Anomie or Imitation?
The Werther Effect of Celebrity Suicides on Suicide Rates in 34 OECD Countries, 1960–2014

Mark Lutter, Karlijn L. A. Roex, and Daria Tisch

About the authors

Mark Lutter is Professor of Sociology at the University of Wuppertal in Germany. He was a researcher at the Max Planck Institute for the Study of Societies from 2005 to 2017 and has headed the MPIfG Research Group on the "Transnational Sociology of Diffusion" since 2014.
Email: lutter@uni-wuppertal.de

Karlijn L. A. Roex is a postdoctoral researcher at the Max Planck Institute for the Study of Societies, Cologne, and was a doctoral researcher at the International Max Planck Research School on the Social and Political Constitution of the Economy (IMPRS-SPCE), Cologne, from 2014 to 2018.
Email: roex@mpifg.de

Daria Tisch is a PhD student in sociology at the Cologne Graduate School in Management, Economics and Social Sciences at the University of Cologne.
Email: tisch@wiso.uni-koeln.de

Abstract

Anomie and imitation have been prominent mechanisms explaining the Werther effect, i.e., the effect of celebrity suicides on a general population's suicide rate. This study presents a new approach to empirically disentangle both mechanisms. Imitation theory suggests that celebrities act as role models, and that the Werther effect is triggered by the status of the celebrity in question. Anomie theory, on the other hand, suggests that the Werther effect is triggered by the unexpectedness of the event. To this end, we empirically compare the effects of celebrity suicides with the effects of celebrities who died unexpectedly from causes other than suicide (accidents, illnesses, alcohol abuse). Based on language and page-link data from 3,855 Wikipedia pages of 495 celebrities who committed suicide between 1960 and 2014, we measure the status a celebrity has in a particular country and calculate the potential country-specific imitation effect of their suicide. In the same manner, we measure status effects of celebrities who died unexpectedly from accidents, illnesses, or alcohol abuse to reflect anomie-related effects. We use these measures in a time-series cross-sectional dataset for 34 OECD countries to assess their effects on a country's overall annual suicide rate. Fixed-effects analyses reveal that country-specific status effects of celebrity suicides lead to significant increases in overall suicide rates, while anomie-related, unexpected celebrity deaths show no effects. The findings remain robust across a number of alternative specifications, such as controlling for further anomic factors at the macro level (divorce or unemployment rate, for instance). We conclude that the results support the imitation mechanism as an essential social explanation for the Werther effect.

Keywords: anomie, imitation, celebrity suicides, contagion, status, suicide, Werther effect, Wikipedia

Zusammenfassung

Anomie und Imitation sind zwei wichtige Mechanismen zur Erklärung des Werther-Effektes, also der Annahme, dass es einen kausalen Zusammenhang zwischen Selbstmorden berühmter Personen und der allgemeinen Selbstmordrate gibt. Die vorliegende Studie präsentiert nun einen neuen Ansatz, der versucht, beide Mechanismen empirisch voneinander zu trennen. Imitationstheorien gehen davon aus, dass Berühmtheiten als Rollenvorbilder fungieren und dass der Werther-Effekt somit durch die Statushöhe der Berühmtheiten erklärt werden kann. Anomietheorien nehmen dagegen an, dass der Werther-Effekt eher durch die unerwartete Plötzlichkeit des Ereignisses erklärt werden kann. Wir vergleichen daher empirisch den Einfluss von Selbstmorden berühmter Personen mit dem plötzlich und unerwartet durch Unfälle, Krankheiten oder Alkoholmissbrauch gestorbener Berühmtheiten. Auf Basis der Sprach- und Page-Link-Daten von 3.855 Wikipedia-Seiten der 495 Berühmtheiten, die zwischen 1960 und 2014 durch Suizid gestorben sind, erfassen wir ein Maß für den Status und Einfluss, den die Personen in einem bestimmten Land aufweisen, und schätzen darüber den potenziellen Nachahmereffekt ihres Selbstmordes. Anomie-bezogene Effekte erfassen wir, indem wir Berühmtheiten einbeziehen, die unerwartet durch Unfälle, Krankheiten oder Alkoholmissbrauch gestorben sind. Wir nutzen diese Maße, um mithilfe eines gepoolten Paneldatensatzes für 34 OECD-Länder ihre Effekte auf die allgemeine Selbstmordrate zu schätzen. Fixed-Effects-Analysen zeigen, dass das Statusmaß mit einem signifikanten Anstieg der länderspezifischen Selbstmordraten einhergeht. Zugleich zeigen sich keine Effekte der anomie-bezogenen Maße zu den unerwartet durch Krankheiten, Unfälle oder Alkoholmissbrauch gestorbenen Berühmtheiten. Die Ergebnisse erweisen sich als robust über eine Reihe alternativer Spezifikationen wie beispielsweise der Konstanthaltung weiterer Anomie-Faktoren auf der Makroebene (zum Beispiel Scheidungs- oder Arbeitslosenraten). Aus diesen Ergebnissen schließen wir, dass der Werther-Effekt wesentlich durch Mechanismen der Nachahmung erklärt werden kann.

Schlagwörter: Anomie, Ansteckung, Imitation, Status, Suizid, Suizid berühmter Personen, Werther-Effekt, Wikipedia

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1   Introduction

In 2008, a famous South Korean actress committed suicide, and her death led to a rise in the country's suicide rate in the following months (Lee et al. 2014). This pattern of imitative suicide is called the Werther effect (Phillips 1974), named after the main character in Goethe's 1774 novel *The Sorrows of Young Werther*, whose fictional suicide induced an increase in real suicides at the time in Europe (Stack 2003). Prior research has found empirical support for the Werther effect with regard to celebrity suicides (Lee et al. 2014; Niederkrotenthaler et al. 2012; Stack 1987; 1990; 2003; Wasserman 1984; Yang et al. 2013; Yip et al. 2006). Anomie and imitation are presented as the main explanatory mechanisms of the Werther effect. However, it remains a challenge to draw any conclusions about which of these mechanisms actually causes suicide (Hoffman and Bearman 2015). Since the two mechanisms are not directly observable, testing both theories empirically is a demanding task. Moreover, due to data limitations, most prior research has not been able to control for important additional anomie effects. In fact, much ecological literature on suicides shows that suicide rates are associated with many factors causing anomie, in a Durkheimian sense ([1897] 1966), including the unemployment rate (e.g., Lin 2006; Page et al. 2013; Stuckler et al. 2009), economic recession (Reeves et al. 2012; Reeves and Stuckler 2016), austerity measures (e.g., Karanikolos et al. 2013; Kentikelenis et al. 2014), and relative deprivation (Liu 2017). However, virtually all previous work on the impact of celebrity suicides has only included three control variables at most, and occasionally key factors such as the unemployment rate were not controlled for (e.g., Yang et al. 2013; Yip et al. 2006).

Another caveat with regard to previous research is the limited scope of that research. With very few exceptions, it has only focused on a single country over a maximum span of three decades (e.g., Stack 1987; Yang et al. 2013; Yip et al. 2006). The exceptions are Fu and Yip (2007) and Phillips (1974), who examined two or three countries, respectively. The statistical power of the studies also tends to be low, and the number of con-

trol variables they include is limited. Moreover, the global impact of celebrity suicides, especially of celebrities with international fame, remains unclear.

Virtually all studies have defined persons as celebrities if they had appeared on the front page of a major newspaper or in online databases shortly before their suicide (e.g., Wasserman 1984; Stack 1987; Yang et al. 2013). However, these studies did not develop an index of a celebrity's imitative potential or status. Celebrities likely differ significantly in the amount of fame and recognition they receive. So far, only indirect means have been used to measure the stardom of the celebrity, such as the type of celebrity or, in meta-analyses, whether a study was devoted to one (likely to be a higher-impact celebrity) or more celebrities (Niederkrotenthaler et al. 2012; Stack 1987; 2003). In these studies, entertainment celebrities, political and religious leaders, and sports celebrities are thought to be the most visible and glorified celebrities, while famous "villains" (i.e., gang leaders, dictators) and foreign celebrities are thought to have the lowest identification potential (Stack 1987; 2003). While it does seem to be true that only entertainment (and occasionally political) celebrities seem to trigger a Werther effect (e.g., Niedenkrotenthaler et al. 2012; Stack 1987; 2003; Wasserman 1984), this categorization only offers a rough approximation of a celebrity's impact. For example, entertainment and political celebrities included in a large study are likely to be a highly heterogeneous group in terms of their individual members' actual status. Similarly, some foreign celebrities may have a high degree of influence on people in other countries if those countries belong to the same language community. The potential global impact of celebrity suicides has been overlooked in the literature so far. Moreover, because celebrity "villains" such as serial and rampage killers can act as role models, their suicide may trigger imitative behavior as well.

The present study seeks to overcome some of these shortcomings and aims to test the effect of celebrity suicides more rigorously. In the paper's theory section (Section 2), we discuss both mechanisms and argue that the Werther effect is triggered by a celebrity's status, which potentially causes anomie and subsequent imitative behavior. In the empirical section (Sections 3 and 4), we aim to disentangle the effects of imitative-related celebrity suicides from those that are anomie-related. In doing so, we present a new approach to measuring celebrity status. Based on the language and page-link data of 3,855 Wikipedia pages for 495 celebrities who committed suicide between 1960 and 2015, we calculate the potential country-specific impact of the celebrity's suicide and use this measure in a large-scale macrocomparative country-year dataset for 34 OECD countries to assess its effect on a country's overall annual suicide rate. According to imitation theory, we expect that the higher the status of a celebrity who has committed suicide, the greater the possible imitative suicide effect.

Using exactly the same procedure as above, we also measure the status effects of celebrities who unexpectedly died from accidents, illnesses, and alcohol abuse (a total of 756 celebrities on 5,880 Wikipedia pages). According to anomie theory (Durkheim [1897] 1966; Hoffman and Bearman 2015), unexpected events such as celebrities dying in a car accident or unexpectedly from pneumonia should trigger anomie-induced suicides;

at the same time, these events are non-imitative because these fatalities do not result from an action that can be imitated. By testing both status-driven celebrity suicides (as a measure of imitation theory) and unexpected celebrity deaths (a measure of anomie) we provide a more rigorous test of the mechanisms that are relevant in explaining what leads to socially induced suicides.

The study's design also enables us to control for further potential macro-level effects such as political, economic, cultural, and demographic factors, including divorce rates, changes in unemployment rates, and other potentially anomie-related (but not celebrity-related) macro-level effects. Based on fixed-effects panel regression, we find that the country-specific status of celebrities who committed suicide shows statistically positive effects on the general suicide rate. However, we do not find significant effects on the general suicide rate by unexpected celebrity deaths. As we outline further below, these findings support imitation rather than anomie theory.

2   Anomie and imitation: Mechanisms of the Werther effect

The causal mechanisms of the observed Werther effect have been traced back to two main factors: anomie and imitation. In a nutshell, anomie theory argues that a celebrity suicide is an unexpected event that causes shock and disrupts the social order. According to imitation theory, high-status celebrities are role models, and their suicide can lead to imitative behavior.

The first mechanism, anomie, is rooted in Durkheim's ([1897] 1966) classical sociological work, in which he argues that anomic societal conditions act as a social driver of individual suicides. According to Durkheim, an anomic society lacks social integration and regulation: it no longer imposes any obligations or moral norms on its individuals. Anomie is caused by weakened social institutions that normally regulate behavior and thereby restrict people's suicidality. Social institutions can be weakened by the dissolution of formerly strong institutions of moral integration (e.g., increases in the divorce rate) or by norm-disrupting events, such as economic crises, unemployment, war – or the suicide of a famous person. These events are especially disruptive for an individual's moral order and increase anomie because they are unanticipated and exceptional (Hoffman and Bearman 2015).

With regard to the Werther effect, some studies support the anomie mechanism. Stack (1987) argues that the suicide of an influential religious leader would trigger further suicides because the norms and values of the religious denomination that the leader represented are temporarily weakened by this act, leading to anomie among its followers. Hoffman and Bearman (2015) recently framed celebrity suicides as unanticipated disruptive events that can temporarily disrupt the social order and cause an anomic

state. Their analysis shows that celebrity suicides, but also other unanticipated, exceptional, and highly publicized events (such as the Chernobyl disaster or a major outbreak of Legionnaires), lead to an increase in the general suicide rate. Apart from celebrity suicides, others have shown that suicides are triggered by unexpected events such as economic crises (Kondo and Oh 2010; Morrell et al. 1993; Reeves et al. 2012; Reeves and Stuckler 2016; Stuckler et al. 2009) or the collapse of Soviet communism and the rapid economic and societal transitions that followed (Brainerd 2001; Mäkinen 2000).

The second mechanism, imitation theory, has its roots in social learning theory. According to this theory, we learn which courses of action are thought to be right or effective by observing others' behavior (Akers 1985). The more we see a certain behavior around us, the more likely we are to adopt this behavior as part of our behavioral 'script' (Akers 1985; Stack 2003). This mechanism is also known in the sociology of diffusion literature (Coleman, Katz, and Menzel 1957; Rogers 2003): the more a previously unknown practice becomes popular, the more it gains legitimacy. It is precisely the increased legitimacy of a given practice that spurs its imitation and further diffusion.

Imitation is suggested as the main mechanism in most research on the Werther effect. Studies show that there is an increase in suicide rates after media reporting about celebrity suicides (Bollen and Phillips 1982; Gould 2001; Hassan 1995; Jonas 1992; Lee et al. 2014; Phillips 1974; Stack 1987; 2003) and suggest imitation as an explanation, although anomie can never be ruled out completely as an alternative explanation (Hoffman and Bearman 2015). Evidence in favor of imitation over anomie includes the fact that the effect becomes stronger when the media reports on a suicide and its circumstances in greater detail, especially when the reporting includes photographs and a detailed account of the means used (Hawton et al. 1999; Shoval et al. 2005). Support for imitation theory is further generated by studies showing that subsequent suicides used the same suicide method, a stronger effect among people of the same gender or age as the celebrity (Lee et al. 2014; Stack 2003; Yip et al. 2006), or geographic proximity (Baller and Richardson 2002). Anomie as a causal driver, however, cannot be completely ruled out simply on the basis of a match in the suicide method. For instance, a celebrity suicide can be more unsettling to members who share the same ethnic or sociodemographic category as the celebrity.

Imitation theory also argues that people are more likely to imitate the behavior of high-status individuals such as opinion leaders (Katz and Lazarsfeld 1955; Tarde 1903). People are apt to imitate their superiors, because the success of these people is taken as a sign that their behavior is somehow effective (Palloni 1998; Young 2007). Because people tend to identify highly with celebrities, celebrities can act as opinion leaders or role models who set trends and define norms. As a result, suicidal behavior becomes more legitimate if a high-status celebrity adopts it (Haw et al. 2013; Stack 1990).

There are reasons to expect that the suicide of a celebrity will also have a Werther effect abroad, but only selectively. With the spread of mass media and globalization, it can be

expected that some celebrities have attained a global audience. For these celebrities, we would expect a Werther effect in both their own country and other countries in which they are well known. Based on this discussion, we propose hypothesis H1:

H1: Imitation theory suggests that in countries in which celebrity suicides have higher impacts (based on country-specific celebrity status), the general suicide rate should increase accordingly.

Anomie theory suggests that suicides increase because celebrity suicides are unexpected and not anticipated (Hoffman and Bearman 2015). While the proposed effect in H1 is likely to contain elements of both mechanisms, meaning imitative and anomic effects, a stronger test of anomie theory would be to identify further unexpected events related to celebrities and to contrast their potential effects on the suicide rate with the effects proposed in H1. Such events would be the unnatural deaths of celebrities due to traffic collisions, alcohol abuse, airplane crashes, or unexpected illnesses, such as pneumonia. In all four cases, the event of death is not anticipated but directly related to celebrities. A high-status celebrity dying unexpectedly from such an event should, if anomie theory holds, cause anomic shocks that increase the number of anomic suicides. At the same time, these events are unrelated to imitative behavior, because there is no role-model type of behavior that can be imitated (i.e., suicide). We therefore formulate the following hypothesis H2:

H2: Anomie theory suggests that in countries in which unexpected celebrity deaths have higher impacts (based on country-specific celebrity status), the general suicide rate should increase accordingly.

3 Data and methods

We use a cross-national panel dataset that comprises 34 OECD countries for the years 1960 to 2014. Our dependent variable is the country's annual suicide rate, measured as the number of suicides per 100,000 inhabitants. The data are taken from OECD statistics, with 2014 as the latest year for which data is available (OECD 2016a). Suicide rates are age-standardized to 2010 OECD population statistics to account for differences in age structure across countries and over time.

We use linear panel regression to estimate our models. In particular, we employ fixed-effects models to estimate the within-country effects of our predictors on a country's overall suicide rate. Fixed-effects models are used because they are based on the variation within a country and control for unobserved time-constant differences between countries, which could confound results. Therefore, fixed-effects models allow for a "within-country" interpretation of the coefficients. That means that they estimate how

changes over time in the predictor variable (yearly lagged country-specific impact of celebrity suicides) affect the dependent variable within a country (annual suicide rate). Fixed-effects models are also suitable when the comparability of data across countries is problematic, as can be the case with suicide data. Due to differences in reporting or standards of forensic investigation, the comparability of suicide data across countries is not always ensured (see OECD 2016a for details).

We estimate models using Driscoll-Kraay standard errors, which are robust to disturbances caused by violations of the heteroscedasticity assumption, autocorrelation, and cross-sectional dependencies that are likely to occur in macrocomparative, country-year datasets (see Hoechle 2007). All models include the number of years from 1960 to 2014. This controls for a possible unobserved linear time trend affecting the dependent variable. All independent variables are time variant and are lagged by one year to avoid simultaneity bias.

Predictor variable: Country-specific impact of celebrity suicides

Our main predictor is the *country-specific impact of celebrity suicides* by country-year. This measure is intended to capture the possible impact that a celebrity suicide has in a specific country. The status and possible impact of a celebrity's suicide on a country's population is not directly observable and can only be approximated. Prior studies measure the impact via the extent to which celebrity suicides are covered in the media. This method, however, has the disadvantage that the extent of media coverage for a celebrity suicide is usually not known for all possible countries or years. The result is that studies are often limited in the number of countries and/or years they can take into account; hence, the scope of their results remains limited. Our measure, by contrast, makes use of big-data techniques and the crowd-sourced information pool in the online encyclopedia Wikipedia. It is calculated in the following way. First, we identify all 495 celebrity suicides between 1960 and 2014 that are noted in Wikipedia's "list of suicides," which lists notable people (celebrities and other notable persons) who committed suicide.[1] We then collect all the Wikipedia webpages of the 495 celebrities in all available languages that are officially spoken in the 34 OECD countries that form our main sample. In total, we collect 3,855 pages for 495 celebrities, which is an average of about 7.8 webpages in different languages per person (with a minimum of 1 and a maximum of 31 language pages per person). We then use the number of pages that link to each of the 3,855 webpages as a measure of status.[2] The number of page links can be considered a relational measure of social status within the world of Wikipedia: the more that other pages refer

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1   Source: https://en.wikipedia.org/wiki/List_of_suicides (accessed July 26, 2016). This is the English site. The list is also available in French, Dutch, and Portuguese, with slightly different names. We collected all names from these four lists.
2   Page-link data can be found under the tab "tools/what links here" on each Wikipedia webpage.

to the respective celebrity's page, the higher the assumed status of that person. We attach the number of pages that link to each celebrity's language page to the countries in which the language of the page is spoken. For countries with more than one official language, the number of page links is a weighted average that consists of the weighted sum of page links for all official languages in that country, weighted by the frequency with which the language occurs in the population (based on census data). Then, for each of the 34 OECD countries and for each year from 1960 to 2014, we add up all page links for all celebrity suicides that happen in each year in the respective language area. To adjust for the size of the respective language community (because there might be more links to pages in languages where there are more webpages in total), we divide number of page links by the total size of the respective language community.[3] This yields a size-adjusted measure of the yearly country-specific impact of celebrity suicides.

For instance, the English Wikipedia page of Ian Curtis, British vocalist of the English post-punk pioneers Joy Division, who committed suicide in 1980 at the age of 23, has 21 different language pages for languages spoken in OECD countries. The English page of Ian Curtis has the highest number of page links (473 links), followed by 116 links to the Portuguese page, 114 to the Italian, 101 to the French, 80 to the German, 75 to the Spanish, 65 to the Japanese, and 12 to the Turkish page. Besides being famous in the English-speaking world, Ian Curtis seems to have a high status in Portugal, Italy, and France – but not so much in Turkey or Japan. Since our measure is the (size-adjusted) sum of all country-specific page links of all celebrity suicides per year, in this example we add the page links for Curtis to the number of pages that link to all other celebrities in the respective language area who committed suicide the same year. Apart from Ian Curtis, we count eight other celebrity suicides in 1980. Among them is Rachel Roberts, a British actress. Her status is a little lower than Curtis's: 230 page links for the English site, 33 for the German, and 36 for the Italian, for instance. For that particular year, our measure now is the (size-adjusted) sum of all page links for all celebrities in the respective language area who committed suicide that year. So, for all English-speaking countries, we count a total of 1,467 page links for 1980 (473 for Ian Curtis, 230 for Rachel Roberts, plus 764 for another seven celebrities), and then adjust this number to account for the total number of English Wikipedia pages. For all German-speaking countries, we count 80 for Curtis, 33 for Roberts, plus 133 for the remaining seven other celebrities who committed suicide in 1980, for a total of 246 page links for that year (and then divide this by the total number of German pages). For Switzerland, a country with more than one official language, we use the weighted sum of all page links relevant in Switzerland. Since the German language is spoken by about 63.5 percent of the population in Switzerland, French by about 22.5 percent, Italian by about 8.1 percent, and Romansh by about 0.5 percent, the weighted sum for Switzerland for 1980 is calculated as $[(246*0.635)+(x1*0.225)+(x2*0.081)+(x3*0.005)]/0.946$, where 246 is the sum of page links for German-language websites, x1 to x3 is the sum of page links

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3   This is based on the total number of Wikipedia articles in each language, as of July 2016. Source: https://stats.wikimedia.org/EN/TablesArticlesTotal.htm (accessed September 1, 2017).

for the respective French, Italian, and Romansh celebrity pages, and 0.946 is the sum of the weights needed to create the weighted sum.

This procedure yields a measure of the yearly country-specific impact of all celebrity suicides per year. The measure will have high values in those country-years in which many high-status celebrity suicides occurred in the respective language area, and low values in those country-years with only a few celebrity suicides with low status. While the final measure will be time-varying by year, it nevertheless has the limitation that the page-link data were collected from Wikipedia in 2016. Wikipedia did not exist in 1980, so it is impossible to gather page-link data for that year. Therefore, our page-link measure is a proxy of the true, albeit unknown, status of a celebrity in the particular year in which the suicide occurred. There might be cases in which this limitation creates bias; for instance, if a celebrity acquires high status many years after their suicide. However, we believe that this is a minor problem because most celebrities in the modern age do not gain their status posthumously, but rather during their career.

Using exactly the same method as above, we calculate four variables that test anomie as discussed for hypothesis H2. These variables constitute country-specific impact measures for four categories of unexpected celebrity deaths, based on celebrity death events from Wikipedia's list of fatalities from aviation accidents, alcohol abuse, traffic accidents, and fatalities from pneumonia.[4]

Controls

Table 1 presents descriptive statistics for variables used in this analysis. Apart from our main predictor variable, we use a battery of control variables. In particular, we control for other potential anomie-inducing factors that may affect the suicide rate but are unrelated to celebrities (such as a country's divorce or unemployment rates). We also control for the sociodemographic composition of a country and a number of other factors. The controls can be divided into five groups: time-trend controls, economic factors, demographic variables, socioeconomic controls, and health and welfare controls. In cases in which there is missing data for the control variables (see below for details), we inter- and extrapolate missing time series based on a linear time-trend regression model.[5]

The first group of controls consists of two variables that account for possibly unobserved time trends in the data. Because Wikipedia was founded in 2001 and its activity

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4   Sources: https://en.wikipedia.org/wiki/List_of_notable_people_who_died_in_traffic_collisions (accessed March 1, 2017); https://en.wikipedia.org/wiki/List_of_deaths_through_alcohol (accessed March 23, 2017); https://en.wikipedia.org/wiki/List_of_fatalities_from_aviation_accidents (accessed April 1, 2017); https://en.wikipedia.org/wiki/List_of_pneumonia_victims (accessed April 2, 2017).
5   The main results do not change when we use non-imputed data (details available upon request).

Table 1   Descriptive statistics for all variables used in this study

	Mean	Std. dev.	Min.	Max.
Dependent variables				
Annual suicide rate (per 100,000 inhabitants)	14.87	8.13	1	49.7
Predictors				
Country-specific impact of celebrity suicides	151.63	181.50	0	2000
Celebrity deaths (traffic)	110.90	157.41	0	2243.9
Celebrity deaths (alcohol)	42.27	114.30	0	991.67
Celebrity deaths (pneumonia)	62.85	151.21	0	2616.67
Celebrity deaths (airplane crash)	70.07	92.42	0	923.47
Controls				
GDP (in US dollars)	8.58E+11	1.86E+12	2.06E+09	1.55E+13
Population	3.07E+07	4.98E+07	175860	3.14E+08
Urban population rate	73.22	11.95	34.96	97.73
Unemployment rate	6.22	4.30	0	26.2
Educational stock	19.38	16.18	0	100
Divorce rate	1.73	1.00	0	5.2
Social expenditures (in percentage of GDP)	17.54	6.61	0	32
Antidepressant intake (daily dosage per 1,000 inhabitants)	20.37	25.49	0	96.94
Time counter	28.77	15.14	1	54
Number of celebrity suicides overall	8.98	5.93	0	24

N (countries) = 34
N (country years) = 1,547

has increased since then, it is less likely to include people as celebrities if they were active before the 2000s. To control for this potential temporality bias, we include two time controls in all models. *Time counter* measures the number of years from 1960 to 2014 and controls for the fact that a general unobserved linear time-trend may impact both the predictor and the dependent variable. *Number of celebrity suicides overall* is another time-trend control that counts the yearly number of celebrity suicides found in Wikipedia. This controls for the possibility that the number of celebrity suicides, and therefore also their country-specific impact measured via page-link data, rises artificially over time simply because Wikipedia has been increasingly active since the 2000s.

Second, we control for a country change in economic wealth by using its level of *GDP*, measured as the nominal gross domestic product in US dollars with constant exchange rates (source: OECD 2016b). Greater economic wealth is expected to lower suicide rates because economic wealth fosters happiness and generally better health conditions.

Third, we control for demographic change within a country. *Population* is the size of the total population (in 1,000s; source: OECD 2016c). *Urban population rate* is the percentage of the population living in urban areas (source: World Bank 2016a). If a population experiences an increase in size and density, according to Durkheim ([1893] 1964), this could shatter the social order, because given norms and beliefs can change or erode or because increased anonymity gives rise to feelings of anomie. Therefore, within-country increases in population size and density over time should be anomie-inducing factors and should therefore be positively associated with increasing suicide rates.

The next group of variables control further for anomie-induced suicides by taking so-cio-economic conditions into account. *Unemployment rate*, measured as the percentage of unemployed in the civilian labor force (source: OECD 2015a), is used to control for anomie caused by rising unemployment and economic instability (244 cases imputed due to missing data). We expect increases in unemployment to drive the suicide rate in a given population. *Educational stock* is measured as the percentage of the labor force with tertiary education (source: World Bank 2016b; 990 cases imputed because this measure is available only for data from 1990 onwards). We expect education to have a dampening effect on suicide rates – probably because of the beneficial effects of education on well-being (Stam et al. 2016). *Divorce rate* is measured as the number of divorces per 1,000 inhabitants (source: OECD 2016d; 253 cases imputed). We expect an increasing number of divorces in a country to have anomie-inducing effects (Durkheim [1897] 1966). We should therefore see higher suicide rates with increasing divorce rates.

The last two variables control for changes in health and welfare conditions within a country. *Social expenditures* measures the percentage of GDP spent on public services and controls for changes in the welfare system (source: OECD 2015b; 1,245 cases imputed because this measure is mostly available in five-year intervals only). We assume that increases in social expenditures should lower suicide rates. *Antidepressant intake* measures the year-average daily dosage of antidepressant drugs per 1,000 inhabitants (source: OECD 2016e; 1,177 cases imputed because this measure is available mostly from 1985 onwards). Antidepressants are said to improve mental health and therefore to have suicide-reducing effects (Grunebaum et al. 2004; but see Bielefeldt et al. 2009; Stone et al. 2009).

4   Results

Table 2 presents the results of the fixed-effects regressions on suicide rates per country-year. The models show the standardized coefficients. Model 1 includes the main predictor plus the two time-trend controls. Models 2 to 5 each include one set of control variables, and Models 6 to 8 add the controls successively. Model 8 constitutes the full model that includes all control variables.

As can be seen, the main predictor variable is positive and significant across all eight models. Since the independent variables are all lagged by one year, this suggests that prior yearly increases in the country-specific impact of celebrity suicides leads to increases in a population's overall suicide rate in the following year. The effect is small in absolute terms, but, given that the Werther effect and suicides in general are rare events, the effect can be considered relatively strong: the standardized coefficients across all models vary between .009 (Model 1) and .068 (Model 8). The standardized effect in Model 8 is about as large as the effect of the unemployment rate. Therefore, imitation seems to have ef-

Table 2   Country-specific impact of celebrity suicides on annual suicide rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country-specific impact of celebrity suicides$_{t-1}$	0.090* (2.425)	0.088* (2.472)	0.086** (3.007)	0.082* (2.432)	0.085* (2.333)	0.088** (3.019)	0.074** (2.842)	0.068* (2.586)
GDP$_{t-1}$		0.035 (0.949)				-0.147** (-2.817)	-0.135** (-2.794)	-0.088* (-2.354)
Population$_{t-1}$			0.231* (2.461)			0.573** (3.305)	0.818*** (5.903)	0.847*** (6.451)
Urban population rate$_{t-1}$			0.548*** (7.390)			0.530*** (7.017)	0.471*** (7.361)	0.436*** (8.477)
Unemployment rate$_{t-1}$				0.026 (1.407)			0.031 (1.360)	0.063** (2.821)
Educational stock$_{t-1}$				-0.014 (-0.755)			-0.068** (-3.124)	-0.012 (-0.607)
Divorce rate$_{t-1}$				0.258*** (4.238)			0.277*** (5.054)	0.320*** (6.468)
Social expenditures$_{t-1}$					-0.077* (-2.321)			-0.229*** (-7.821)
Antidepressant intake$_{t-1}$					-0.155*** (-3.614)			-0.113*** (-4.475)
Time counter	-0.000 (-0.005)	-0.008 (-0.190)	-0.223*** (-5.099)	-0.121* (-2.490)	0.116* (2.380)	-0.211*** (-4.843)	-0.322*** (-6.164)	-0.223*** (-4.421)
Number of celebrity suicides overall$_{t-1}$	-0.149*** (-4.251)	-0.149*** (-4.299)	-0.131*** (-4.663)	-0.113*** (-3.970)	-0.107** (-3.083)	-0.132*** (-4.668)	-0.089*** (-4.220)	-0.045* (-2.580)
R^2 (within)	0.104	0.105	0.193	0.161	0.139	0.195	0.255	0.303
N (countries)	34	34	34	34	34	34	34	34
N (country-years)	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547

Note: Fixed-effects regression with Driscoll-Kraay standard errors; standardized beta coefficients; t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

fects on suicide rates that are similar to anomie-causing factors like unemployment. The respective unstandardized coefficients (not shown) vary between .004 and .003. That means that each additional page link referring to a celebrity suicide on Wikipedia contributes to an average increase of .004 to .003 suicides in the overall suicide rate. In substantive terms, about 250 (=1/.004) additional yearly country-specific page links are needed to increase the general suicide rate by one person for every 100,000 inhabitants. Since we count an average of about nine celebrity suicides per country-year with an average of 46 country-specific page links, this means that about five (250/46) additional celebrity suicides a year (with an average impact of 46 page links) increase the overall suicide rate by one suicide per 100,000 inhabitants. If a celebrity with a higher impact commits suicide, then the effect is much stronger. For instance, if a global superstar such as Kurt Cobain kills himself (about 500 page links on average for all countries), then this high-impact celebrity alone increases the general rate by an average of about two (500/250) additional suicides per 100,000 inhabitants.

Table 3 replicates Table 2 but includes the four measures of unexpected celebrity deaths in order to provide a stricter test of the anomie theory as proposed in H2. As can be seen from the results, none of the unexpected celebrity death measures show significant effects. At the same time, the country-specific impact of celebrity suicides remains positively significant across all models. This analysis lends support for hypothesis H1 rather than H2, suggesting that imitation theory might be a stronger mechanism.

An additional check tests whether the country-specific impact of celebrity suicides remains robust if we control for increases in the country's prior suicide rate. It could well be that both celebrity suicides and the general suicide rate are affected by a common norm or propensity to commit suicide in a given country-year. Therefore, Table 4 replicates Table 2 with a lagged dependent variable.[6] The inclusion of the lagged dependent variable makes it possible to control for such a norm. Table 4 reveals that the past predicts the future: increases in the prior level of the general suicide rate significantly affect the rise in general suicides in the subsequent year. This pattern could be explained by an increase in the legitimacy of suicide and thus an increasing tendency to mimic this behavior. The greater the number of people who commit suicide, the more this behavior becomes legitimate, which gives rise to an increase in further suicides. At the same time, our main predictor remains positively significant across all models. This suggests that the impact of celebrity suicides on the general suicide rate is not driven by a general propensity to commit suicide within a country-year, as measured by the lagged dependent variable. Celebrity suicides seem to have an independent, direct effect.

Another robustness test further disaggregates the data by gender and age. If imitation theory holds, then the celebrity suicide effect should be stronger especially among younger suicide cohorts, because celebrities might act as stronger role models among

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6   To reduce high levels of collinearity, we include logged values of the lagged dependent variable and drop the time counter from the models.

Table 3 Country-specific impact of celebrity suicides on annual suicide rates: Testing celebrity-related anomie

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country-specific impact of celebrity suicides$_{t-1}$	0.092* (2.382)	0.090* (2.422)	0.088** (2.962)	0.084* (2.405)	0.087* (2.313)	0.090** (2.984)	0.076** (2.834)	0.070* (2.618)
GDP$_{t-1}$		0.035 (0.957)				−0.144** (−2.908)	−0.133** (−2.836)	−0.089* (−2.427)
Population$_{t-1}$			0.227* (2.438)			0.563** (3.414)	0.810*** (6.217)	0.842*** (6.773)
Urban population rate$_{t-1}$			0.548*** (7.406)			0.531*** (7.032)	0.472*** (7.405)	0.437*** (8.581)
Unemployment rate$_{t-1}$				0.024 (1.271)			0.029 (1.254)	0.061* (2.626)
Educational stock$_{t-1}$				−0.013 (−0.680)			−0.066** (−3.067)	−0.011 (−0.543)
Divorce rate$_{t-1}$				0.260*** (4.264)			0.278*** (5.092)	0.321*** (6.485)
Social expenditures$_{t-1}$					−0.075* (−2.233)			−0.227*** (−7.513)
Antidepressant intake$_{t-1}$					−0.153*** (−3.676)			−0.113*** (−4.571)
Time counter	0.010 (0.271)	0.002 (0.057)	−0.216*** (−5.081)	−0.113* (−2.320)	0.121* (2.593)	−0.205*** (−4.819)	−0.316*** (−6.099)	−0.223*** (−4.592)
Number of celebrity suicides overall$_{t-1}$	−0.153*** (−4.407)	−0.152*** (−4.461)	−0.132*** (−4.702)	−0.115*** (−4.049)	−0.111** (−3.120)	−0.133*** (−4.700)	−0.090*** (−4.187)	−0.046* (−2.426)
Celebrity deaths (traffic)$_{t-1}$	0.001 (0.050)	0.000 (0.007)	0.007 (0.592)	0.005 (0.378)	0.002 (0.132)	0.008 (0.616)	0.009 (0.842)	0.011 (1.168)
Celebrity deaths (alcohol)$_{t-1}$	0.015 (0.737)	0.015 (0.732)	0.013 (0.746)	0.013 (0.742)	0.015 (0.888)	0.013 (0.762)	0.010 (0.752)	0.011 (0.943)
Celebrity deaths (pneumonia)$_{t-1}$	−0.016 (−1.055)	−0.017 (−1.083)	−0.013 (−1.013)	−0.014 (−0.985)	−0.011 (−0.869)	−0.013 (−0.978)	−0.012 (−0.995)	−0.003 (−0.266)
Celebrity deaths (airplane crash)$_{t-1}$	0.019 (1.563)	0.019 (1.562)	0.021 (1.701)	0.023 (1.957)	0.015 (1.180)	0.020 (1.647)	0.021 (1.969)	0.016 (1.423)
R^2 (within)	0.107	0.108	0.196	0.165	0.142	0.199	0.259	0.305
N (countries)	34	34	34	34	34	34	34	34
N (country-years)	1,547	1,547	1,547	1,547	1,547	1,547	1,547	1,547

Note: Fixed-effects regression with Driscoll-Kraay standard errors; standardized beta coefficients; t statistics in parentheses; * $p<0.05$, ** $p<0.01$, *** $p<0.001$ (two-tailed tests).

Table 4   Country-specific impact of celebrity suicides on annual suicide rates: Robustness test including lagged dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country-specific impact of celebrity suicides$_{t-1}$	0.050* (2.225)	0.050* (2.202)	0.053* (2.539)	0.048* (2.347)	0.043 (1.909)	0.049* (2.481)	0.042* (2.341)	0.037* (2.040)
Lagged annual suicide rate	0.816*** (9.255)	0.817*** (9.286)	0.809*** (9.219)	0.811*** (9.678)	0.807*** (9.257)	0.841*** (9.806)	0.842*** (10.582)	0.806*** (9.887)
GDP$_{t-1}$		0.037** (2.815)				0.284*** (4.338)	0.339*** (4.578)	0.337*** (4.773)
Population$_{t-1}$			−0.021 (−0.361)			−0.712*** (−3.873)	−0.725*** (−3.372)	−0.610** (−3.009)
Urban population rate$_{t-1}$			0.041 (1.585)			0.036 (1.446)	0.040 (1.576)	0.054* (2.088)
Unemployment rate$_{t-1}$				−0.040* (−2.518)			−0.042* (−2.679)	−0.036* (−2.634)
Educational stock$_{t-1}$				−0.074*** (−5.590)			−0.113*** (−8.036)	−0.076*** (−4.291)
Divorce rate$_{t-1}$				0.136*** (6.247)			0.127*** (5.133)	0.163*** (7.576)
Social expenditures$_{t-1}$					0.009 (0.299)			−0.048 (−1.898)
Antidepressant intake$_{t-1}$					−0.060* (−2.035)			−0.085* (−2.537)
Time counter								
Number of celebrity suicides overall$_{t-1}$	−0.084*** (−4.948)	−0.090*** (−5.058)	−0.095*** (−6.677)	−0.080*** (−4.771)	−0.045* (−2.097)	−0.096*** (−6.529)	−0.082*** (−5.507)	−0.042** (−3.017)
R^2 (within)	0.615	0.616	0.616	0.636	0.621	0.625	0.649	0.659
N (countries)	34	34	34	34	34	34	34	34
N (country-years)	1,523	1,523	1,523	1,523	1,523	1,523	1,523	1,523

Note: Fixed-effects regression with Driscoll-Kraay standard errors; standardized beta coefficients; t statistics in parentheses; * $p<0.05$, ** $p<0.01$, *** $p<0.001$ (two-tailed tests).

Figure 1   Country-specific impact of celebrity suicides on annual suicide rates
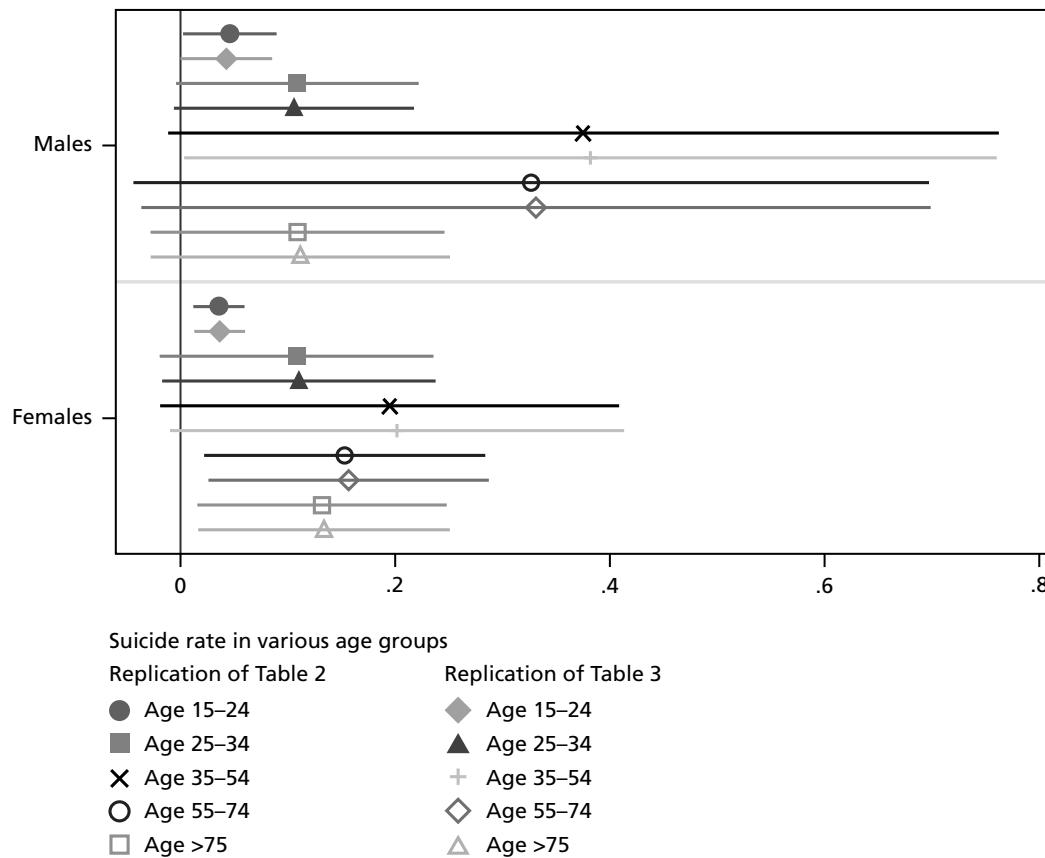
Note: Estimated model coefficients (plus 95 percent confidence intervals) from replication of model 8 in Tables 2 and 3, by suicide age cohorts and gender.

young people. Figure 1 shows estimated coefficients from the replication of the full co-variate model (Model 8) in Tables 2 and 3 using five age cohorts separately for male and female suicide rates as the dependent variable.[7] The figure plots the coefficients plus its 95 percent confidence intervals for the main predictor, the country-specific impact of celebrity suicides. As can be seen, in line with our expectations, the imitative celebrity Werther effect is especially strong (and significant) among the youngest cohorts of both genders. Moreover, an imitation effect can also be seen among females of older age groups (55–75 as well as >75).

Before we conclude, we would like to discuss briefly the results of the control variables, which are very similar in both Tables 2 and 3. Both time-trend controls show negative effects in most of the models. Suicide rates in general have been declining since the 1960s, and the two coefficients support this. As for increases in economic levels, GDP

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7   Age-specific suicide data comes from the WHO World Mortality Database (see http://www.who.int/healthinfo/mortality_data/en/). Unfortunately, in most of the time series, data is missing for the years 1960 to 1979.

shows a negative effect that becomes significant only in Models 6–8. This suggests that economic wealth has a moderate effect on suicidal behavior: increases in economic productivity lowers overall suicide rates.

The two demographic variables are in line with our expectations. Durkheim's anomie theory proposes that within-country changes in population size and density can have an erosive effect on the social order, which should result in anomie-induced increases in suicide rates. Indeed, population size and the size of urban population both show significant positive effects; (urban) population has one of the strongest effects of all the coefficients in the models.

The next three control variables show mixed support with regard to theoretical expectations. The unemployment rate was expected to have a positive effect on suicide rates. It turns out that unemployment is indeed significantly related to suicide rates in the full model (Model 8). This result is supportive of anomie theory. As mentioned above, the effect of the unemployment rate is as large as the effect of celebrity suicides. Educational stock was theorized as having a suicide-decreasing effect. The model results do not support this, because the coefficients show small negative effects that are significant only in Model 7. A result supportive of anomie theory is shown by the divorce-rate control. This measure is positively significant across all models, suggesting that within-country increases in divorce lead to higher suicide rates overall.

The last two variables control for a country's welfare and health status. The results of the regressions are essentially in line with the proposed expectations. If social expenditures in a country increase, a decrease in the suicide rate can be expected. Moreover, the more antidepressants are prescribed, the lower a country's suicide rate is.

5   Conclusions

While a number of previous studies have suggested that celebrity suicides have a positive effect on a population's general suicide rate, inferences about which of the two explanatory mechanisms – anomie or imitation – actually causes suicide remain challenging. For this reason, this study tests the question of whether the Werther effect is triggered by anomie or imitation. It empirically disentangles imitation from anomie by testing the simultaneous effects of status-driven celebrity suicides (as a measure of imitation) and the effects of unexpected celebrity deaths from causes other than suicide (as a measure of anomie) on suicide rates of the general population. It presents a unique method of measuring celebrity status based on Wikipedia page-link data and uses this measurement in a macrocomparative analysis to estimate the country-specific impact of a celebrity's suicide. In addition, it controls for further anomic factors at the societal level that are unrelated to celebrities, such as divorce rates and levels of unemployment.

Our findings suggest support for imitation theory. The analysis shows status effects of celebrity suicides that can be considered evidence for imitative effects. We find that the more page links there are for a celebrity who committed suicide in a given country – that is, the higher the celebrity's country-specific status is – the higher the general suicide rate will be a year after the celebrity's suicide. We estimate that an increase of approximately one suicide per 100,000 inhabitants is linked to about five additional suicides of celebrities with an average impact. For high-impact celebrities (such as Kurt Cobain, with 500 page links on average), the effect is about two additional suicides per 100,000 inhabitants.

Our findings do not directly support anomie theory as a possible mechanism explaining the Werther effect. Unexpected celebrity deaths show no significant effects on the suicide rate throughout all models. However, we do find significant anomie effects that are unrelated to celebrities (and therefore unrelated to the Werther effect), such as divorce rates, urban density, and, to a lesser degree, unemployment. While these results generally suggest that Durkheimian anomic suicide seems to be at work, our study does not support the hypothesis that these anomic effects are caused by celebrity suicides and therefore are not part of the mechanisms that explain the Werther effect. Hence, anomie might be a possible general predictor of suicides in the case of drastic real-world shocks, such as increases in divorce rates, unemployment, or – as Hoffman and Bearman (2015) argue – events such as the Chernobyl disaster or outbreaks of unexpected diseases. When we compare the magnitude of the effects in our analysis, anomic factors such as divorce rates seem to have stronger impacts on suicides than imitative celebrity suicides, while the effect of factors such as unemployment rates or increases in GDP are similar in size.

Our study contributes to prior research in several ways and has implications for future research and policy recommendations. However, it also has some limitations. In terms of theory, we advance prior discussions on the potential mechanisms of the Werther effect by disentangling potential explanatory factors for both imitative and anomic suicidal behavior. Our study also contributes to prior research by presenting an innovative cross-national comparative index of individual celebrity status that makes it possible to estimate the global and local impact of celebrity suicides (via page-link data and language pages in Wikipedia). A call (Wasserman 1984) for such an index remained unanswered for more than 30 years; now it is time to heed this call. By using Wikipedia data, this study makes use of globally available comprehensive online information. Whereas previous work was unable to cover large percentages of the suicide stories published during the time period they examined, the current data mining done with Wikipedia results in a complete coverage of all celebrity suicides between1960 and 2014. In addition, no previous work has covered such a wide time period as the present study.

Further, the study's time-series cross-sectional design has enabled us to include many macrolevel control variables. Most other studies, in contrast, have only controlled for a very limited number of factors (Fu and Yip 2007; Lee et al. 2014; Stack 1987; 1990;

Wasserman 1984). The current study controls for many other potential predictors, such as general versus celebrity-specific degrees of anomie (e.g., divorce rates vs. unexpected celebrity deaths), population variables, welfare-state generosity, and a mental health indicator.

What the results do not reveal, however, is how quickly the suicide rate responds to a celebrity suicide, while previous studies have indicated this effect in terms of months and even weeks (e.g., Lee et al. 2014; Phillips 1974; Stack 1987; Wasserman 1984; Yang et al. 2013; Yip 2006). The literature has often assumed that suicide stories have their largest impact in the two to four weeks following the celebrity suicide (Lee et al. 2014; Wasserman 1984; Yang et al. 2013; Yip 2006), although some Asian studies have also found a longer lasting effect (two to three months in Yip 2006 and six months in Fu and Yip 2007). Our use of yearly suicide data here may therefore inaccurately estimate the effect of celebrity suicides on subsequent suicidality. However, at worst, it would lead to an underestimation of the effect. The fact that we still find an effect despite this caveat suggests that there must be a large and enduring Werther effect.

It is a debatable practice to include a lagged dependent variable, as we have done in our additional analysis. Some argue that this is necessary in order to control for the past suicidal mood or to correct for autocorrelation. However, methodologists have warned about the risk that this practice may underestimate the effect of given variables or over-look a significant result (Plümper, Troeger, and Manow 2005). In our case, we still find a significant and substantial effect (in addition to the main results that leave out this measure). This also contributes to our confidence in the theorized processes.

Finally, it could be that the measured impact of celebrity suicides might actually be the result of an increase in the suicide rate. A sudden increase in the suicide rate shortly after a celebrity suicide can be a shocking and widely broadcast event, and this in turn may increase both the impact of the celebrity's suicide and the subsequent suicide rate. In this case, we are dealing with a potential endogeneity problem. With the data at hand, this possibility cannot be completely ruled out. We cannot see how page links changed before and after the suicide, especially for celebrities who committed suicide before the internet age. Still, the impact of initial imitations of a celebrity suicide on its later impact should not be overrated. There are reasons to expect that the effect is a minor one. To relate a sudden increase in the suicide rate to the suicide of a celebrity means that the celebrity must still be relatively well known from the outset. People and the media will be less likely to associate a rise in the suicide rate with the suicide of a "forgotten" celebrity, for example. Moreover, the extent to which a celebrity's recognition will be elevated by their suicide will be limited, because media coverage of the suicide will be proportional to the celebrity's current impact.

We can never be fully sure of what exactly drives people to commit suicide, be it the death of a celebrity, a recent increase in the general suicide rate, or other factors. Future research, based on micro-level data, could explore this issue more deeply. People's real

reasons are often hidden deep within them. Future research could further exploit online data to learn more about these processes of diffusion and imitation and to shed light on people's motives for ending their lives. Data mining of online forums on suicide, where people share their motives, give preventive peer support, or encourage suicide, could provide a rich database for further research on this issue.

It is interesting that the increase in the number of celebrity suicides between 1960 and 2014 is correlated with an overall decline in suicidality. However, this effect might be the result of a possible measurement error. Due to nonexistence of Wikipedia in the 1960s and 1970s, the number of celebrities could be underestimated for that period. For this reason, we have treated this variable as a general time-trend control (which controls for changes in Wikipedia contributions, for example) rather than a substantive effect.

When the media publicizes information about celebrity suicides, it may also provide information about support services. When the degree of identification with the celebrity is relatively low, the suicide-prevention effect of exposure to such information can outweigh the imitation effect of the suicide. If, in contrast, the celebrity concerned happens to have a high status, the suicide-enhancing effect of their suicide will outweigh the preventive effect of information about services.

Therefore, our results may provide relevant suggestions for further improvement of the World Health Organization's guidelines (WHO 2008) on safe and responsible media reporting of suicides. Future research should look into this suggestion more closely. Another policy recommendation that we derive from our results is that suicide intervention programs should increase their efforts after a famous person commits suicide. This would enhance the efficiency of those programs and probably save lives.

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