Short Communication

Crisis Text Line use following the release of Netflix series 13 Reasons Why Season 1: Time-series analysis of help-seeking behavior in youth

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A R T I C L E   I N F O

A B S T R A C T

The availability of near real-time data from Crisis Text Line (CTL) and other technology-based platforms on crisis events provides an opportunity for targeted interventions prior to serious mental health outcomes (e.g., suicide, self-harm). This study examined the association between the release of the popular Netflix series 13 Reasons Why (13RW) and CTL usage in a national sample of youth in the US. We implemented interrupted time-series, autoregressive integrated moving average (ARIMA) modeling to examine this association at a daily scale. We observed a significant but momentary rise in CTL conversation volume following the release of 13RW on April 5 and 6, 2017 followed by a significant reduction (12.7%) in conversation volume for the overall study period. This reduction in call volume was sustained for 49 days and is the most sustained reduction in conversation volume in the 365 day dataset. This unexpected trough in conversation volume is concerning in light of elevated search engine volume for terms indicating an increase in suicidal thoughts in the days following the release of the show (Ayers et al., 2017). CTL was featured by the show as a resource for viewers in the recently released Season 2, and our results highlight the reasoning and need for such promotion. Future work should explore whether the promotion of CTL in Season 2 positively impacted conversation volume, as there is a clear need to harness the power of these digital technologies to detect population-based trends in mental health and expand the reach of life saving services.

1. Introduction

Prior research has demonstrated the utility of high-resolution data from twitter, Google search activities, and other social media platforms to monitor trends and identify shifts in population-level mental distress and suicidal ideation (e.g., Gunn and Lester, 2013; McClellan et al., 2017). Ayers et al. (2017) reported that in the 19 days following the release of the popular Netflix series 13 Reasons Why (13RW), Season 1, which dramatizes and graphically depicts the suicide of an adolescent, internet searches on suicide related topics increased (900k to 1.5 million) more than expected. The unexpected surge is not necessarily bad news, given that many of the queries were arguably for help seeking purposes ("suicide hotlines", "suicide prevention"). At the same time, a significant proportion of the spike in searches involved word combinations such as, "how to kill yourself." To the authors' knowledge, no studies have explored whether these same trends can be observed by

monitoring changes in national crisis intervention resource usage. The objective of this study was to address this gap by examining the temporal relationship between the release of 13RW, Season 1, and Crisis Text Line (CTL) usage in a national sample of individuals (80% less than 22 years old) in the U.S. Results from this study will help inform much needed, targeted health interventions to prevent adolescent death by suicide. Suicide is now the second leading cause of death for youth between ages 10 and 24 (CDC WISQARS, 2016) and approximately 157,000 youth are treated each year for self-harm injuries across the U.S. (CDC, 2017).

2. Data

This study used CTL conversation counts from the top 10 percent of the most populous U.S. counties (n = 70,330 total conversations). This number represents total conversations, and a single user may be

Table 1

Daily CTL conversation counts and ARIMA predicted counts following the release of 13RW (March 31, 2017). Prediction confidence intervals are provided along with the difference and percent difference between the predicted and observed CTL conversation counts.

Date	Conversation count	Predicted count	Lower 95% CI	Upper 95% CI	Difference	Percent difference
3/31/2017	1234[a]	983.0	808.8	1157.2	251.0	25.5%
4/1/2017	893	921.0	709.1	1132.9	−28.0	−3.0%
4/2/2017	1069	993.5	770.9	1216.2	75.5	7.6%
4/3/2017	1197	1075.2	843.0	1307.4	121.8	11.3%
4/4/2017	1220	1035.3	803.0	1267.5	184.7	17.8%
4/5/2017	1296[a]	969.9	735.1	1204.6	326.1	33.6%
4/6/2017	1318[a]	980.6	745.5	1215.6	337.4	34.4%
4/7/2017	983	976.3	732.5	1220.0	6.7	0.7%
4/8/2017	496[a]	978.0	730.4	1225.6	−482.0	−49.3%
4/9/2017	561[a]	977.3	724.3	1230.3	−416.3	−42.6%
4/10/2017	700[a]	977.6	720.0	1235.2	−277.6	−28.4%
4/11/2017	773	977.5	715.1	1239.9	−204.5	−20.9%
4/12/2017	722	977.5	710.5	1244.5	−255.5	−26.1%
4/13/2017	649[a]	977.5	705.9	1249.1	−328.5	−33.6%
4/14/2017	635[a]	977.5	701.5	1253.5	−342.5	−35.0%
4/15/2017	583[a]	977.5	697.1	1257.9	−394.5	−40.4%
4/16/2017	617[a]	977.5	692.7	1262.3	−360.5	−36.9%
4/17/2017	686[a]	977.5	688.5	1266.6	−291.5	−29.8%
4/18/2017	725	977.5	684.2	1270.8	−252.5	−25.8%

[a] CTL (Crisis Text Line) observed conversation volume was significantly lower than predicted volume (alpha = 0.05).

represented in more than one conversation record. Daily conversation volume was only available for the most populous counties to protect the privacy of users from less populous locations. This study focused on a small window of time from January 15, 2017 to March 30, 2017. CTL does not capture demographic information on all callers; however, results from their optional surveys suggests that approximately 75% of CTL users are below 25 years old (Crisis Text Line, 2019). Because *13RW* dramatizes the trials and tribulations of high school students, the authors conjecture there is likely substantial overlap between CTL usership, which is predominantly used by youth, and *13RW* viewership. Year-end press releases from Netflix ranked *13RW* at the top of the 2017 list of shows that were binged watched for more than 2 h a day coupled with more than 3.5 million Twitter conversations discussing the series. The most active age demographic on Twitter are youth (age 18–29) who represent 40% of adult users (PEW, 2018). Even if this age group did not view *13RW*, there is potential for normalization and/or glorification of self-harm and suicide among young adult viewers due to unmoderated peer discussions (Cooper Jr et al., 2018, Messina and Iwasaki, 2011).

3. Methods

Interrupted time-series, autoregressive integrated moving average (ARIMA) modeling was implemented to examine the impact of the release of *13RW* on rates of daily CTL text use. ARIMA modelling is widely used to forecast time-series data and has recently been applied to mental health data to observe temporal trends in self-harm and suicidal ideation (McClellan et al., 2017, Ayers et al., 2017). Expected conversation rates were forecasted using Hyndman and Khandakar's ARIMA algorithm in R version 3.4.4 (R Foundation, Hyndman and Khandakar, 2008) and the forecast package (Hyndman et al., 2018). *13RW* was released on March 31, 2017. Forecasted conversation rates for the subsequent nineteen days, March 31, 2017 through April 18, 2017, were predicted using conversation rates from January 15, 2017 to March 30, 2017. These time frames were selected based on those used by Ayers et al., and were chosen to avoid any interaction with Aaron Hernandez's suicide on April 19, 2017 (2017). However, based on the presence of an ongoing trend in reduced volume, the present study chose to extend the forecast through May 18, 2017. The ARIMA (p,d,q) model parameters were specified using autocorrelation and partial autocorrelation function (ACF and PACF) values to identify recurrent lags. The (p,d,q) parameters correspond to the memory of the

preceding observations (p), the number of times the series must be differenced to achieve the assumption of stationarity (d), and the memory of preceding random shocks (q) (Runkle et al., 2012). Due to the short time period considered, seasonality was not included in the model. The temporal window was determined to be stationary, a requirement for ARIMA analysis, after differencing (d = 1) using the Augmented Dickey-Fuller Test in the *tseries* package (p < 0.05) (Trapletti and Hornik, 2018). Inspection of the final ARIMA model (1,1,7) indicated no correlation and normal distribution of residuals. In addition, the Box Ljung test indicated non-zero autocorrelation (p-value = 0.57), demonstrating proper model fit.

4. Results

We observed a significant, but brief rise in CTL conversation volume on April 5 and 6, subsequent to the release of *13RW*. This increase was followed by a much more substantial and significant reduction (12.7%) in conversation volume for the overall study period (Table 1, Fig. 1A). When the study period was extended through May 18, this trough continued (n = 49 days) with 32 days having significantly lower conversation volume for an overall 29.5% reduction in CTL conversation counts. Daily CTL usage from August 2016 to August 2017 further highlights this uncharacteristic reduction in volume following the release of *13RW* (Fig. 1B). Further examination of monthly trends of CTL conversations specifically related to suicidal thoughts also exhibited a similar decline during this same period (e.g., April–May), confirming a potential decline in support-seeking behaviors for suicidal thoughts via CTL following the release of *13RW*.

5. Discussion

Near real-time data from CTL and other technology-based platforms on crisis events provides an opportunity for targeted interventions prior to serious mental health outcomes. Our analysis provides new evidence of associations between youth reactions to media portrayals of suicide and CTL usage following the release of *13RW*. Several hypotheses might explain this trough. Perhaps, as the show's producers hoped, individuals were having conversations within their existing social network, potentially reducing the need for supplemental support resources. However, the increase in Google search queries for suicidal ideation and hotline resources following the release of *13RW* suggests this is unlikely (Ayers et al., 2017). Instead, this decline may have occurred
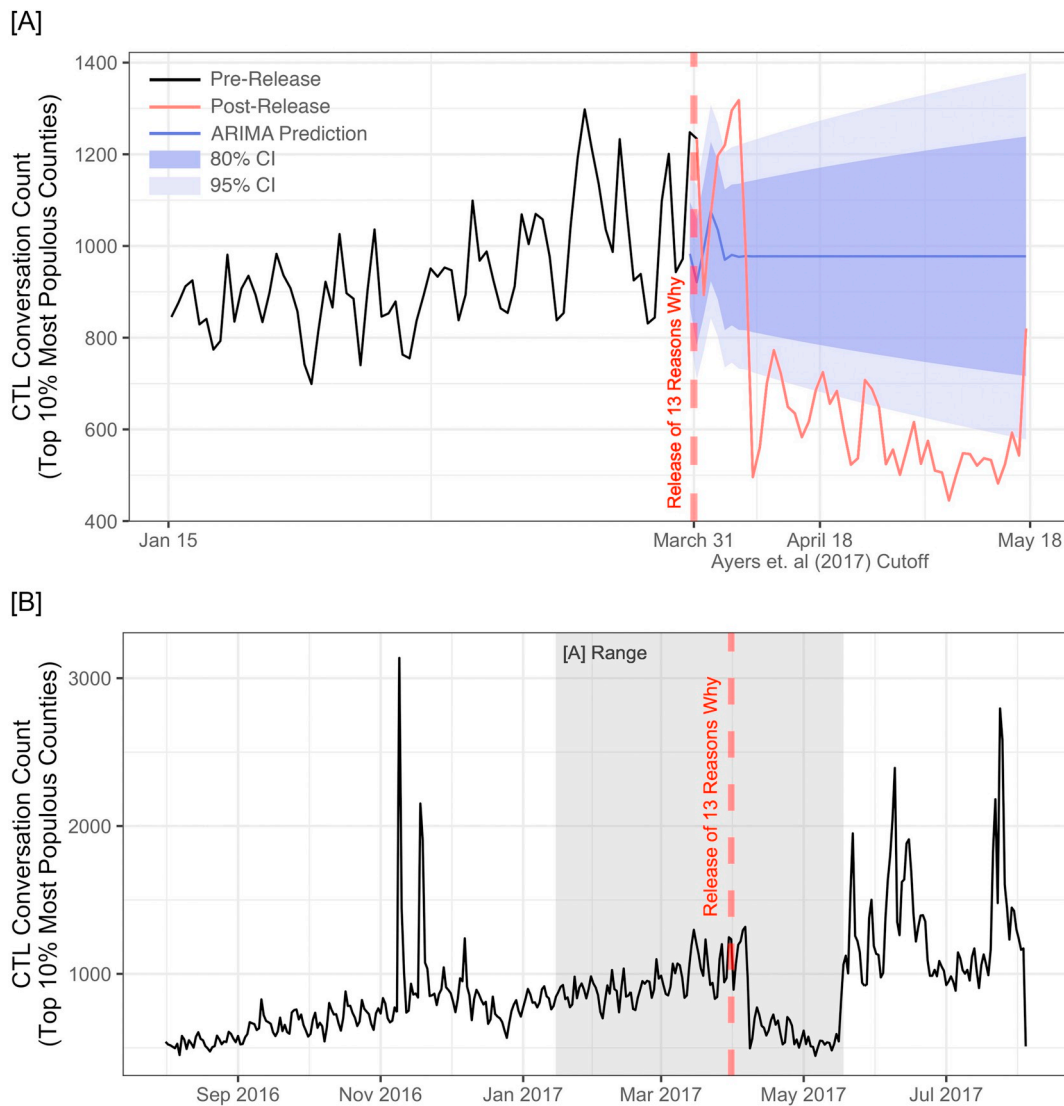
Fig. 1. [A] Daily CTL conversation volume before and after the release of *13RW*. Predicted conversation volume was based on conversation counts from January 15 through March 30. [B] Daily CTL conversation volume from August 2016 through July 2017. We observed the highest peak in CTL conversations for our study period following the 2016 presidential election.

due to the absence of CTL in Google searches mentioning suicide. The authors performed an independent Google search using terms such as "suicide prevention", "crisis intervention", and "crisis resources" and CTL was not captured in the first or second key word searches (i.e., 4–5 pages), but did appear on the 2nd page of the "crisis resource" search. Youth searching for suicide resources on Google may not have been made aware of CTL based on our preliminary searches. Our findings are significant in light of other recent data where unexpected increases in admissions for suicidal patients between 4–18 years-old were reported for the months following the release of *13RW* (Cooper Jr et al., 2018). In an even more granular analysis, Hong et al. (2018) interviewed 87 youth during an emergency department psychiatric visit, approximately half (41) of whom watched at least 1 episode of Season 1. Of the youth who watched at least 1 episode, 21 reported that watching *13RW* "increased their own risk of suicide to some degree" (p. 4). In addition, youth who had higher levels of depressive symptoms were more likely to report negative reactions to the series and to identify with Hannah, the lead character in *13RW* who dies by suicide. Though these data are far from proof that watching *13RW* uniformly induces suicide risk, when coupled with the data presented here, it should serve as a call to action for researchers and clinicians alike to make crisis intervention

resources like CTL more visible and available than ever before, especially for youth who might be more vulnerable or at heightened risk for a suicide attempt. Indeed, a major limitation of our study is that we did not have information on actual suicide and/or attempt rates during the study period. However, the interrupted time-series study design is a robust strategy for evaluating population-level health impacts of an unplanned event (e.g., infectious disease outbreak, Bernal et al., 2017). We only know that other than a brief, 2 day increase in CTL usage, help-seeking via this resource declined significantly and unexpectedly shortly after Season 1 was released. In essence, the observed trough represents potential lost opportunities for intervention and prevention of death by suicide using CTL.

Interestingly, CTL was selected as a primary crisis resource and promoted prominently prior to and during the release of Season 2 on May 18, 2018. Future research should explore whether this enhanced promotion increased usage of CTL in the days following the release of Season 2. More generally, steps should be taken to increase the visibility and accessibility of CTL and other resources in the context of search engine queries geared towards help-seeking behavior and suicide prevention in adolescents and young adults.

Acknowledgements

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