RESEARCH ARTICLE

Increase in suicides the months after the death of Robin Williams in the US

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Abstract

Investigating suicides following the death of Robin Williams, a beloved actor and comedian, on August 11th, 2014, we used time-series analysis to estimate the expected number of suicides during the months following Williams’ death. Monthly suicide count data in the US (1999–2015) were from the Centers for Disease Control and Prevention Wide-ranging ONline Data for Epidemiologic Research (CDC WONDER). Expected suicides were calculated using a seasonal autoregressive integrated moving averages model to account for both the seasonal patterns and autoregression. Time-series models indicated that we would expect 16,849 suicides from August to December 2014; however, we observed 18,690 suicides in that period, suggesting an excess of 1,841 cases (9.85% increase). Although excess suicides were observed across gender and age groups, males and persons aged 30–44 had the greatest increase in excess suicide events. This study documents associations between Robin Williams’ death and suicide deaths in the population thereafter.

Introduction

On August 11, 2014, well-known actor and comedian Robin Williams committed suicide in his home in Paradise Cay, California at the age of 63. The details of his suicide were widely reported in the media in the days and weeks that followed. Although Williams’ widow revealed his struggles with Lewy Body Dementia, the initial reports on Williams’ death did not mention this condition.

The effects of a widely reported celebrity suicide on population health are extensively documented in the international literature [1–9]. Recent meta-analysis suggests that, on average, suicides increase by approximately 0.26 per 100,000 population in the weeks following a high profile celebrity suicide [1], with heterogeneity in the magnitude of the effect across country, event, and celebrity. Effects are particularly prominent when the celebrity is an entertainment star [2, 3], among other factors. While some evidence indicates that suicides in the population tend to increase among those at a similar age as the deceased and using a similar method [4, 10, 11], such evidence is not always consistent [12]. However, there is a paucity of evidence about the effects of a celebrity suicide on population health within the U.S. [13], and no study, to our knowledge, has examined this effect within the modern era of the 24-hours news cycle.
Celebrity suicide effects have led to the World Health Organization to establish media guidelines for reporting a high profile celebrity death, including sensitivity and non-sensationalism in the reporting of the means of suicide, the precipitating factors, and the risk factors for suicide apparent in the deceased [14], and clear and consistent messages about suicide prevention and help-seeking during reporting [6, 15]. The extent to which these guidelines were followed after the death of Mr. Williams, however, is questionable, and as such, we examined suicide incidence in the United States by month surrounding the time frame of Mr. Williams’ death.

Materials and methods

Data sources

Monthly suicide count data and monthly suicide rates (from January 1999 to December 2015), by sex, age, and method, in the United States were from the Centers for Disease Control and Prevention Wide-ranging ONline Data for Epidemiologic Research (CDC WONDER) [16]. These are publicly available, de-identified, data exempt from review by an institutional review board.

We also used the Bloomberg Terminal’s (http://www.bloomberg.com/professional/education/) news trend (NT) function to identify the number of global English-language news media reports with first, the terms Suicide and Dead, and second, the term Robin Williams. To provide a comparison to the same time during the previous year, we analyzed the number of news media reports from June 1, 2013 to January 1, 2015.

Analyses

Time-series analysis was used to determine the expected number of suicides during the months following Williams’ death. Over the calendar year, the monthly number of suicides in a population tends to exhibit a seasonal pattern, with a peak in the early spring and trough in the summer months. As a result, the error term of these observations are often autocorrelated, and not independent, which violates an assumption of ordinary least squares regression. Time-series analysis accounts for the violations of the independence assumption and models the data generating process. Therefore, we used a seasonal autoregressive integrated moving averages (SARIMA) model for this study [17]. Seasonal variation and linear trends were removed by differencing the population parameters between successive years and months, respectively. We examined both the autocorrelation function and partial autocorrelation function to identify the best fitting autoregressive and moving average parameters. The model that provided the lowest Akaike information criterion and Bayesian information Criterion was chosen to best model the data generation process. To assess the difference in observed suicides and expected suicides following Williams’ death on August 14th, 2014, we used an SARIMA \((0,1,1)x(0,1,1)12\) to model the observed number of suicides from January 1999 to July 2014 and forecasted the expected number of suicides, and 95% confidence intervals (CIs), from August 2014 to December 2014. There was no evidence that residuals deviated from white noise (Q tests, \(p = 0.31\)). All analyses were performed using R version 3.2.4 (Vienna, Austria) and STATA version 14 (College Station, Texas).

Results

News media reports with the terms Suicide and Dead, and the term Robin Williams drastically increased in the weeks after Mr. Williams’ death (Fig 1). These increments in media reports were greater that those observed in previous months and also during the August-December
period in 2013. Although the maximum number of stories about Robin Williams was during the approximately four weeks after his death from August-September 2014, stories about Williams were published during the entire period from August-December 2014.

Fig 2 shows the number of suicides in the United States by month from 2010 through 2015. Monthly suicide counts followed a consistent seasonal pattern over the year, with the fewest suicides occurring in February and counts increasing over the summer months. Furthermore, monthly suicide counts tended to increase each year over the prior year’s count for that same month such that more suicides were recorded for January 2011 than January 2010. Compared to prior years, there was a marked increase in the number of suicides beginning in August 2014 through December 2014. This increase in the number of suicides per month appeared to remain consistent over 2015.

Fig 3 shows the observed and predicted number of suicides in the months that followed Williams’ death. Specifically, we observed a 9.9% increase in the number of suicides in the US from August to December 2014. The monthly number of suicides observed during 2015 followed the upper 95% prediction interval.

Increases in suicides from August to December 2014 were consistently observed across gender, both in males (9.1%) and females (9.7%), and across all age groups; those ages 30–44 showed the greatest increase in suicides (12.9%) (Table 1). These increments represent and excess of 1,841 cases (1,398 among males, 386 among females, and 175, 265, 577, 363 and 376
cases among those 12–19, 20–29, 30–44, 45–59 and 60+, respectively). Finally, Table 2 show that, compared to all other methods of suicide, the difference between the observed and predicted number of suicides was greatest and most consistent among suffocation suicides. Specifically, we observed a 32.3% increase in the number of suffocation suicides in the five months that followed Williams’ death, compared to a 3.1% increase in the number of suicides from all other methods combined (i.e., cutting/piercing, poisoning, firearm, falls, all other methods), albeit we found a higher than expected number of poisoning suicides and firearm suicides in August and September, respectively.

As a sensitivity test, we used the same method to forecast the five months interval from August to December in 2013, one year prior to Williams’ suicide (Fig 4). Using the same method that we employed to predict the number of monthly suicides following Williams’ death, we found the model performed very well (i.e., the predicted counts overlapped the observed counts), suggesting that any differences between the observed and predicted number of suicides in the months that followed Williams’ death were likely not attributed to modelling decisions.

Fig 2. Monthly number of suicides in the United States from January 2010 to December 2015. Number of suicides are presented for each month, January to December, from 2010 (lightest grey) to 2015 (darkest grey). The year of Robin Williams’ suicide is in red (2014).

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Discussion

There was an excess of approximately 1,841 suicides in the United States in the four months after the death of Robin Williams compared to what would be expected for that time period based on forecasted models. While excess suicides were observed across all gender and age groups, the highest excesses were observed for men (1,398 excess suicides) and persons 30–44 years (577 excess suicides). Furthermore, the difference between the observed and expected number of suicides were a function of a greater than expected number of suffocation suicides, over all other methods. Although we cannot determine with certainty that these deaths are attributable to the death of Robin Williams, we found both a rapid increase in suicides in August 2014, and specifically suffocation suicides, that paralleled the time and method of Williams’ death, and a dramatic increase in news media reports on suicides and Robin Williams during this same period, suggesting a connection between Williams’ death and the subsequent increase in suicide deaths from August to December 2014.

Our findings extend previous studies that have documented a parallel increase in media reporting of suicides and suicide rates [1, 6, 15, 18, 19]. Our study used a SARIMA model to estimate the predicted number of suicides in the months that followed Williams’ death. This method represents a substantial improvement over previous methods employed in this literature. For example, Phillips [20], in an attempt to estimate the number of suicides expected in a given month, averaged the number of suicides that occurred in that month during the year prior to and after the event. Whereas our sensitivity analysis demonstrated accurate prediction of suicides from August to December 2013, one year prior to Williams’ suicide, Phillips [20] averaging method overestimated the predicted number of suicides in August 2014, predicting 3746 suicide deaths in August 2014 (3580 deaths in August 2013 plus 3912 deaths in August 2014).
Table 1. Observed and expected number of suicides from August 2014 to December 2014 in the United States.

| Demographics | No. of Observed Suicides | Predicted Suicides | Difference between Observed and Predicted Suicides |
|--------------|--------------------------|--------------------|----------------------------------------------------|
|              |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| Ages 12–19 years |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 210                      | 159                 | 134, 189 | 51        | 21, 76 |
| September    | 218                      | 178                 | 149, 212 | 40        | 6, 69  |
| October      | 213                      | 186                 | 155, 222 | 2         | -9, 58 |
| November     | 208                      | 168                 | 140, 202 | 40        | 6, 68  |
| December     | 167                      | 151                 | 125, 182 | 16        | -15, 42|
| Aug-Dec      | 1,016                    | 841                 | 175     |           |        |
| Ages 20–29 years |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 576                      | 549                 | 494, 610 | 27        | -34, 82|
| September    | 596                      | 525                 | 472, 585 | 71        | 11, 124|
| October      | 586                      | 534                 | 479, 596 | 52        | -10, 107|
| November     | 570                      | 495                 | 443, 552 | 75        | 18, 127|
| December     | 536                      | 496                 | 444, 555 | 40        | -19, 92|
| Aug-Dec      | 2,864                    | 2,600               | 246     |           |        |
| Ages 30–44 years |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 995                      | 841                 | 770, 919 | 154       | 76, 225|
| September    | 941                      | 784                 | 717, 857 | 157       | 84, 224|
| October      | 927                      | 789                 | 721, 863 | 138       | 64, 206|
| November     | 790                      | 749                 | 684, 820 | 41        | -30, 106|
| December     | 822                      | 735                 | 670, 805 | 87        | 17, 151|
| Aug-Dec      | 4,475                    | 3,898               | 577     |           |        |
| Ages 45–59 years |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 1,243                    | 1,121               | 1029, 1221 | 122    | 22, 214|
| September    | 1,231                    | 1,080               | 989, 1180 | 151    | 51, 242|
| October      | 1,073                    | 1,054               | 963, 1154 | 19     | -81, 110|
| November     | 1,020                    | 978                 | 891, 1073 | 42     | -53, 129|
| December     | 1,015                    | 986                 | 897, 1084 | 29     | -69, 119|
| Aug-Dec      | 5,582                    | 5,219               | 363     |           |        |
| Ages 60+ years |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 971                      | 916                 | 827, 1014 | 55     | -43, 144|
| September    | 1,039                    | 888                 | 800, 984 | 151     | 55, 238|
| October      | 985                      | 883                 | 796, 980 | 102     | 5, 189 |
| November     | 881                      | 832                 | 749, 924 | 49      | -43, 132|
| December     | 847                      | 829                 | 745, 921 | 18      | -74, 102|
| Aug-Dec      | 4,723                    | 4,347               | 376     |           |        |
| Females      |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 929                      | 804                 | 732, 883 | 125     | 46, 197|
| September    | 907                      | 782                 | 711, 860 | 125     | 47, 196|
| October      | 867                      | 802                 | 727, 883 | 65      | -16, 140|
| November     | 818                      | 743                 | 673, 820 | 75      | -2, 145|
| December     | 706                      | 710                 | 642, 785 | -4      | -79, 64|
| Aug-Dec      | 4,227                    | 3,841               | 386     |           |        |
| Males        |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| August       | 3,074                    | 2,796               | 2633, 2969 | 278   | 105, 441|
| September    | 3,124                    | 2,663               | 2506, 2831 | 461   | 293, 618|

(Continued)
2015 divided by 2), compared to our SARIMA model, predicting 3585.72 (95% CI: 3399.25, 3782.42). Increased access to fast, low-cost, computing over the past several decades has led to more recent literature using SARIMA models to predict suicide deaths in a given month, over Philips averaging method.

Our findings that document a parallel increase in media reporting of suicides and suicide rates suggest that media reporting possibly inducing changes in suicidal ideation via reinforcement, as social learning theory suggests [21, 22]. In this regard, Kumar et al. (2015) described how Williams’ death was also followed by an increased number of online posts in the “Suicide-Watch” forum (a suicide support platform in Reddit), and also with changes in posted content linked to suicidal ideation (e.g. expressing greater negativity, anxiety and anger, and manifesting decreased social concerns) [23]. Further, it is hypothesized that celebrity suicides may influence the population patterns of suicide given the ubiquity of knowledge about the celebrity, and potential identification with the celebrity as a model for a subsequent suicide. Identification with the deceased as a mechanism for so-called “copycat suicides” has long been described as a “Werther effect” [20, 24], named after a 1774 novel by Johann Wolfgang von Goethe. That we observed the greatest excess suicide cases were among persons who used a similar method (i.e., suffocation) and who were of the same sex (i.e., male) and in a similar age group as Williams, it is possible that this excess in suicide cases is an example of the “Werther effect”.

The link between media and suicides is also supported by the fact that interventions aiming at guiding media reporting have an impact on suicides following specific suicide cases [1, 15, 25, 26]. Popular news media headlines suggest that media guidelines for suicide reporting were not followed in the case of Mr. Williams. For example, media guidelines suggest that explicit description of the suicide method be avoided, as well as speculation on causes or details of site of suicide, especially in headlines [14]; however, on August 12th, 2014, the Washington Post reported “Robin Williams’s death shows the power of depression and the impulsiveness of suicide” [27] and the New York Times reported with the headline “Robin Williams Died by Hanging, Official Says” [28]. Similar headlines can be found across many other population news media sources. A public news conference by the Sheriff assigned to the case detailed the belt that was used in Williams’ death, his body position, and wrist marks, among other details.

| Demographics | No. of Observed Suicides | Predicted Suicides | Difference between Observed and Predicted Suicides |
|--------------|--------------------------|--------------------|---------------------------------------------------|
|              |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| October      | 2,921                    | 2,651               | 2492, 2821 | 270 | 100, 429 |
| November     | 2,658                    | 2,470               | 2319, 2630 | 188 | 28, 339 |
| December     | 2,686                    | 2,485               | 2332, 2648 | 201 | 38, 354 |
| Aug-Dec      | 14,463                   | 13,065              | 3399, 3782 | 417 | 221, 604 |
| August       | 4,003                    | 3,586               | 3262, 3639 | 586 | 392, 769 |
| September    | 4,031                    | 3,445               | 3248, 3632 | 354 | 156, 54 |
| October      | 3,788                    | 3,434               | 3018, 3383 | 281 | 93, 458 |
| November     | 3,476                    | 3,195               | 3008, 3379 | 2034 | 13, 384 |
| December     | 3,392                    | 3,188               | 3008, 3379 | 1,841 |
| Aug-Dec      | 18,690                   | 16,849              | 3008, 3379 | 1,841 |

Abbreviations: PI, prediction interval

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Table 2. Observed and expected number of suicides by method from August 2014 to December 2014 in the United States.

| Suicide Method   | No. of Observed Suicides | Predicted Suicides | Difference between Observed and Predicted Suicides |
|------------------|--------------------------|--------------------|---------------------------------------------------|
|                  |                          | No. of Predicted Suicides | 95% PI | Difference | 95% PI |
| Suffocation      |                          |                         |        |            |        |
| August           | 1,237                    | 909                   | 814, 1,014 | 51       | 21, 76 |
| September        | 1,266                    | 881                   | 788, 985 | 40       | 6, 69 |
| October          | 1,144                    | 862                   | 770, 965 | 27       | -9, 58 |
| November         | 929                      | 764                   | 681, 856 | 40       | 6, 68 |
| December         | 971                      | 778                   | 693, 874 | 16       | -15, 42|
| Aug-Dec          | 5,547                    | 4,194                 | 175     |           |        |
| Cut/pierce       |                          |                       |        |            |        |
| August           | 60                       | 66                    | 48, 90  | -6        | -30, 12|
| September        | 69                       | 65                    | 47, 89  | 4         | -20, 22|
| October          | 59                       | 62                    | 45, 86  | -3        | -27, 14|
| November         | 67                       | 60                    | 43, 83  | 7         | -16, 24|
| December         | 60                       | 60                    | 43, 83  | 0         | -23, 17|
| Aug-Dec          | 315                      | 312                   | 3       |           |        |
| Poisoning        |                          |                       |        |            |        |
| August           | 646                      | 573                   | 510, 643 | 73       | 3, 136 |
| September        | 582                      | 549                   | 488, 617 | 33       | -35, 94|
| October          | 557                      | 549                   | 488, 618 | 8        | -61, 69|
| November         | 563                      | 538                   | 477, 606 | 25       | -43, 86|
| December         | 485                      | 517                   | 459, 584 | -32      | -99, 26|
| Aug-Dec          | 2,833                    | 2,726                 | 107     |           |        |
| Firearm          |                          |                       |        |            |        |
| August           | 1,839                    | 1,822                 | 1,703, 1,948 | 17   | -109, 136|
| September        | 1,898                    | 1,742                 | 1,627, 1,865 | 156  | 33, 271 |
| October          | 1,819                    | 1,776                 | 1,658, 1,904 | 43   | -85, 161|
| November         | 1,708                    | 1,680                 | 1,566, 1,802 | 28   | -94, 142|
| December         | 1,696                    | 1,664                 | 1,550, 1,787 | 32   | -91, 146|
| Aug-Dec          | 8,960                    | 8,684                 | 276     |           |        |
| Fall             |                          |                       |        |            |        |
| August           | 94                       | 89                    | 66, 117 | 6        | -23, 28|
| September        | 83                       | 85                    | 64, 114 | -2       | -31, 19|
| October          | 79                       | 80                    | 60, 106 | -1       | -27, 19|
| November         | 91                       | 74                    | 55, 99  | 17       | -8, 36 |
| December         | 66                       | 74                    | 55, 99  | -8       | -33, 11|
| Aug-Dec          | 413                      | 400                   | 13      |           |        |
| All other methods|                          |                       |        |            |        |
| August           | 127                      | 136                   | 109, 170 | -9       | -43, 18|
| September        | 133                      | 129                   | 103, 160 | 4        | -27, 30|
| October          | 130                      | 130                   | 104, 163 | 0        | -33, 26|
| November         | 118                      | 116                   | 93, 146  | 2        | -28, 25|
| December         | 114                      | 110                   | 88, 137  | 4        | -234, 26|
| Aug-Dec          | 622                      | 621                   | 1       |           |        |

Abbreviations: PI, prediction interval

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Thus, substantial evidence suggests that the major US news media outlets tended to deviate from the established suicide reporting guidelines following Williams’ death.

Oversights in media reporting regarding the death of Robin Williams stands in contrast to another high profile US entertainment star suicide, Kurt Cobain, lead singer of the enormously popular rock band Nirvana, in 1994. There was minimal impact of Cobain’s death on suicide rates in the Seattle area of the United States, and available evidence indicates that restrictive reporting of the details of death, as well as consistent messages regarding suicide prevention throughout reporting, may have played a pivotal role in preventing subsequent suicides [29, 30]. It should be noted that this study only counted suicides before and after Cobain’s death in the Seattle area [29], and it is possible that the suicide trends in Seattle differed from the national trends.

It is also worth considering the role of social media as a new and emerging risk factor for how information is disseminated after the death of a celebrity. The PEW research center estimates that as of 2015, approximately 65% of adults in the US receive their news updates through Facebook and Twitter [31]. Even if traditional media outlets follow established reporting guidelines for celebrity suicides, the role of social media speculation and news dissemination may counter any prevention messages that are disseminated in traditional sources.

There are 4 limitations important for interpretation of this study. First, we cannot determine with certainty that the increase in deaths from August to December 2014 can be attributed to the death of Robin Williams. It is possible that a different event, capable of increasing population suicide rates, occurred during the same period as Williams’ death in August 2014. While we cannot entirely rule-out such an event during this time period, we find this hypothesis unlikely given that the greatest spike in suicide-related media reports occurred on the days following Williams’ death. Second, we did not model exogenous factors that could increase suicide risk in the population (e.g., unemployment, weather patterns). However, the SARIMA model used data from 204 time points to model the mechanism generating the monthly

![Graph showing observed and predicted number of suicides in the United States from January 2012 to December 2013.](https://doi.org/10.1371/journal.pone.0191405.g004)
 suicide deaths in the U.S., without the need for input from exogenous factors. However, correct specification of a SARIMA model can produce accurate predictions without the need for modeling exogenous factors. To verify our model specification, we used a sensitivity analysis to accurately predict suicide counts during the same time period (August to December) in 2013 (i.e., the year prior to Williams’ death), providing evidence accurate model specification without a need to consider exogenous factors. Third, the length of time that media reports influence copycat suicides is unknown. While we modeled a 4 month copycat effect following Williams’ suicide, many previous studies have assumed that the impact of media reporting on copycat suicides lasts approximately 4 weeks after the event [4, 9–11]. Two factors influenced our decision to consider this length of time: (1) monthly suicide counts did not return to pre-Williams’ levels until December 2014 and (2) media reports continued for several months after Williams’ death. Finally, misclassification of suicides in the death records might have led to underestimates of the effects.

Our work adds evidence about the relationship between celebrity suicide, the subsequent media coverage of the event, and subsequent suicide deaths. The number of excess deaths was greatest among men and persons 30–44 years, while suffocation deaths increased over all other suicide methods. Although we cannot determine with certainty that the excess suicides were attributable to news media reports on Williams’ death, Williams’ death might have provided the necessary stimulus for high-risk segments of the U.S. population (e.g., middle-aged men in despair) to move from suicidal ideation to attempt. Therefore, the media industry can positively or negatively influence imitation suicides. Suicide remains a central threat to public health, and high profile celebrity suicides will continue to occur; preventing such effects will require substantial resources and training, as well as creative responses to emerging media.

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