

# Association Between the Release of Netflix's *13 Reasons Why* and Suicide Rates in the United States: An Interrupted Time Series Analysis

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**Objective:** To estimate the association between the release of the Netflix series *13 Reasons Why* and suicide rates in the United States.

**Method:** Using segmented quasi-Poisson regression and Holt-Winters forecasting models, we assessed monthly rates of suicide among individuals aged 10 to 64 years grouped into 3 age categories (10–17, 18–29, and 30–64 years) between January 1, 2013, and December 31, 2017, before and after the release of *13 Reasons Why* on March 31, 2017. We also assessed the impact of the show's release on a control outcome, homicide deaths.

**Results:** After accounting for seasonal effects and an underlying increasing trend in monthly suicide rates, the overall suicide rate among 10- to 17-year-olds increased significantly in the month immediately following the release of *13 Reasons Why* (incidence rate ratio [IRR], 1.29; 95% CI, 1.09–1.53); Holt-Winters forecasting revealed elevated observed suicide rates in the month after release and in two subsequent months, relative to corresponding forecasted rates. Contrary to expectations, these associations were restricted to boys. Among 18- to 29-year-olds and 30- to 64-year-olds, we found no significant change in level or trend of suicide after the show's release, both overall and by sex. The show's release had no apparent impact in the control analyses of homicide deaths within any age group.

**Conclusion:** The release of *13 Reasons Why* was associated with a significant increase in monthly suicide rates among US youth aged 10 to 17 years. Caution regarding the exposure of children and adolescents to the series is warranted.

**Key words:** suicide, *13 Reasons Why*, suicide media reporting guidelines, time series

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**S**uicide is a major public health concern in the United States, and the national age-adjusted rate increased 33% between 1999 and 2017.<sup>1</sup> One established public health approach to suicide prevention is accurate and responsible reporting of suicide in the news media and entertainment industry.<sup>2,3</sup> Responsible portrayals of suicide, mental illness, and related issues have the potential to promote awareness and help-seeking behaviors, to reduce stigma, and to refute misperceptions that suicide cannot be prevented.<sup>4</sup> Unfortunately, media depictions about suicide also have the potential to do harm, often through a process in which direct or indirect exposure to suicide increases the risk of subsequent suicidal behavior, known as suicide contagion.<sup>5</sup> Stories profiling someone who died by suicide appear to carry the greatest risk, as vulnerable individuals may identify with the person in the report, with youth potentially more susceptible to this effect.<sup>6,7</sup>

On March 31, 2017, Netflix released the series *13 Reasons Why*, based on the best-selling book of the same name.<sup>8</sup> The series portrays the story of an adolescent girl who kills herself following a sequence of traumatic life events that she catalogues before her death on 13 audiotapes and leaves behind for those she believes are at least partially to blame for her suicide. Since its release, the critically acclaimed and widely viewed series has generated substantial debate and controversy, largely due to concerns about its potential for increasing suicide contagion. Critics have argued that the series overlooked or ignored evidence<sup>9–11</sup> and media guidelines<sup>12,13</sup> suggesting that suicide contagion is fostered by stories that sensationalize or promote simplistic explanations of suicidal behavior, glorify or romanticize the decedent, present suicide as a means of accomplishing a goal such as community change or revenge, or offer potential prescriptions of “how to” die by suicide.<sup>14–17</sup> Unlike most shows with a suicide theme, the creators of *13 Reasons Why*

also depicted the lead character's suicide in graphic detail believing that showing viewers how disturbing and painful suicide is would be a deterrent for others.<sup>18</sup> Netflix included warnings at the beginning of three episodes involving the sexual assaults and the suicide. A website was also launched with the release of the show that contained resources and referral information.<sup>19</sup> However, more than a month had passed after the series' release before Netflix strengthened the graphic content advisories and added a warning about the whole series; this appeared only before the initial episode.<sup>20</sup>

Like other Netflix series, after promoting the show in the months before the premiere, all episodes of *13 Reasons Why* were released simultaneously, allowing for unlimited viewing of episodes over a short-period of time (ie, "binge-watching"). According to Netflix, *13 Reasons Why* was the third most binge-watched show of 2017, which they defined as viewing activity of more than 2 hours per day.<sup>21</sup> A recent editorial expressed concern that binge-watching *13 Reasons Why* may have a powerful influence on adolescents, whose brains are still developing the ability to inhibit risky behaviors and emotions.<sup>22</sup>

In this study, we aimed to evaluate the association between the release of *13 Reasons Why* and suicide rates in US individuals aged 10 to 64 years. We hypothesized the release would have an immediate and sustained impact on suicide rates in youth and emerging adults,<sup>23</sup> because media failure to incorporate best suicide prevention practices is associated with increases in suicide in these age groups relative to adults.<sup>6</sup> We also evaluated sex-specific associations. We expected increases in youth suicide rates in both sexes after the series' release, and that girls would be particularly affected because the show's protagonist was a teenage girl. Youth viewing patterns of *13 Reasons Why* revealed that strong identification with the lead female character was significantly correlated with the belief that the series increased individual suicide risk.<sup>24</sup> We also assessed homicide rates as a control outcome.

## METHOD

### Participants and Data Source

The Centers for Disease Control and Prevention's (CDC's) Web-based Wide-ranging Online Data for Epidemiologic Research (WONDER) was used to obtain annual and monthly data on deaths for which suicide (coded X60-X84, Y87.0, and \*U03 for *International Classification of Diseases, Tenth Revision [ICD-10]*) and homicide (coded X85-YY09, Y87.1, \*U01-\*U01) were listed as the underlying cause of death among 10- to 64-year-olds between January 1, 2013, and December 31, 2017.<sup>25</sup> The lower and upper age limits in this study were chosen to span 3 developmental periods: childhood and adolescence (10–17 years), emerging

adulthood (18–29 years), and early-to-middle adulthood (30–64 years). Number of suicide deaths per month was extracted overall and by sex. Mean monthly counts and crude rates per 100,000 persons were calculated with WONDER population estimates.<sup>25</sup> This study was not considered human participant research according to the review policy of the Abigail Wexner Research Institute at Nationwide Children's Hospital.

### Statistical Analysis

An interrupted time series segmented regression analysis<sup>26,27</sup> was used to compare suicide rates before and after the release of *13 Reasons Why*. Poisson regression models were used to estimate the suicide incidence rates and incidence rate ratios (IRRs) along with their 95% CIs within each targeted age group, and separately for male and female individuals. Initial analyses indicated overdispersion in the data (ie, extra-Poisson variability), and so a more flexible quasi-Poisson model was used for all analyses.<sup>28</sup> The model provides independent tests of the underlying trend in suicide rates before the release of *13 Reasons Why*; the step change in level after the release; and the post-release trend. Youth suicide rates demonstrate a seasonal pattern with rates being highest in the fall and spring and lowest during summer months.<sup>29</sup> Seasonal variation in suicide rates was modeled using harmonic functions of time.<sup>30</sup> Although all episodes of *13 Reasons Why* were released on the same day (March 31, 2017), a promotional trailer for the series began airing on March 1, 2017. In our interrupted time series analyses, we have managed the gap between promotion and release of the series in three ways: (1) include March rates as part of the pre-release period (primary analysis); (2) include March rates in the post-release period; and (3) exclude March and look at the change between February and April. March was included as a pre-release month in the primary analysis because the show could be viewed for only 1 day (March 31, 2017), with 13 episodes, each roughly 1 hour long.

The Holt-Winters' method<sup>31</sup> was used to produce forecasts of expected suicide rates after the release of *13 Reasons Why*. This approach uses a triple exponential smoothing model to forecast time series data: one equation for level, one for trend, and one for seasonality. The additive model form was selected because it displayed a better fit to the data than the multiplicative method, with smaller squared prediction errors. For these analyses, the pre-release period was defined as the 4 years and 2 months prior to the release of *13 Reasons Why*, that is, from January 1, 2013, to February 28, 2017. The promotional period spanned March 1, 2017, through March 31, 2017. The post-release period spanned April 1, 2017, through December 31, 2017.

The R Holt-Winters Filtering package identified optimal values of level, trend, and seasonality.<sup>32</sup> Using rates from the pre-release period, the model provides predicted suicide rates for the promotional and post-release periods along with 95% prediction intervals. The estimated number of additional suicides after the series' release was calculated by summing the difference in observed and expected deaths between April 1, 2017, and December 31, 2017, obtained from the Holt-Winters forecasting model. A 95% confidence interval for the difference in deaths was calculated using the Poisson distribution and test-based methods.<sup>33</sup>

To distinguish any association with the release of *13 Reasons Why* from other concurrent events, a control analysis was also performed using homicide as the outcome.<sup>26,34</sup> Homicide is unlikely to be affected by the series' release but is similar to suicide in that it is also influenced by social and environmental events.<sup>35</sup> Finding an association with suicide but not homicide provides stronger evidence to support a link between the series' release and suicide. In contrast, the presence of an association between the series' release and both suicide and homicide would indicate that the change may be attributable to other factors. We used models and tests for the outcome of homicide similar to those described above for suicide.

Statistical analyses were performed with R statistical software version 3.4.1 (R Foundation for Statistical Computing, Vienna, Austria) and Stata/IC Statistical Software, Release 15.0 (StataCorp, College Station, TX). Significance was based on 95% CIs for interrupted time series regression models and 95% prediction intervals (PIs) for forecasting models. 95% CIs that did not include 1.00 were considered statistically significant. Observed suicide rates that fell outside the 95% PIs were considered statistically significant.

## RESULTS

Between January 1, 2013 and December 31, 2017, a total of 180,655 suicide deaths occurred in individuals aged 10 to 64 years in the US. Most suicide decedents were male individuals ( $n = 137,838$  [76.3%]), with a male-to-female IRR of 3.22 (95% CI, 3.02–3.44). Table 1 displays the mean monthly counts and rates of suicide before and after the release of *13 Reasons Why* on March 31, 2017. In the months before the series' release, suicide rates in 10- to 17-year-olds showed a significantly increasing trend. After accounting for seasonal effects and the underlying trend, we found that the release of *13 Reasons Why* was associated with a 28.9% step increase in the April 2017 suicide rate (95% CI, 1.09–1.53;  $P = .004$ ) among 10- to 17-year-old youths. The April 2017 suicide rate of 0.57 per 100,000 persons was the highest monthly suicide rate of any month during

the 5-year study period. Following this spike, there was a nonsignificant decline from April through December, 2017 (IRR, 0.97; 95% CI, 0.95–1.00;  $p = .057$ ).

When the observed and forecasted rates of youth suicide were graphed based on the Holt-Winters analysis, there was a visible and statistically significant effect of the release of *13 Reasons Why* on subsequent suicide (Figure 1), with observed rates in April, June, and December being significantly higher than corresponding rates forecasted using Holt-Winters modeling. Interestingly, the observed rate in the month of March (promotional period) is also statistically significantly higher than the model forecast. In absolute numbers, we estimated 195 (95% CI, 168–222) additional suicide deaths among 10- to 17-year-old youths occurred between April 1 and December 31, 2017, following the series' release. To test whether the April, 2017, spike accounted for the excess number of suicide deaths after the release of *13 Reasons Why*, we calculated the difference in observed and expected suicide deaths removing April, 2017 and still observed 137 excess suicide deaths (95% CI, 114–160) between May 2017 and December 2017. Among 10- to 17-year-olds, results of separate analyses that (1) excluded March 2017 and (2) included March 2017 as a post-event were consistent with the primary interrupted time series analyses (Tables S1 and S2, available online).

We hypothesized that the release of *13 Reasons Why* would have a larger impact on suicide in girls than in boys. When analyses were stratified by sex, a statistically significant increase in suicide rates was observed for boys in keeping with overall results in the 10- to 17-year-old age group (IRR, 1.35; 95% CI, 1.12–1.64; Table 1 and Figure S1, available online). Although the mean monthly count and rate of suicide for female children and adolescents increased after the series' release, the difference was not statistically significant (IRR, 1.15; 95% CI, 0.89–1.50), with no change in post-release trends (IRR, 0.97; 95% CI, 0.93–1.01). Observed suicide rates for 10- to 17-year-old girls in June 2017 were significantly greater than corresponding forecasted rates, but observed rates in September were significantly lower than expected rates (Figure S1, available online).

In contrast to findings for children and adolescents, analysis of suicide rates in 18- to 29-year-olds and 30- to 64-year-olds showed no statistically significant increase in the suicide rate immediately following the release of *13 Reasons Why*; there also was no change in post-release trends. When stratified by sex, statistically significant increases in suicide were not observed for older age-stratified groups of male and female individuals (Table 1).

Results of the control analyses revealed no significant changes in homicide rates in any of the targeted age groups

**TABLE 1** Association Between the Release of 13 Reasons Why and Suicide in the United States, by Age Group

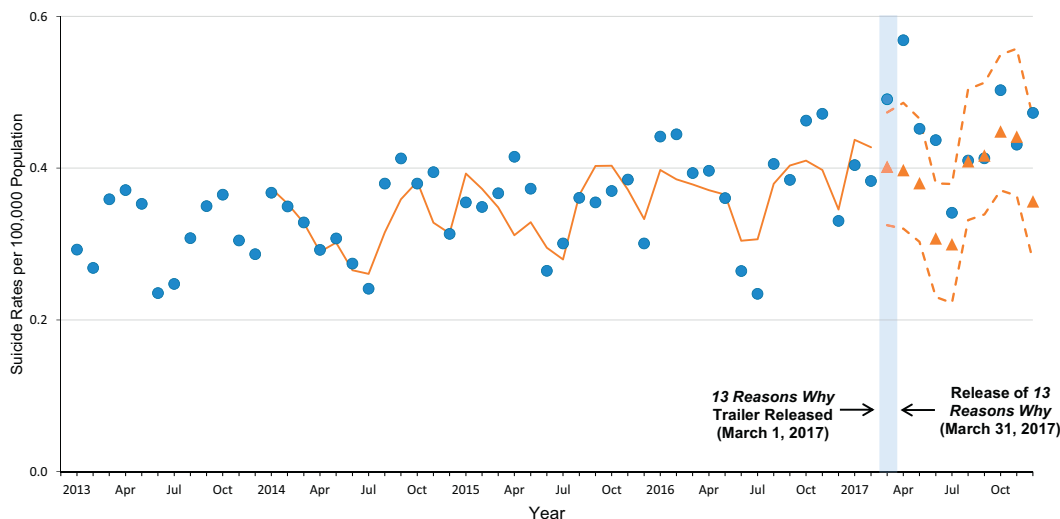
Characteristic	Mean Monthly Count		Mean Monthly Rate per 100,000 Persons		Pre-13RW Trend <sup>a</sup>	p	Post-13RW Trend <sup>b</sup>	p	Step Change <sup>c</sup>	p
	Pre-13RW	Post-13RW	Pre-13RW	Post-13RW	(IRR) (95% CI)		(IRR) (95% CI)		(IRR) (95% CI)	
10–17 Years										
Overall	116.29	149.56	0.35	0.45	1.005 (1.003–1.008)	<.001	0.97 (0.95–1.00)	.057	1.29 (1.09–1.53)	.004
Sex										
Female	35.67	42.00	0.22	0.26	1.007 (1.003–1.010)	<.001	0.97 (0.93–1.01)	.163	1.15 (0.89–1.50)	.279
Male	80.63	107.56	0.47	0.63	1.005 (1.002–1.007)	<.001	0.97 (0.94–1.00)	.098	1.35 (1.12–1.64)	.002
18–29 Years										
Overall	651.14	774.22	1.22	1.43	1.004 (1.003–1.005)	<.001	0.99 (0.98–1.01)	.443	1.07 (0.98–1.18)	.135
Sex										
Female	120.37	143.56	0.46	0.54	1.003 (1.001–1.005)	.006	0.98 (0.95–1.01)	.252	1.15 (0.97–1.38)	.111
Male	530.76	630.67	1.94	2.29	1.004 (1.003–1.005)	<.001	1.00 (0.98–1.01)	.675	1.05 (0.96–1.16)	.285
30–64 Years										
Overall	2193.35	2371.22	1.50	1.60	1.001 (1.000–1.002)	.060	1.00 (0.99–1.01)	.914	1.03 (0.95–1.12)	.448
Sex										
Female	549.76	572.33	0.74	0.77	1.002 (1.000–1.003)	.008	0.99 (0.98–1.01)	.465	1.00 (0.90–1.11)	.980
Male	1643.59	1798.89	2.29	2.48	1.001 (1.000–1.002)	.184	1.00 (0.99–1.02)	.879	1.04 (0.96–1.13)	.333

**Note:** 13RW = 13 Reasons Why; IRR = incidence rate ratio.

<sup>a</sup>Time period from January 1, 2013 to March 31, 2017.

<sup>b</sup>Time period from April 1, 2017 to December 31, 2017.

<sup>c</sup>Refers to changes in suicide rates during the first month following the release of 13 Reasons Why on March 31, 2017.

**FIGURE 1** Association Between the Release of *13 Reasons Why* and Suicide Rates in 10- to 17-Year-Old Children and Adolescents in the United States

**Note:** Blue circles indicate observed suicide rates between January 1, 2013, and December 31, 2017. Orange solid line indicates fitted values that best account for underlying level, trend, and seasonal variation prior to release. The leading edge of the shaded area indicates the initial airing of the *13 Reasons Why* trailer. The trailing edge of the shaded area indicates the release date of *13 Reasons Why*. Orange triangles indicate forecasted suicide rates; curved orange dashed lines indicate the upper and lower 95% prediction intervals. Observed suicide rates in March, April, June, and December 2017 were significantly higher than corresponding forecasted rates. Please note color figures are available online.

(Table 2, Tables S3 and S4, available online). Sensitivity analyses that used negative binomial regression to correct for overdispersion produced results similar to findings obtained by quasi-Poisson regression models, for both suicide and homicide outcomes (Tables S5 and S6, available online).

## DISCUSSION

This national study identified an increase in suicide rates for children and adolescents aged 10 to 17 years after the release of the first season of the Netflix series *13 Reasons Why*. We estimate that the series' release was associated with approximately 195 additional suicide deaths in 2017 for 10- to 17-year-olds. Control analyses found no evidence of a significant change in homicide rates over the same time period for any of the studied age groups. In contrast to the observed increase in youth suicide in association with the release of *13 Reasons Why*, suicide rates for individuals aged 18 to 29 years and 30 to 64 years did not show a significant increase. This finding highlights previous reports that youth may be particularly vulnerable to suicide contagion.<sup>6,7</sup> Study findings are particularly troubling, given that some mental health professionals and advocates had previously expressed concerns that the release of *13 Reasons Why* might actually promote suicide.<sup>15,17</sup>

The increase in the youth suicide rate that occurred after the initial release of *13 Reasons Why* provides an example of potential unintended negative consequences of

media portrayals of suicide that do not adhere to best practices. However, it is possible to portray suicide in a way that cultivates hope by increasing awareness of available supports for those who struggle with suicidal thoughts or behaviors.<sup>3</sup> Accurate, humanizing depictions of an individual coping with suicidal thoughts, seeking help when distressed, and modeling resilience may, in fact, reduce suicidal behaviors,<sup>36</sup> but this has yet to be tested in fictional accounts. Media and entertainment professionals understandably value freedom of expression and might equate responsible messaging with censorship, as much still remains to be learned about suicide contagion and how media might best contribute to suicide prevention efforts. Nevertheless, study findings should encourage dialogue and reflection within the entertainment industry about balancing creative license and the medical dictum “primum non nocere”—“first do no harm.”<sup>16</sup>

Contrary to expectations, data from this study did not conclusively demonstrate that the release of *13 Reasons Why* was associated with increased suicide rates in 10- to 17-year-old girls. Reasons for this finding are unclear. Previous studies indicate that suicide contagion disproportionately affects those who strongly identify with the person who died by suicide (particularly celebrities).<sup>11,37-39</sup> Numerous media outlets failed to adhere to guidelines for suicide reporting after the death of the actor Robin Williams. This resulted in a roughly 10% increase in suicide deaths in the subsequent

**TABLE 2** Association Between the Release of 13 Reasons Why and Homicide in the United States, by Age Group

Characteristic	Mean Monthly Count		Mean Monthly Rate per 100,000 Persons		Pre-13RW Trend <sup>a</sup>	p	Post-13RW Trend <sup>b</sup>	p	Step Change <sup>c</sup>	p
	Pre-13RW <sup>a</sup>	Post-13RW	Pre-13RW	Post-13RW	(IRR) (95% CI)		(IRR) (95% CI)		(IRR) (95% CI)	
10–17 Years										
Overall	63.31	75.56	0.19	0.23	1.007 (1.004–1.009)	<.001	0.99 (0.96–1.02)	.551	1.01 (0.82–1.24)	.913
Sex										
Female	—	—	—	—						
Male	51.10	60.78	0.30	0.36	1.006 (1.004–1.009)	<.001	0.99 (0.96–1.03)	.680	1.00 (0.80–1.25)	.995
18–29 Years										
Overall	548.92	616.89	1.03	1.14	1.006 (1.005–1.008)	<.001	0.99 (0.97–1.01)	.214	0.96 (0.85–1.08)	.497
Sex										
Female	74.24	85.56	0.28	0.32	1.006 (1.004–1.008)	<.001	0.99 (0.97–1.02)	.690	0.97 (0.82–1.15)	.725
Male	474.69	531.33	1.74	1.93	1.006 (1.005–1.008)	<.001	0.99 (0.96–1.01)	.214	0.96 (0.83–1.09)	.512
30–64 Years										
Overall	692.29	813.44	0.47	0.55	1.006 (1.005–1.007)	<.001	1.00 (0.98–1.02)	.983	0.95 (0.86–1.05)	.315
Sex										
Female	150.08	172.11	0.20	0.23	1.004 (1.002–1.006)	<.001	1.02 (0.99–1.04)	.225	0.92 (0.79–1.08)	.322
Male	542.22	641.33	0.75	0.88	1.006 (1.005–1.008)	<.001	1.00 (0.98–1.01)	.645	0.96 (0.86–1.06)	.415

**Note:** 13RW = 13 Reasons Why; IRR = incidence rate ratio.

<sup>a</sup>Time period from January 1, 2013 to March 31, 2017.

<sup>b</sup>Time period from April 1, 2017 to December 31, 2017.

<sup>c</sup>Refers to changes in suicide rates during the first month following the release of 13 Reasons Why on March 31, 2017.



5 months, representing an excess of 1,841 cases.<sup>40</sup> In that instance, male individuals had the greatest increase in excess suicide events especially from suffocation/hanging, strengthening the case for modeling and identification.<sup>37,38,41</sup> Imitation may have contributed to the increase in the male youth suicide rate after the release of *13 Reasons Why*, given that a male adolescent character made a serious suicide attempt by firearm at the end of the series. A well-known gender paradox in suicide also exists, with male rates of suicide being higher than female rates and female rates of attempted suicide being higher than male rates across the lifespan.<sup>42</sup> Rates of hospitalizations for suicidal behavior have increased steadily among youth over the last decade, with female rates increasing more rapidly than male rates.<sup>43</sup> Although nonfatal suicide attempt rates may have increased for girls after the release of *13 Reasons Why*, national monthly suicide attempt data were not available to address this question. Finally, the book on which the series was based has been on the *New York Times* best sellers list during the past decade,<sup>44</sup> with its 10th anniversary re-release in 2016.<sup>45</sup> Given the likely preponderance of female readership, there may have been some degree of desensitization among girls prior to the Netflix series original release.

This study has several important limitations. First, the quasi-experimental design of our study limits our ability to draw any causal conclusions between the release of *13 Reasons Why* and increased suicide rates in young people in the United States. Nevertheless, the time series and forecasting approaches used in this study allow us to make credible inferences about this association. The initial increase in youth suicide rates in the month immediately following the series release is concordant with a prior report showing a spike in Internet searches about suicide in the month following release,<sup>46</sup> and a small, single-hospital study showing an increase in suicide attempt admissions after the series' premiere.<sup>47</sup> Second, we were unable to assess whether the observed increase in youth suicide rates was attributable to the portrayal of suicide in the series, a lack of adherence to media guidelines (eg, failure to provide national suicide prevention resources until later months), or other factors. The observation that the series was first released on March 31, 2017, and that suicide rates increased that month also raises questions about effects of pre-release media promotion of the series premiere. Third, we did not examine the impact of *13 Reasons Why* on specific methods of suicide (eg, suicide by cutting) due to small cell sizes, which would result in unstable estimates. Fourth, there may have been other events or unmeasured factors that occurred during the study period that might be associated with increased suicide rates. Fifth, our study may have lacked sufficient statistical

power to detect a significant association in 10- to 17-year-old girls. Finally, as with most studies looking at possible contagion, we have little understanding of "dose" or context, including who specifically watched the series, when they watched, whether they binge watched, whether it was further discussed in peer groups, how secondary discussions may have influenced vulnerable individuals, and whether the subsequent focus on suicide prevention may have actually mitigated some of the pronounced contagion effects.

In conclusion, we found a significant increase in suicide rates among US children and adolescents in the month after the release of *13 Reasons Why*. Suicide rates in 2 subsequent months remained elevated over forecasted rates, resulting in 195 additional deaths. There is no discernible public health benefit associated with viewing the series, and caution regarding the exposure of children and adolescents is warranted. As the second season of the series is now underway, and a third season is planned, continued surveillance is needed to monitor potential consequences on suicide rates in association with viewing the series.

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Author Contributions: Dr. Bridge had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Author contributions are as follows: study concept and design: Bridge, Greenhouse, Ruch, Stevens, Kelleher, Campo; acquisition of data: Bridge, Ruch; Analysis and interpretation of data: All authors; drafting of the manuscript: Bridge; critical revision of the manuscript for important intellectual content: all authors; statistical analysis: Bridge, Greenhouse, Ruch; obtained funding: Bridge; administrative, technical, or material support: Bridge, Ruch; study supervision: Bridge, Greenhouse, Kelleher, Campo.

Drs. Bridge, Greenhouse, and Ruch served as the statistical experts for this research.

Disclosure: Dr. Bridge has served on the Scientific Advisory Board of Clarigent Health. Drs. Greenhouse, Ruch, Stevens, Ackerman, Sheftall, Horowitz, Kelleher, and Campo have reported no biomedical financial interests or potential conflicts of interest.

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