compared with other high-income countries, although the rates have been declining from 2000 to 2019 (Organisation for Economic Co-operation and Development, 2021). In 2019, age-specific suicide rates for those aged 30–39, 40–49, and 50–59 years were 17.7, 18.5, and 21.1, respectively (National Police Agency, 2022). The increased suicide risk during the pandemic may involve unemployment (Kawohl and

Nordt, 2020), reduced social contact (Fiorillo and Gorwood, 2020), and increased harmful alcohol use (Wasserman et al., 2020). COVID-19 countermeasures involved early closure of restaurants and bars, which could have reduced eating out behaviors and caused a shift in alcohol consumption, from on-premise locations, such as restaurants and bars, to off-premise locations (Jacob et al., 2021; Callinan et al., 2021). Even though the Japanese government's COVID-19 responses until mid-2020 were least stringent than those in other OECD countries (Cross et al., 2020), the social distancing measures resulted in a decline in GDP (Cross et al., 2020) and lifestyle changes such as extended at-home hours and increased alcohol consumption that persisted after the national emergency was eased (Nishijima et al., 2021). To assess the increase in suicide mortality during the COVID-19 pandemic, these changes in economic and social behavioral measures should be considered. The present study estimated the excess suicidal mortality during the COVID-19 pandemic considering the changes in unemployment, alcohol consumption, and eating out behaviors in Japan.

2. Methods

We obtained the monthly number of deaths by suicide, from January 2008 to December 2021; this information is publicly available on the NPA website as finalized on March 15, 2022 (National Police Agency,

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<https://doi.org/10.1016/j.psychres.2022.114774>

Received 26 May 2022; Received in revised form 4 August 2022; Accepted 6 August 2022

Available online 7 August 2022

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2022). In Japan, all deaths due to external (or unnatural) causes, including unconfirmed cases, are reported to the police. National data on suicide are compiled by the NPA and disseminated to the Ministry of Health, Labour, and Welfare. Mortality data from the Ministry of Health, Labour, and Welfare are based on classification of leading causes of death, which could exclude some cases where the cause of death involved unidentified intent or was unknown causes, but which was afterwards investigated and confirmed by the NPA as suicide. Therefore, we used the NPA information as the data source, given its greater accuracy and the timeliness of reports. We included all deaths by suicide in the analysis. Data regarding the population was based on confirmed estimates of the population by month (Statistics Bureau of Japan, 2022a). The period from April 2020 to December 2021 covered four instances of national emergency declarations.

To estimate the excess suicidal mortality during the pandemic (April 2020–December 2021), a Poisson regression model was assigned to the number of suicides, by sex, from January 2008 to March 2020. The log-transformed population by sex was treated as an offset. The cumulative number of months since the beginning of the study (January 2008), was included as a covariate of underlying linear trends since the suicide rates in Japan have been declining in recent years (Nakanishi et al., 2020). Seasonal effects were also adjusted by defining dummy variables for each calendar month; this particular approach has been used in a previous study (Radeloff et al., 2021). Covariates were the seasonally adjusted national unemployment rate for each month and each sex (Statistics Bureau of Japan, 2022b) and the national average of monthly household expenditure for alcohol and eating out (Statistics Bureau of Japan, 2022c). The identified model was then applied to the data (population, calendar month, the cumulative number of months, unemployment, and expenditure for alcohol and eating out) from April 2020 to December 2021 to calculate the expected number of suicides for each month. The expected and observed suicides in the COVID-19 period were compared by calculating 95% prediction intervals (PIs). The number of estimated excess suicidal mortality during the pandemic was calculated by sex. Excess deaths and the 95% prediction intervals were estimated by subtracting the number of forecasted deaths from the

number of observed deaths.

All statistical analyses were performed using Stata version 17.0 (StataCorp LLC, College Station, TX, USA). Statistical significance was set at a two-tailed *p*-value of < 0.05.

Ethical approval was not sought for the present study because no individuals' data were used. Furthermore, no data could be linked to any individual. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013.

3. Results

During the first 21 months of the pandemic, there were 37,180 suicides, with an unadjusted monthly rate of 1.41 per 100,000 people. Unemployment rates increased during the COVID-19 period, for both sexes (Supplemental Material Fig. S1). Average household expenditures for eating out dropped from the onset of COVID-19. Expenditures for off-premise alcohol were stable, with a slight increase during the COVID-19 period. Expenditures for on-premise alcohol declined during the COVID-19 period (Supplemental Material Fig. S1).

The Poisson regression of the pre-COVID-19 model indicated that an increased unemployment rate was significantly associated with increased suicides among both sexes (Supplemental Material Table S1). Higher expenditure for on-premise alcohol and lower expenditure for eating out were significantly associated with increased suicides among men and women. Moreover, there was a slightly decreasing trend in suicides in both sexes (Supplemental Material Table S1).

The suicides observed in April and May 2020 among women were lower than expected (Fig. 1). However, for men, the observed suicides from July 2020 to December 2021 were higher than expected (Fig. 1). For women, the observed suicides from July 2020 to December 2021 were higher than expected (Fig. 1). A total number of estimated excess deaths from suicides during the pandemic was 3397 in men (95% prediction interval [PI], 1882–4911), corresponding to 5.56 per 100,000 population (95%PI, 1.96–8.04). The incidence of suicide was higher

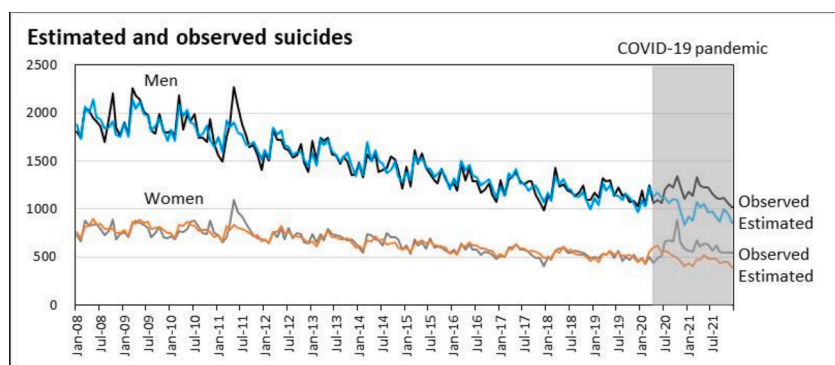
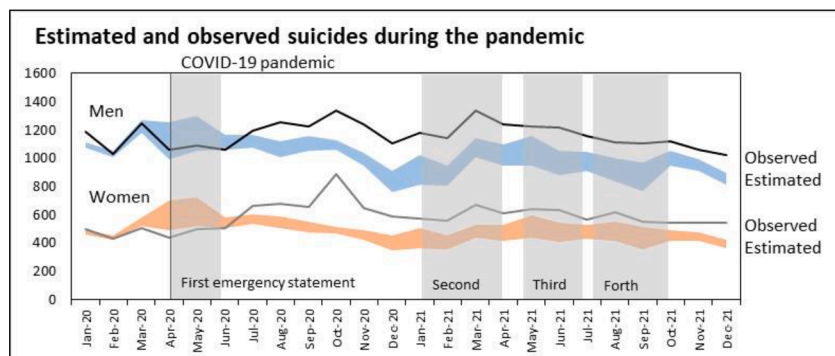


Fig. 1. Estimated and observed suicide incidence in Japan. The estimated number and 95% projection interval (95%PI) are based on the Poisson regression analysis of suicides from January 2008 to March 2020. It also shows the observed suicides (lines) in the individual months by gender. The grey areas present periods when national emergency statement was issued, and restaurants and bars were requested to close early. The first national emergency statement was issued from April 7 to May 25, 2020. The second declaration of national emergency was issued from January 8 to March 21, 2021, followed by a third declaration from April 25 to June 20, and a fourth from July 12 to September 30.



than the estimated rate by 16.1% (95%CI, 8.3%–25.0%). A total number of estimated excess deaths was 2390 in women (95%PI, 1267–3513), corresponding to 3.70 per 100,000 population (95%PI, 1.96–5.45). The incidence of suicide was higher than the estimated rate by 23.3% (95% CI, 11.1%–38.4%) (Supplemental Material Table S2).

4. Discussion

This study revealed that a long-term increase in suicide rates occurred during the 2-year COVID-19 period. This long-term increase could not be accounted for by the changes in unemployment, alcohol expenditure, or eating out during the pandemic. A decline in suicide rates during the early months of the pandemic has been observed in a previous study that used data from Japan (Anzai et al., 2021; Tanaka and Okamoto, 2021). The immediate decline in suicide rates implies that the feeling of social cohesion may have temporarily increased in the early months of the pandemic (Wasserman et al., 2020). In this regard, an initial decline in suicides after natural disasters has been frequently reported; this is called the “pulling-together effect” or “honeymoon effect” (Bavel et al., 2020). Following this, pandemic fatigue may have emerged among the population in Japan because the pandemic and its related restrictions were prolonged. The reasons for suicide during the pandemic became more numerous compared with before the pandemic across all categories, suggesting there was multilayered psychological distress following the second COVID-19 wave (Koda et al., 2022). Similar to what has been reported in a previous study in Japan (Nomura et al., 2021; Sakamoto et al., 2021; Tanaka and Okamoto, 2021; Watanabe and Tanaka, 2022), the observed suicide rates in women were lower than expected, in April and May 2020, and higher than expected, from July 2020 to December 2021. The present study’s results extended the findings by showing that excessive mortality from suicide was retained in both sexes, even 21 months after the pandemic emerged. In 2021, Japan experienced three waves of COVID-19 surge. Notably, the Tokyo Olympic and Paralympic Games were held during the fifth wave of the pandemic, while the COVID-19 vaccine roll-out was delayed in Japan (Kosaka et al., 2021). Prolonged periods of uncertainty due to the pandemic and its related restrictions, may have caused cumulative stress, leading to anxiety and depression (Varga et al., 2021). Therefore, mental health support and interventions are warranted to mitigate potential increases in suicide during such pandemics.

Our study has some limitations. First, we used the average household expenditure for alcohol, which could not accurately reflect the frequency or quantity of drinking behaviors. Thus, our results may not generalize how the pandemic could have impacted suicide rates in countries where pandemic policies differ from those in Japan. Furthermore, although the level of restrictions varied substantially during this period, our model assumed that the post-COVID-19 trend was stable. In addition to these policies, people could show pandemic fatigue over time and lower adherence to the same restriction levels (Reicher and Drury, 2021). Future studies, using mobile phone location data, can contribute to examining the association between the level of restrictions on social gatherings and suicide rates during the pandemic.

5. Conclusion

A long-term increase in suicide rates was observed in Japan during the COVID-19 period. This trend could not be attributed to unemployment, expenditure for alcohol, or eating out behaviors. Mental health support is warranted to mitigate the potential increase in suicide rates during such pandemics and following related restrictions imposed by the government.

Role of the funding source

The funding sources had no role in the study design, data collection, data analysis, interpretation, or in writing the report. The views

expressed in this paper are solely those of the authors.

Data availability

This study is based on publicly available data from the National Police Agency and the Statistics Bureau of Japan. Corresponding author will make aggregated data available to other scientists upon request.

Funding

This study was supported by the Ministry of Health, Labour Sciences research grant (grant number 19189500) from the Ministry of Health, Labour, and Welfare; JSPS KAKENHI (grant numbers JP20H01777, JP20H03951, JP21H05173) from the Ministry of Education, Culture, Sports, Science and Technology; and JST-Mirai Program (grant number JPMJMI21J3) from the Japan Science and Technology Agency, Japan.

CRediT authorship contribution statement

Miharu Nakanishi: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Funding acquisition. **Syudo Yamasaki:** Formal analysis, Writing – review & editing, Supervision. **Kaori Endo:** Writing – review & editing. **Shuntaro Ando:** Writing – review & editing, Supervision. **Mai Sakai:** Writing – review & editing, Supervision. **Hatsumi Yoshii:** Writing – review & editing, Supervision. **Atsushi Nishida:** Writing – review & editing, Supervision, Project administration.

Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2022.114774.

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