Increase in Diabetes Mortality Associated With COVID-19 Pandemic in the U.S.

Jinjun Ran,[1] Shi Zhao,[2,3] Lefei Han,[4] Yang Ge,[5] Marc K.C. Chong,[2,3] Wangnan Cao,[6,7] and Shengzhi Sun[8]

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The coronavirus disease 2019 (COVID-19) pandemic has claimed a notable number of deaths in the U.S. The COVID-19 death toll could not wholly explain the substantial increase in all-cause mortality during the pandemic (1), suggesting that the pandemic has indirect impacts on susceptible populations with underlying medical problems, such as cardiovascular diseases (2). Diabetes is a chronic illness that requires continuing close monitoring, primary care support, and medication. Due to fear of COVID-19 infection and lack of health care resources, patients with diabetes might die prematurely without timely treatment. Accordingly, we aimed to assess whether diabetes mortality changed during the pandemic period in the U.S.

We obtained weekly death data between 1 January 2015 and 2 November 2020 from the National Center for Health Statistics, Centers for Disease Control and Prevention (3). Deaths from diabetes were coded as E10–E14 according to the tenth revision of International Classification of Diseases. We excluded deaths with an underlying cause of COVID-19 from our analyses, as we aimed to investigate the indirect effect of the pandemic. This study was exempted from institutional review board approval because we used publicly available data without personal identification.

We included 39 states or cities in the analysis after excluding states or cities with missing data. Considering early surges in COVID-19 cases and implementation of stay-at-home orders (2), we defined the prepandemic period from 1 January to 17 March 2020 and the pandemic period from 18 March to 3 November 2020. To explore the time course of the pandemic impacts, we further divided the pandemic period into early pandemic (18 March to 2 June 2020) and later pandemic period (3 June to 3 November 2020). We used a Poisson regression separately for each state/city to compare death rates during the pandemic period to those in the prepandemic period in 2020. We used a similar approach to compare death rates between the same two time periods in 2015–2019. We then calculated the ratio of the relative change in death rates in 2020 versus the relative change in death rates in 2015–2019. This approach allows us to estimate the increase in diabetes deaths associated with the pandemic while controlling for seasonal variations in deaths and variables that do not change markedly with time, such as age, sex, and race. We conducted all analyses in R software (version 3.6.1).

We documented 82,928 deaths due to diabetes between 1 January and 3 November 2020, of which 62,561 cases occurred during the pandemic period. Of the 39 states or cities, we observed an increase in diabetes mortality associated with the pandemic overall (relative change in death rates 1.19 [95% CI 1.13, 1.25]) and in 24 states, with the highest ratio of relative change in death rates in Mississippi (1.46 [95% CI 1.23, 1.72]), followed by New Jersey (1.44 [95% CI 1.08, 1.91]) (Fig. 1). The increase in diabetes mortality was more pronounced during the early pandemic versus later pandemic period.

We observed an apparent increase in deaths due to diabetes during the pandemic period in most U.S. states or cities, suggesting the indirect impacts of the COVID-19 pandemic on routine diabetes care. Several hypotheses might explain the increase in diabetes mortality associated with the pandemic. First, patients with severe diabetic

[1]*School of Public Health, Shanghai Jiao Tong University School of Medicine, Shanghai, China*
[2]*Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong, Hong Kong, China*
[3]*The Chinese University of Hong Kong Shenzhen Research Institute, Shenzhen, China*
[4]*School of Global Health, Chinese Center for Tropical Diseases Research, Shanghai Jiao Tong University School of Medicine, Shanghai, China*
[5]*Department of Epidemiology & Biostatistics, School of Public Health, University of Georgia, Athens, GA*
[6]*Department of Social Medicine and Health Education, School of Public Health, Peking Universit, Beijing, China*
[7]*Center for Evidence Synthesis in Health, Brown University School of Public Health, Providence, RI*
[8]*Department of Environmental Health, Boston University School of Public Health, Boston, MA*

Corresponding authors: Wangnan Cao, wangnan_cao@brown.edu, and Shengzhi Sun, szsun@bu.edu

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J.R., S.Z., and L.H. contributed equally and are joint first authors.

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A Pandemic period (March 18 to November 3, 2020)

Jurisdiction	Relative change in death rate in 2015–2019* (3/18–11/3 vs. 1/1–3/17) (95% CI)	Relative change in death rate in 2020† (3/18–11/3 vs. 1/1–3/17) (95% CI)	Ratio of relative change in death rates in 2020 versus 2015–2019‡ (95% CI)
Alabama	0.81 (0.76, 0.85)	1.06 (0.94, 1.20)	1.31 (1.15, 1.50)
Arizona	0.84 (0.80, 0.88)	0.98 (0.87, 1.10)	1.16 (1.03, 1.32)
Arkansas	0.89 (0.84, 0.95)	1.05 (0.90, 1.24)	1.18 (0.99, 1.40)
California	0.82 (0.80, 0.84)	0.96 (0.90, 1.02)	1.17 (1.10, 1.26)
Colorado	0.87 (0.82, 0.93)	1.04 (0.89, 1.21)	1.19 (1.01, 1.41)
Connecticut	0.95 (0.89, 1.01)	1.06 (0.92, 1.21)	1.11 (0.95, 1.29)
Florida	0.88 (0.85, 0.90)	1.08 (1.00, 1.16)	1.23 (1.14, 1.33)
Georgia	0.86 (0.83, 0.90)	1.00 (0.91, 1.11)	1.16 (1.05, 1.29)
Illinois	0.87 (0.83, 0.90)	1.04 (0.95, 1.15)	1.20 (1.09, 1.33)
Indiana	0.85 (0.81, 0.90)	1.02 (0.91, 1.15)	1.20 (1.05, 1.36)
Iowa	0.89 (0.83, 0.95)	0.98 (0.85, 1.13)	1.11 (0.95, 1.29)
Kansas	0.92 (0.86, 0.98)	1.12 (0.93, 1.36)	1.22 (1.00, 1.49)
Kentucky	0.85 (0.80, 0.90)	0.88 (0.76, 1.02)	1.03 (0.89, 1.21)
Louisiana	0.88 (0.83, 0.93)	1.05 (0.90, 1.21)	1.19 (1.02, 1.40)
Maryland	0.86 (0.81, 0.91)	1.12 (0.96, 1.31)	1.30 (1.10, 1.53)
Massachusetts	0.83 (0.79, 0.88)	1.03 (0.87, 1.22)	1.24 (1.04, 1.49)
Michigan	0.88 (0.84, 0.92)	1.04 (0.91, 1.20)	1.18 (1.02, 1.37)
Minnesota	0.89 (0.84, 0.94)	0.97 (0.83, 1.13)	1.09 (0.92, 1.28)
Mississippi	0.87 (0.82, 0.93)	1.27 (1.09, 1.48)	1.46 (1.23, 1.72)
Missouri	0.86 (0.82, 0.91)	0.99 (0.88, 1.12)	1.15 (1.01, 1.32)
Nebraska	0.96 (0.89, 1.03)	1.01 (0.86, 1.19)	1.06 (0.88, 1.26)
Nevada	0.89 (0.83, 0.95)	0.85 (0.74, 0.98)	0.96 (0.82, 1.12)
New Jersey	0.84 (0.80, 0.88)	1.20 (0.91, 1.60)	1.44 (1.08, 1.91)
New Mexico	0.91 (0.86, 0.97)	1.07 (0.95, 1.21)	1.18 (1.03, 1.34)
New York State (excluding NYC)	0.88 (0.84, 0.92)	1.10 (0.95, 1.27)	1.25 (1.07, 1.46)
New York City	0.86 (0.81, 0.90)	1.15 (0.68, 1.95)	1.35 (0.79, 2.29)
North Carolina	0.89 (0.85, 0.92)	1.02 (0.88, 1.19)	1.15 (0.99, 1.35)
Ohio	0.86 (0.83, 0.89)	1.06 (0.98, 1.14)	1.23 (1.13, 1.34)
Oklahoma	0.80 (0.75, 0.86)	0.99 (0.87, 1.14)	1.24 (1.07, 1.44)
Oregon	0.91 (0.85, 0.97)	0.94 (0.83, 1.07)	1.04 (0.90, 1.20)
Pennsylvania	0.85 (0.82, 0.89)	1.00 (0.91, 1.11)	1.18 (1.06, 1.31)
South Carolina	0.90 (0.85, 0.95)	0.96 (0.85, 1.08)	1.07 (0.94, 1.23)
Tennessee	0.88 (0.84, 0.92)	1.08 (0.98, 1.18)	1.22 (1.10, 1.35)
Texas	0.84 (0.82, 0.87)	1.07 (0.99, 1.15)	1.26 (1.17, 1.37)
Utah	0.95 (0.89, 1.01)	1.08 (0.92, 1.28)	1.15 (0.96, 1.37)
Virginia	0.90 (0.86, 0.95)	0.96 (0.86, 1.07)	1.06 (0.94, 1.20)
Washington	0.90 (0.86, 0.95)	0.98 (0.86, 1.11)	1.08 (0.94, 1.24)
West Virginia	0.92 (0.86, 0.98)	0.81 (0.72, 0.92)	0.89 (0.77, 1.02)
Wisconsin	0.88 (0.83, 0.93)	0.95 (0.82, 1.10)	1.08 (0.93, 1.27)

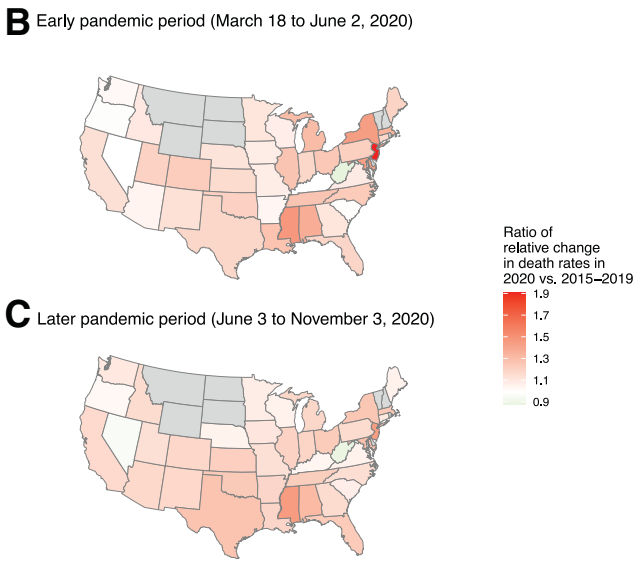

Figure 1—Change in diabetes death rates associated with the COVID-19 pandemic in the U.S. over the pandemic period (*A*), the early pandemic period (*B*), and the later pandemic period (*C*). States in gray indicate missing data. NYC, New York City. *Ratio of weekly death rate (per 100,000 population) from 18 March to 3 November vs. 1 January to 17 March in 2015–2019. †Ratio of weekly death rate (per 100,000 population) from 18 March to 3 November vs. 1 January to 17 March in 2020. ‡Ratio of the relative change in death rates in 2020 (18 March to 3 November 3 vs. 1 January to 17 March 17) vs. the change in death rates in 2015–2019 (18 March to 3 November vs. 1 January to 17 March). This ratio indicates the relative change in death rates of patients with diabetes attributable to the pandemic compared with the historical level.

symptoms might hesitate to receive medical services in the hospital due to concerns about the in-hospital transmission of COVID-19. Second, patients with diabetes might be discharged prematurely because the COVID-19 crush overwhelmed hospitals. Third, the restrictions in outpatient care for diabetes and potential delays in emergency medical service might contribute to the increased death toll of diabetes, especially in states or cities that were hardest hit by the pandemic (4). Fourth, the suboptimal management of patients with diabetes could reduce life quality and, therefore, increase mortality (5). We note that the impacts in the later pandemic period are relatively mild compared with those in the early pandemic period in most states, which might be explained by the relief of medical resource shortages and better management during the midpandemic period. The limitation of this study is the use of provisional data to ascertain diabetes mortality, which might be incomplete due to reporting delays. However, we used data up to 3 November 2020 to minimize the effects of delays in reporting.

In conclusion, we observed a substantial increase in deaths due to diabetes during the pandemic period in most U.S. states or cities. We highlighted the importance of diabetes care and management, especially in cities suffering rising cases of COVID-19. The impacts of the pandemic on patients with diabetes should consider both direct and indirect contributions.

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