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Psychiatry Research 290 (2020) 113104

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Projected increases in suicide in Canada as a consequence of COVID-19

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ABSTRACT

Macroeconomic indicators, notably unemployment, are significant moderators of suicide. We projected the number of excess suicides in Canada as a consequence of the impact of COVID-19 on unemployment. Annual suicide mortality (2000-2018) and unemployment (2000-2019) data were derived from Statistics Canada. Time-trend regression models were used to evaluate and predict the number of excess suicides in 2020 and 2021 for two possible projection scenarios following the COVID-19 pandemic: 1) an increase in unemployment of 1.6% in 2020, 1.2% in 2021, or 2) an increase in unemployment of 10.7% in 2020, 8.9% in 2021. A percentage point increase in unemployment was associated with a 1.0% increase in suicide between 2000 and 2018. In the first scenario, the rise in unemployment rates resulted in a projected total of 418 excess suicides in 2020-2021 (suicide rate per 100,000: 11.6 in 2020). In the second scenario, the projected suicide rates per 100,000 increased to 14.0 in 2020 and 13.6 in 2021, resulting in 2114 excess suicides in 2020-2021. These results indicate that suicide prevention in the context of COVID-19-related unemployment is a critical priority. Furthermore, timely access to mental healthcare, financial provisions and social/labour support programs, as well as optimal treatment for mental disorders is urgently needed.

1. Introduction

As a consequence of the COVID-19 pandemic, approximately one-third of the global population currently resides under some form of lockdown or quarantine. The impact of the containment measures on the global economy is projected to dwarf the macroeconomic impact of the 2008-09 financial crisis in both magnitude and scope (OECD Economics Department, 2020). Unprecedented proportions of the employment sectors in the USA and Canada have filed for unemployment benefits. Statistics Canada reported, on April 9, 2020, that one-in-ten working-age individuals (i.e., fifteen years of age and over) in Canada lost their jobs or worked less than half their usual hours as a result of the widespread restrictions imposed in March 2020 (Government of Canada, Statistics Canada, 2020).

Suicide rates, at a population-level, are highly sensitive to macroeconomic indicators, particularly unemployment (Chang et al., 2009; Reeves et al., 2012; Stuckler et al., 2009). We recently reported that the rapid rise in unemployment as a result of the COVID-19 pandemic is predicted to result in 3,235-8,164 excess suicides between 2020 and 2021, representing a 3.3-8.4% increase in suicides per year from the 2018 rate of 48,432 suicides in the USA (McIntyre and Lee, 2020). During the Great Recession, an increase in the number of suicides was also reported in Canada (Reeves et al., 2014). Herein, we replicate and extend our previous findings and project the number of excess suicides in Canada as a consequence of the impact of COVID-19 on unemployment.

2. Methods

2.1. Data sources

Annual, national-level suicide mortality (2000-2018) and unemployment (2000-2019) data were acquired from Statistics Canada (Government of Canada, Statistics Canada, 2019, 2018). The Vital Statistics - Death Database records the number of deaths due to suicide among Canadian residents and non-residents in Canada. Suicide rate per 100,000 was codified using International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) codes for intentional self-harm (i.e., X60-X84, Y87.0). The Labour Force Survey collects cross-sectional unemployment data with stratified multi-stage sampling and a rotating panel sample design (i.e., rotation groups of six consecutive months). This research was based on publicly available data and therefore did not require ethics approval.

2.2. Statistical models

Time-trend regression models were used to evaluate and predict the number of excess suicides attributable to the projected rise in

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https://doi.org/10.1016/j.psychres.2020.113104
Received 22 April 2020; Received in revised form 12 May 2020; Accepted 14 May 2020
Available online 19 May 2020

unemployment rate following the COVID-19 pandemic. First, we modelled the number of suicide deaths annually between 2000 and 2018 and the association between suicide and unemployment rates. Second, we estimated the number of suicide deaths in 2019 using the time-trend model and the published unemployment rate of 5.7% for 2019. Third, we predicted the number of suicide deaths in 2020 and 2021 for the three following scenarios: 1) Minimal change in unemployment (i.e., average annual unemployment rate of 5.9% in 2020, 6.0% in 2021; derived from the 2019 Federal Budget); 2) Moderate increase in projected unemployment rate (i.e., average annual unemployment rate of 8.3% in 2020, 8.1% in 2021), as forecasted by the International Monetary Fund based on the assumption that the pandemic will fade in the second half of 2020 that there will not be a second outbreak in 2021; and 3) Extreme increase in projected unemployment rate (i.e., average annual unemployment rate of 16.6% in 2020, 14.9% in 2021), approximating the peak unemployment rate of 19% during the Great Depression (Government of Canada, Department of Finance, 2019; "World Economic Outlook, April 2020 – Chapter 1: The Great Lockdown," 2020).

We quantified the number of excess suicide deaths associated with a moderate increase in unemployment by subtracting the number of suicide deaths estimated in the first scenario from the number of suicide deaths in the second scenario. Similarly, we quantified the number of excess suicide deaths associated with an extreme increase in unemployment by subtracting the number of suicide deaths estimated in the first scenario from the number of suicide deaths in the third scenario. The suicide rate per 100,000 and the unemployment rate were ln-transformed. The analyses were conducted using the functions *ts* from the package *stats* and *auto.arima* and *forecast* from the package *forecast* on R statistical software version 3.6.3 (Hyndman et al., 2020; Hyndman and Khandakar, 2008; R Core Team, 2020).

3. Results

The historical suicide rates for 2000-2018 and the projected suicide rates for 2019-2021 are visualized in Fig. 1. The overall annual suicide mortality rate decreased in Canada by 0.2% per year between 2000 and 2018 (95% CI [−0.6, 0.1], p = 0.219). Notwithstanding, we found that a percentage point increase in unemployment was associated with a 1.0% increase in suicide rates between 2000 and 2018 (95% CI [0.8, 1.2], p = 0.003).

In the first scenario, wherein unemployment rates change minimally between 2019 and 2021, the predicted suicide rates are 11.0 per

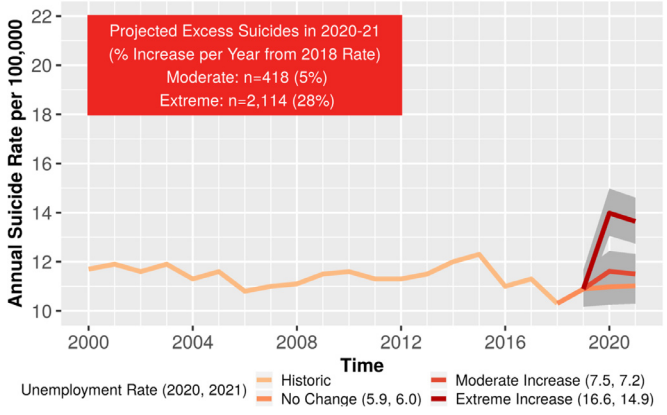

Fig. 1. We conducted a time-trend regression analysis of suicide and unemployment rates between 2000 and 2018 in Canada. Suicide mortality in 2019 was predicted using the 2019 unemployment rate of 5.7%. Suicide mortality in 2020 and 2021 were projected for three scenarios of change in unemployment rates: no change (i.e., 5.9% in 2020 and 6.0% in 2021 as published in the 2019 Federal Budget), moderate increase (i.e., 7.5% in 2020, 7.2% in 2021), and extreme increase (i.e., 16.6% in 2020, 14.9% in 2021).

Table 1
Projected suicide rate per 100,000 population in 2019-2021, across a range of national unemployment scenarios.

Year	Minimal change in unemployment rate		Moderate increase in unemployment rate		Extreme increase in unemployment rate	
	Suicide Rate per 100,000 [95% CI]	UR, %	Suicide Rate per 100,000	UR, %	Suicide Rate per 100,000	UR, %
2019	10.9 [10.2, 11.7] *n* = 4094	5.7	-	-	-	-
2020	11.0 [10.2, 11.8] *n* = 4127	5.9	11.6 [10.8, 12.4] *n* = 4365	7.5	14.0 [13.0, 15.0] *n* = 5256	16.6
2021	11.0 [10.3, 11.8] *n* = 4143	6.0	11.5 [10.7, 12.3] *n* = 4323	7.2	13.6 [12.7, 14.6] *n* = 5128	14.9

Abbreviations: CI = confidence interval, UR = unemployment rate.

100,000 in 2020 and 2021 (Table 1). The foregoing suicide rates would result in 4127 suicides in 2020 and 4143 in 2021 (assuming 2019 population size of 37,589,262). In the second scenario, wherein the pandemic is contained and lockdown measures are lifted during the latter half of 2020, moderate increases in projected unemployment rates to 7.5% in 2020 and 7.1% in 2021 will increase the forecasted suicide rates per 100,000 from 10.9 in 2019 to 11.6 in 2020 and 11.5 in 2021. This second scenario would result in a total of 418 excess suicides over the 2020-2021 period, representing a 5.5% increase in suicides per year (when compared to the 2018 rate of 3811). In the third scenario (i.e., extreme increase in projected unemployment rate), suicide rates per 100,000 are projected to increase to 14.0 in 2020 and 13.6 in 2021. This rise in suicide rate would result in 2114 excess suicides over the two-year period, representing a 27.7% increase in suicides per year (relative to the 2018 suicide rate).

4. Interpretation

The results of our projection analysis are in accordance with what we previously discovered in a similar analysis in the USA that the abrupt increase in unemployment in Canada is associated with an increase in deaths due to suicide. The projection estimates we have observed are also similarly aligned with what was observed in Canada during the Great Recession (Reeves et al., 2014). We recognize that no single variable accounts for completed suicide within individuals or populations. We additionally recognize that no single macroeconomic indicator is sufficiently predictive of suicide. Notwithstanding, it was observed during the Great Recession in the USA, Canada, and various economies of Europe, as well as Asia, that the change in unemployment rate was highly associated with increase in suicide rates (Chang et al., 2009; Reeves et al., 2014, 2012; Stuckler et al., 2009). Moreover, the association between economic distress and adverse mental health outcomes, notably suicide, is a highly replicated observation (Alicandro et al., 2019; Collins et al., 2020).

The COVID-19 pandemic introduces other aspects that are detrimental to mental health not seen during the Great Recession and other economic downturns, notably the risk of viral infection, as well as social distancing and quarantine measures. A separate body of literature indicates that quarantine alone is an independent contributor to adverse mental health outcomes (e.g., post-traumatic stress symptoms), as observed during the SARS epidemic in Toronto, Canada in 2013 (Brooks et al., 2020). It was reported in several countries in Europe after the Great Recession (e.g., Denmark) that social spending on emergency healthcare/mental healthcare, wage subsidies, supplemental income, and work retraining mitigated risk of suicide (Peeples, 2019). It was also reported in Japan, as well, during the Great

Depression, that increased social spending significantly mitigated suicide completion (Matsubayashi et al., 2020).

The results of our analysis underscore the urgency of prioritizing access to mental healthcare and the provision of psychological first aid. The COVID-19 pandemic has accelerated the implementation of telemedicine/telehealth; clinicians are encouraged to incorporate the assessment of mental health amongst all patients, including, but not limited to, those previously diagnosed with mental illness. Social isolation measures are critical to reduce the spread of the coronavirus and a previous analysis also indicates that during the Great Depression those cities in the USA that had the most rapid and robust social isolation measures also witnessed the greatest economic rebound (Stuckler et al., 2009). A policy approach to managing the COVID-19 pandemic needs to be informed by the projection of possible suicides to prevent excess suicides in the context of the COVID-19 pandemic.

We see a role for primary, secondary, and tertiary prevention. For example, wage subsidies, forbearance on financial obligation, government support of small business, work retraining programs, and access to community-based support programs can all serve as primary prevention. We also believe that the creation of virtual, as well as conventional, services that provide timely access to high quality mental health assessment and, where appropriate, specific treatment for persons at risk of mental illness are urgently needed. Finally, we assert that specialized services with an emphasis on psychiatric first aid available in communities and co-localized with other medical services will be especially relevant as a mechanism to reduce suicide at this time.

CRediT authorship contribution statement

Roger S. McIntyre: Conceptualization, Methodology, Validation, Investigation, Resources, Writing - original draft, Writing - review & editing, Supervision, Project administration. **Yena Lee:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization, Project administration.

Declaration of Competing Interest

None.

Acknowledgment

Author RM has received research grant support from Stanley Medical Research Institute, CIHR/GACD/ National Natural Science Foundation of China; speaker/consultation fees from Lundbeck, Janssen, Shire, Purdue, Pfizer, Otsuka, Allergan, Takeda, Neurocrine, Sunovion, Minerva. Author YL declares no competing interests.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2020.113104.

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