

behavioral elements are needed to allow a more comprehensive understanding of factors influencing oral health.<sup>6</sup>

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## Evaluation of Suicides Among US Adolescents During the COVID-19 Pandemic

In 2021, the American Academy of Pediatrics declared a state of emergency regarding child and adolescent mental health.<sup>1</sup>



Supplemental content

During the COVID-19 pandemic, US adolescents have been affected by the widespread loss of primary caregivers. Suicide-risk screenings have yielded higher positive rates than during the prepandemic period<sup>2</sup>; thus, we sought to measure suicide-related mortality in this population.

**Methods** | Through partnerships with 14 state departments of public health, we collected data from 2015 through 2020 for 85 102 decedents with suicide as the cause of death. MIT

COUHES approved the conduct of this research and waived ethical review and the informed consent requirement because the study was not human participant research and used death certificates from deceased individuals.

To assess pandemic-period changes in suicide, we first compared counts of suicides between the prepandemic (2015-2019) and pandemic (2020) periods. Counts were collated for adolescents aged 10 to 19 years<sup>3</sup> and across all ages (overall). We then computed the yearly proportion of overall suicides among adolescents to examine how the burden of suicide has shifted across age groups throughout the pandemic. To measure the change in adolescent suicidality between the prepandemic and pandemic periods, we investigated the absolute count of adolescent suicides and proportion of overall suicides that occurred among adolescents. Reflecting the relative burden for adolescents rather than absolute suicidality, the second outcome was chosen to inform resource reallocation decisions in this age group, particularly about mental health, psychiatric services, and emergency care. Additional study details are provided in the eMethods in the [Supplement](#).

**Results** | Georgia, Indiana, New Jersey, Oklahoma, and Virginia had an increase in absolute count of adolescent suicides during the pandemic. These states, along with California, also had an increase in the proportion of overall suicides among adolescents. In contrast, Montana had a decrease in both absolute count and proportion of adolescent suicides during the pandemic, whereas Alaska had a decrease in proportion only. When data were aggregated across all 14 states, the proportion of overall suicides among adolescents increased during the pandemic. No other pandemic-period changes in adolescent outcomes were statistically significant ([Table](#)).

**Discussion** | Proportion of suicides among adolescents has shifted markedly and heterogeneously across the 14 participating states. Although the study was limited to states with available data, this 14-state cohort included representation from all 10 Department of Health and Human Services regions and comprised 32% of all US residents (33% adolescents). Future research is needed to expand this analysis to the remaining US states. The format of data available from each state varies greatly, but any existing aberrations are unlikely to change the directionality of the findings because of standardization of *International Classification of Diseases* coding across states.

In accordance with previous work on excess mortality during the pandemic,<sup>4</sup> we treated the full year of 2020 as the pandemic period. Although previous studies reported that suicide-related deaths in the broader population decreased during the pandemic,<sup>5</sup> we found that adolescents have not experienced the same patterns as adults in the participating 14 states in the same period; specifically, suicides among adults 35 years or older have followed a downward pattern,<sup>5</sup> although there is undoubtedly variation across geographic areas and subpopulations. Stratification by age group and geography will be necessary to expose these heterogeneities in mental health outcomes associated with the pandemic. Moreover, given recent evidence that pandemic-period suicidality may be differen-

Table. Suicides Among Adolescents and General Population During the Prepandemic and Pandemic Periods in 14 Participating States<sup>a</sup>

|   | Alaska              | Arkansas            | California             | Colorado               | Connecticut         | Georgia                | Indiana               | Montana             | Nebraska            | New Jersey          | Ohio                   | Oklahoma            | Virginia               | Vermont           | All 14 states             |
|---|---------------------|---------------------|------------------------|------------------------|---------------------|------------------------|-----------------------|---------------------|---------------------|---------------------|------------------------|---------------------|------------------------|-------------------|---------------------------|
| <b>No. of adolescent suicides</b>               |                     |                     |                        |                        |                     |                        |                       |                     |                     |                     |                        |                     |                        |                   |                           |
| 2015-2019, mean (95% CI)                        | 22.6 (5.7-29.5)     | 32.6 (20.2-45.0)    | 204.6 (185.0-224.2)    | 92.8 (80.8-104.8)      | 18.0 (11.0-25.0)    | 87.8 (79.2-96.4)       | 62.8 (45.4-80.2)      | 21.4 (16.2-26.6)    | 21.2 (14.7-27.7)    | 32.4 (29.3-35.5)    | 111.4 (88.5-134.3)     | 54.8 (46.9-62.7)    | 67.6 (56.9-78.3)       | 5.6 (3.2-8.0)     | 835.6 (746.7-924.5)       |
| 2020 <sup>b</sup>                               | 17                  | 41                  | 220                    | 101                    | 14                  | 106 <sup>c</sup>       | 83 <sup>c</sup>       | 16 <sup>d</sup>     | 20                  | 37 <sup>c</sup>     | 90                     | 67 <sup>c</sup>     | 85 <sup>c</sup>        | 6                 | 903                       |
| <b>No. of overall suicides</b>                  |                     |                     |                        |                        |                     |                        |                       |                     |                     |                     |                        |                     |                        |                   |                           |
| 2015-2019, mean (95% CI)                        | 198.2 (187.4-209.0) | 573.4 (532.1-614.7) | 4360.0 (4204.4-4515.6) | 1200.2 (1092.2-1308.2) | 398.6 (379.0-418.2) | 1455.2 (1298.5-1611.9) | 1024.0 (952.1-1095.9) | 275.6 (250.1-301.1) | 264.6 (222.2-307.0) | 700.2 (657.3-743.1) | 1748.4 (1653.7-1843.1) | 794.6 (762.1-827.1) | 1145.0 (1101.5-1188.5) | 98.2 (81.7-114.7) | 14236.2 (13606.4-14866.0) |
| 2020 <sup>b</sup>                               | 204                 | 583                 | 4048 <sup>d</sup>      | 1294                   | 340 <sup>d</sup>    | 1488                   | 1017                  | 294                 | 281                 | 643 <sup>d</sup>    | 1642 <sup>d</sup>      | 837 <sup>c</sup>    | 1152                   | 98                | 13921                     |
| <b>Proportion of suicides among adolescents</b> |                     |                     |                        |                        |                     |                        |                       |                     |                     |                     |                        |                     |                        |                   |                           |
| 2015-2019, mean (95% CI)                        | 11.3 (8.5-14.2)     | 5.6 (3.9-7.4)       | 4.7 (4.2-5.2)          | 7.7 (6.9-8.6)          | 4.5 (2.8-6.2)       | 6.0 (5.7-6.4)          | 6.1 (4.8-7.4)         | 7.8 (5.5-10.2)      | 8.0 (5.80-10.2)     | 4.6 (4.3-5.0)       | 6.3 (5.3-7.4)          | 6.9 (5.8-8.0)       | 5.9 (5.2-6.6)          | 5.6 (3.6-7.7)     | 5.9 (5.4-6.3)             |
| 2020 <sup>b</sup>                               | 8.3                 | 7.0                 | 5.4 <sup>c</sup>       | 7.8                    | 4.1                 | 7.1 <sup>c</sup>       | 8.2 <sup>c</sup>      | 5.4 <sup>d</sup>    | 7.1                 | 5.8 <sup>c</sup>    | 5.5                    | 8.0 <sup>c</sup>    | 7.4 <sup>c</sup>       | 6.1               | 6.5 <sup>c</sup>          |

<sup>a</sup> Proportions of suicides among adolescents (aged 10-19 years) were calculated as the number of adolescent suicides divided by the number of overall suicides in a given year.

<sup>b</sup> No 95% CIs were included because death certificate counts for a single year (2020) were considered to be the ground truth.

<sup>c</sup> Statistically significant increase between the prepandemic period mean (2015-2019) and the pandemic period (2020).

<sup>d</sup> Statistically significant decrease between the prepandemic period mean (2015-2019) and the pandemic period (2020).

tially affected by race and ethnicity, especially among youth, future work is needed to capture variability across ethnora-  
cial subpopulations.<sup>6</sup>

These findings highlight the importance of alleviating the downstream consequences of the pandemic for adolescent well-being. Examples of interventions that may address shifting suicidality among young people in the US include expanding bereavement counseling to cope with the loss of care-givers and implementing more readily available suicide risk assessment solutions.

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## COMMENT & RESPONSE

### COVID-19 Pandemic Effects on Neurodevelopment?

**To the Editor** The cohort study by Shuffrey et al<sup>1</sup> showed that birth during the COVID-19 pandemic was associated with lower neurodevelopmental functioning at 6 months, even in the absence of maternal SARS-CoV-2 infection. However, methodological limitations prevent the data from being interpretable.

First, the only measure of neurodevelopmental functioning was the Ages & Stages Questionnaire (ASQ-3).<sup>2</sup> Data analyses focused on ASQ-3 mean score differences between prepandemic and pandemic cohorts. However, the ASQ-3 is merely a screener used to identify risk for developmental delay. Screeners are not suitable for comparing individual performance within that of the general population. When used to identify cutoffs for at-risk status, the ASQ-3 has good reliability and validity; psychometric data on its use as a comparative measure are not provided, because such usage would be inappropriate (for many reasons, including the fact that item selection for each age group is restricted to items representing middle to low levels of development for that group). In sum, I believe the main findings are uninterpretable owing to misuse of a screener.

The authors did report 1 analysis that treated ASQ-3 data appropriately. This analysis showed that compared with the prepandemic cohort, proportionally more infants in the pandemic cohort exceeded cutoffs for delay with respect to gross motor skills. No cohort differences were observed for the other 4 dimensions of the ASQ-3. In other words, even the appropriate analysis fails to support the authors' general summary of cohort differences. Moreover, sample size was insufficient for conducting this analysis in the first place, which renders even these results uninterpretable.

The sample was not only small from the perspective of statistical power. Data from only 62 prepandemic infants served as the standard for evaluating development among infants born during the pandemic. This is questionable, scientifically speaking, given the many known influences

on neurodevelopment that could not have been controlled for.

Reports on this study have appeared in national news media and other venues, and such reports have spurred more than 1 layperson to approach me with concerns. Although the authors claim that their data suggest "the potential for a significant public health crisis,"<sup>1</sup> I believe the data should not be taken as suggesting anything, owing to the methodological limitations noted here.

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**In Reply** We appreciate the response to our preliminary report<sup>1</sup> indicating that birth during the COVID-19 pandemic, but not exposure to prenatal maternal SARS-CoV-2 infection, was associated with lower scores on the gross motor, fine motor, and personal-social domains of the Ages & Stages Questionnaire, 3rd Edition (ASQ-3).

Springer raises concern over the validity of the ASQ-3 screener as a measure of neurodevelopmental outcomes of infants born during the pandemic. We feel strongly that screening tools with high sensitivity and specificity, such as the ASQ-3,<sup>2</sup> confer the greatest benefit for efforts toward identifying early neurobehavioral markers in the context of a novel disease or environment. The ASQ-3 is recommended by the American Academy of Pediatrics and Family Physicians and the US Preventive Services Task Force and is a measure of choice for large National Institutes of Health-funded efforts. The ASQ-3 is widely used by both researchers and practicing general pediatricians, thus allowing for comparison across many geographic and temporal contexts. Throughout the pandemic, researchers and clinicians have relied more on parent-report measures of infant development following the shift to telehealth. The choice to use a parent-report measure was made not only for practicality, but also to circumvent confounding factors associated with novel conditions to the testing environment (eg, researchers wearing masks during the assessment).

Springer also raised concerns about our use of the ASQ-3 scores as continuous variables in statistical analyses. However, research studies commonly use the ASQ-3 as a continuous measure of child neurodevelopment.<sup>3-5</sup> Additionally, studies examining the latent factor structure of the ASQ-3 using continuous subdomain scores demonstrate they measure specific developmental constructs.<sup>6</sup> Our analysis of the pro-