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Internet suicide searches and the incidence of suicide in young people in Japan

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Abstract Although several case reports have suggested a relationship between accessing Internet suicide sites and the incidence of suicide, the influence of the Internet on the incidence of suicide is not known. Thus, we examined the association between Internet suicide-related searches and the incidence of suicide in 20- and 30-year-old individuals in Japan. The Box–Jenkins transfer function model was applied to monthly time series data from January 2004 to May 2010 (77 months). The terms "hydrogen sulfide," "hydrogen sulfide suicide," and "suicide hydrogen sulfide suicide" at (t-11) were related to the incidence of suicide among people aged in their 20 s ($P = 0.005$, 0.005, and 0.006, respectively) and people aged in their 30 s ($P = 0.013$, 0.011, and 0.012, respectively). "BBS on suicide" at (t-5) and "suicide by jumping" at (t-6) were related to the incidence of suicide in people aged 30–39 ($P = 0.006$ and 0.001, respectively). Internet searches for specific suicide-related terms are related to the incidence of suicide among 20- and 30-year-old individuals in Japan. Routine interrogation by a clinician about visiting Internet suicide websites and stricter regulation of these websites may reduce the incidence of suicide among young people.

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Introduction

Internet websites and chat rooms provide detailed information on suicide. An increasing number of websites graphically describe various types of suicide methods, including the lethal doses of medications [7]. It has been argued that the Internet may have a more direct influence on copycat suicides than do the print media [5, 7]. Indeed, suicide-related Internet sites have proliferated in Japan, and more than 600,000 Japanese sites have provided information on potential methods for suicide [15] since the *Suicide Manual*, which illustrates suicide methods, was published on July 4, 1993 [29]. Several cases suggesting an association between visits to Internet suicide sites or chat rooms and actual suicides have been reported [1, 2, 6, 7]. For example, on February 11, 2003, a 17-year-old high school senior committed suicide by carbon monoxide poisoning using a briquette. Since 2003, incidents in which young people who meet for the first time via the Internet and commit suicide as a group have been reported frequently [22]. On February 17, 2008, three young people were reported to have met for the first time via the Internet and to have committed suicide as a group using hydrogen sulfide [4, 14]. This event resulted in increased interest in Internet sites that provide information about committing suicide using hydrogen sulfide (Fig. 1).

Although these findings suggest that visits to Internet sites and chat rooms that support suicide are associated with an increased incidence of suicide, these conclusions are based only on anecdotal evidence. Empirical evidence of an association between suicide and Internet use

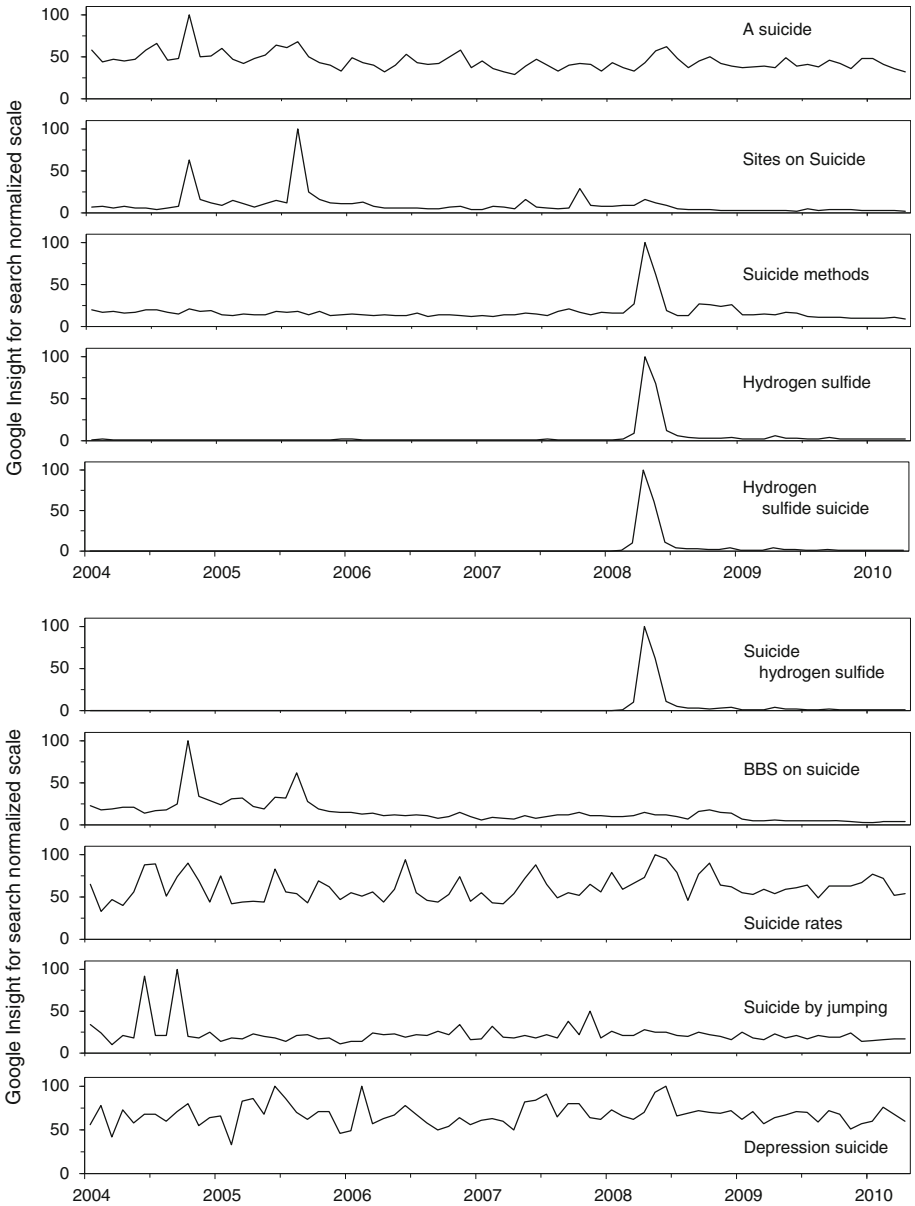

Fig. 1 Top 10 suicide-related query terms in the Google search engine. Monthly variations in the number of top 10 suicide-related query terms in the Google Internet search engine between January 2004 and May 2010 in Japan. The data have been normalized between 0 and 100, such that the highest value during the period is equivalent to 100 and 0 is equivalent to 0

in specific age groups has not been reported [7, 18, 24, 26]. A quantitative evaluation of the association between access to Internet suicide sites and the incidence of suicide may help in the prevention of suicide. However, such quantitative studies have been difficult to perform primarily because data on specific Internet searches have not been available. This problem was overcome in the present study because data on suicide queries from January 2004 to the present have recently been made available via the "Google Insights for Search" [11, 12]. Our findings will be useful to clinicians who evaluate suicide risk and will contribute to the ongoing discussion in many countries concerning the regulation of suicide-related websites [18].

Methods

Study period

The study period was January 2004 through May 2010 (77 months).

Data collection

Monthly suicide statistics for people aged 20–29 and 30–39 from 2004 to 2010 were obtained from the Vital and Health Statistics summary published by the Statistics and Information Department of the Japanese Ministry of Health, Labour and Welfare [25]. When a person dies, the law

requires that a death certificate that includes the time, date, and cause of death be issued by a medical doctor or a coroner. The information provided by the Vital and Health Statistics summary is based on death certificates.

The monthly figures for suicide-related searches in the "Google Insights for Search" were used in our analyses. When a key word [i.e., "*jisatsu*" (suicide)] along with the search period is entered in "Google Insights for Search," the top 20 search terms related to the key word entered by Internet users during the search period are shown in descending order of search frequency. Yet, the way in which this system identified suicide-related words is crucial to the integrity of any findings deriving from this process. Indeed, query terms frequently have multiple meanings. As will be shown, "hydrogen sulfide" was the fourth most popular suicide-related search between January 2004 and May 2010, and hydrogen sulfide was identified as a suicide-related key word in the present study. However, such query terms may be used to seek chemical, suicide-related, or other information. In this case, the overall query patterns of users seeking chemistry-related information, suicide-related information, and other information were compared. If users seeking suicide-related information entered hydrogen sulfide as a query term, it is highly probable that they would have entered other suicide-related terms immediately before or after hydrogen sulfide. Based on the overall patterns of queries, the system categorized this term as suicide-related. Thus, the system identified suicide-related terms during a specified period in a specified area. The top 20 search terms related to the query terms are shown [13]. Normalized time series data for the top 20 search terms were also available. The data are displayed on a scale of 0–100 after normalization; each point on the graph has been divided by the highest point (i.e., 100). For example, when interest in the term "suicide methods" (*"jisatsu houhou"*) surged in November 2008, the system designated the peak as 100. When interest decreased significantly in December to approximately half of that of November, the level was designated as 50 [13]. We treated the time series data for the top 10 suicide-related query terms (i.e., the 10 suicide-related query terms that were searched most frequently) as variables. The logic behind using Google as the data source for Internet searches was as follows. In Japan, the market share of the Google search engine is second to that of the Yahoo search engine [10]. However, time series data on specific Internet searches are available only from Google, and the data available from Yahoo are very limited (e.g., the top 10 query terms) [28]. Thus, we used the time series data from "Google Insights for Search." To verify information-seeking trends in both Google and Yahoo, we compared the top 10 query terms entered into these two search engines. Because we obtained the same results from both search engines, we believe that the Google data were the most appropriate data available to answer the research question.

Data analysis

Statistical analysis

We used the Box–Jenkins transfer function model to assess the relationship between two time series (i.e., monthly variations in Internet suicide-related searches and the number of suicide cases per month) from January 2004 to May 2010 ($n = 77$ months) [20, 23, 27]. Ten types of normalized time series data were individually entered into a model for the top 10 search terms. The output and input variables for the transfer function model were the number of suicide cases per month (y_t) and the frequency of suicide-related term searches per month (x_t), respectively. It was assumed that the output variable (y_t) was composed of two functions: u_t, which could be explained in terms of the input explanatory variable (x_t), and n_t an error or noise factor that describes the unexplained aspect of y_t. The explained aspect (u_t) is given as a weighted sum of the present and past values of x_t (i.e., $u_t = v_1 x_t + v_2 x_{t-1} + \ldots$), whereas n_t is an autoregressive integrated moving average (ARIMA).

Briefly, the first step in the analysis was to make the series stationary. According to Jenkins [23], a power or logarithmic transformation is recommended to stabilize the variance if it is related to the mean. Additionally, we performed differencing and/or seasonal differencing on the transformed time series. The stationarity of the time series data was verified by checking the plots of the autocorrelation functions (ACF) and the augmented Dickey–Fuller test [9, 19]. After selecting the appropriate transformation and differencing methods, a univariate ARIMA model was created for each input (x_t) and output (y_t) series. A prewhitening procedure (i.e., obtaining the appropriate univariate model for each time series involved by removing autocorrelation) was applied to the univariate models of the input series in the next step. An ACF, partial autocorrelation function (PACF), and inverse autocorrelation function (IACF) were used to assess model parameter appropriateness and seasonality. The model residuals were checked by autocorrelations at various lags using the Ljung–Box chi-square statistic to confirm white noise [9, 21]. In the third step of the analysis, the relationship between the input (x_{t-b}) and output (y_t) series was determined using a cross-correlation function (CCF). The CCF determined the correlation between the two time series as a function of the time shift (b). All p-values were two-sided, and the analyses were conducted using the PROC ARIMA procedures included in SAS (version 8.2, Cary, NC, USA).

Table 1 Variables used in ARIMA transfer function models

Variables	Mean ± SD	Range
Top 10 suicide-related query terms		
A suicide	45.18 ± 10.59	29.00–100.00
Sites on suicide	9.47 ± 13.17	2.00–100.00
Suicide methods	17.17 ± 11.62	9.00–100.00
Hydrogen sulfide	4.01 ± 13.52	1.00–100.00
Hydrogen sulfide suicide	2.91 ± 13.27	0.00–100.00
Suicide hydrogen sulfide	2.94 ± 13.33	0.00–100.00
Bulletin board system (BBC) on suicide	15.10 ± 13.73	3.00–100.00
Suicide rates	61.17 ± 15.10	33.00–100.00
Suicide by jumping	22.81 ± 13.41	10.00–100.00
Depression suicide	67.81 ± 12.70	33.00–100.00
Monthly number of the suicides		
20–29 age group	260.00 ± 24.88	220.00–325.00
30–39 age group	359.65 ± 32.32	300.00–456.00

Results

The top 10 suicide-related search terms from the Google search engine between January 2004 and May 2010 in Japan were as follows: 1. "A suicide" (*jisatsusya*); 2. "Sites on suicide" (*jisatsu saito*); 3. "Suicide methods" (*jisatsu houhou*); 4. "Hydrogen sulfide" (*ryukasuiso*); 5. "Hydrogen sulfide suicide" (*ryukasuiso jisatsu*); 6. "Suicide hydrogen sulfide" (*jisatsu ryukasuiso*); 7. "Bulletin board system (BBS) on suicide" (*jisatsu keijiban*); 8. "Suicide rates" (*jisatsu ritsu*); 9. "Suicide by jumping" (*tobiori jisatsu*); and 10. "Depression suicide" (*utsu jisatsu*). A suicide ("*jisatsusya*") referred to a person who committed suicide. The variables used in this study are summarized in Table 1. Monthly variations in the top 10 suicide-related search terms and the number of suicides between January 2004 and May 2010 are shown in Figs. 1 and 2. Of the top 10 suicide-related queries terms, depression suicide, suicide rates, and a suicide received the highest number of queries per month. The terms that had the fewest queries were hydrogen sulfide, hydrogen sulfide suicide, and suicide hydrogen sulfide (Table 1). The monthly variations in the frequency of queries for these three terms were similar throughout the study period (Fig. 2).

Table 2 shows the results of the ARIMA transfer function model analyses. One type of input (x_t) series (i.e., sites on suicide) was not stationary. Thus, this type of time series data underwent log transformation. Additionally, first-order differencing was introduced to every input (x_t) and output (y_t) series. Additionally, when necessary, first-order and seasonal differencing with a span of 12 months were introduced to the input (x_t) and output (y_t) series. As a result, the stationarity of the series was verified by the augmented Dickey–Fuller test. Next, univariate models for the input (x_t) and output (y_t) series were prewhitened using a prewhitening filter and cross-correlated. Because x_t was hypothesized to be a predictor of y_t, cross-correlation with negative lags (leads) (i.e., time shift (b) <0) contradicts this hypothesis. Thus, when a model showed cross-correlation with negative lags (leads), the result of analysis based on the corresponding model is indicated by "no effective model" in Table 2.

Table 2 shows the results of the conditional least squares estimation and estimation procedures. We found that three search terms were related to the number of suicides in both age groups: hydrogen sulfide at (t-11) (i.e., with a time shift (b) of 11 months), 20 s ($P = 0.005$) and 30 s ($P = 0.013$); hydrogen sulfide suicide at (t-11), 20 s ($P = 0.005$) and 30 s ($P = 0.011$); and suicide hydrogen sulfide at (t-11), 20 s ($P = 0.006$) and 30 s ($P = 0.012$). BBS on suicide at (t-5) (i.e., with a time shift (b) of 5 months) was related to the incidence of suicide only in the 30–39-year-old group ($P = 0.006$). Suicide by jumping

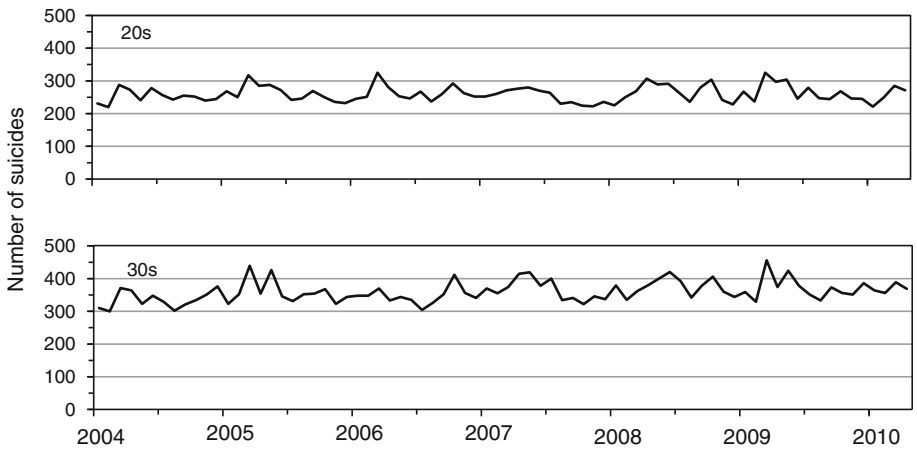

Fig. 2 Monthly number of suicide cases in people aged 20–39. The number of suicide cases per month in people 20–29 and 30–39 years old between January 2004 and May 2010 in Japan

Table 2 ARIMA regression of the monthly suicide incidence (January 2004–May 2010) from the Internet search engine query data

	20–29 age group				30–39 age group		
	B	SE	*P*		*β*	SE	*P*
A suicide							
ARIMA (1, 1, 1) $(0, 1, 0)_{12}$				ARIMA (1, 1, 1)			
Moving average (lag 1)	0.972	0.035	<0.0001	Moving average (lag 1)	0.939	0.046	<0.0001
Autoregression (lag 1)	0.419	0.137	0.003	Autoregression (lag 1)	0.217	0.132	0.105
Term query (shift 7)	0.501	0.287	0.087	Term query (shift 4)	0.113	0.394	0.776
Sites on suicide[a]							
ARIMA (0, 1, 1) $(1, 1, 0)_{12}$				ARIMA (0, 1, 1) $(1, 1, 0)_{12}$			
Moving average (lag 1)				Moving average (lag 1)			
Seasonal autoregression (lag 12)	(no effective model)			Seasonal autoregression (lag 12)	(no effective model)		
Term query				Term query			
Suicide methods							
ARIMA (1, 1, 1)				ARIMA (0, 1, 1) $(0, 1, 1)_{12}$			
Moving average (lag 1)	0.965	0.036	<0.0001	Moving average (lag 1)	0.657	0.110	<0.0001
Autoregression (lag 1)	0.421	0.128	0.002	Seasonal moving average (lag 12)	0.647	0.126	<0.0001
Term query (shift 11)	−0.340	0.293	0.249	Term query (shift 13)	0.249	0.355	0.487
Hydrogen sulfide							
ARIMA (1, 1, 1)				ARIMA (1, 1, 2)			
Moving average (lag 1)	0.970	0.033	<0.0001	Moving average (lag 2)	0.733	0.115	<0.0001
Autoregression (lag 1)	0.384	0.128	0.004	Autoregression (lag 1)	−0.849	0.089	<0.0001
Term query (shift 11)	0.694	0.239	0.005	Term query (shift 11)	0.697	0.272	0.013
Hydrogen sulfide suicide							
ARIMA (1, 1, 1)				ARIMA (0, 1, 1)			
Moving average (lag 1)	0.970	0.033	<0.0001	Moving average (lag 1)	0.855	0.066	<0.0001
Autoregression (lag 1)	0.390	0.128	0.004				
Term query (shift 11)	0.706	0.244	0.005	Term query (shift 11)	0.716	0.274	0.011
Suicide hydrogen sulfide							
ARIMA (1, 1, 1)				ARIMA (0, 1, 1)			
Moving average (lag 1)	0.970	0.033	<0.0001	Moving average (lag 1)	0.855	0.066	<0.0001
Autoregression (lag 1)	0.388	0.128	0.004				
Term query (shift 11)	0.700	0.243	0.006	Term query (shift 11)	0.711	0.273	0.012
Bulletin Board System(BBS) on suicide							
ARIMA (1, 1, 1) $(0, 1, 0)_{12}$				ARIMA (0, 1, 1)			
Moving average (lag 1)				Moving average (lag 1)	1.000	0.024	<0.0001
Autoregression (lag 1)	(no effective model)			Autoregression (lag 1)	0.243	0.123	0.052
Term query				Term query (shift 5)	0.879	0.310	0.006
Suicide rates							
ARIMA $(0, 1, 1)(0, 1, 1)_{12}$				ARIMA (0, 1, 1) $(0, 1, 1)_{12}$			
Moving average (lag 1)	0.503	0.123	<0.0001	Moving average (lag 1)			
Seasonal moving average (lag 12)	0.757	0.126	<0.0001	Seasonal moving average (lag 12)	(no effective model)		
Term query (shift 5)	0.284	0.207	0.177	Term query			
Suicide by jumping							
ARIMA (1, 1, 1) $(0, 1, 0)_{12}$				ARIMA (0, 1, 1)			
Moving average (lag 1)				Moving average (lag 1)	0.889	0.058	<0.0001
Autoregression (lag 1)	(no effective model)						
Term query				Term query (shift 6)	0.894	0.256	0.001
Depression suicide							
ARIMA (1, 1, 1) $(0, 1, 0)_{12}$				ARIMA (0, 1, 1)			
Moving average (lag 1)				Moving average (lag 1)			
Autoregression (lag 1)	(no effective model)			Autoregression (lag 1)	(no effective model)		
Term query				Term query (shift 6)			

[a] Log-transformed

at (t-6) (i.e., with a time shift (b) of 6 months) was also related to the incidence of suicide only in the 30–39-year-old group ($P = 0.001$). We will explain these findings using the terms hydrogen sulfide and suicide hydrogen sulfide as examples. An increase by 10 units in the frequency of queries about hydrogen sulfide was related to 6.94 and 6.97 additional suicide cases approximately 11 months after people in their 20 and 30 s, respectively, performed an Internet search using this term. An increase by 10 units in the frequency of queries about suicide hydrogen sulfide was related to 7.00 and 7.11 additional suicide cases approximately 11 months after people in their 20 and 30 s, respectively, performed an Internet search using this term.

The other suicide-related search terms were not correlated with the incidence of suicide in individuals aged in their 20 and 30 s. To evaluate the adequacy of the models in Table 2, the ACF of the residuals and the CCF between the explanatory variables and the residuals were checked. No evidence of model inadequacy was found.

Discussion

Several important findings were obtained in the present study. The Internet search terms hydrogen sulfide, hydrogen sulfide suicide, and suicide hydrogen sulfide were significantly related to the incidence of suicide among young people in their 20 and 30 s approximately 11 months following the Internet search (Table 2). The terms bulletin board system (BBS) on suicide and suicide by jumping were related to the incidence of suicide approximately 5 and 6 months following the Internet search in the 30–39-year-old group, respectively (Table 2). Previous findings based on case reports and qualitative data have suggested that Internet searches were related to the incidence of suicide in young people [7, 18, 24]. The present study provides the first quantitative evidence for a link between Internet searches and suicide at the population level.

We found that the search terms bulletin board system (BBS) on suicide and suicide by jumping were related to suicide in people aged 30–39 and that the time lags were 5 and 6 months, respectively (Table 2). The age difference observed in our study may be partly attributable to a higher incidence of poor mental health or isolation among those in their 30 s, as indicated by other data. For example, in July 2010, the Cabinet Office of the Government of Japan published the results of a survey on *hikikomori* (i.e., the state of staying in one's own room and having no contact with others) among young people [8]. *Hikikomori* is defined as the state of (1) seldom leaving one's own room; (2) leaving one's own room, but seldom going out of the house; (3) never going out of the house, except for trips to the nearest convenience store; or (4) never going out of the house, except to pursue a hobby [8]. It was estimated that 696,000 people in Japan were experiencing a state of *hikikomori* and that half of these were in their 30 s [8]. Furthermore, the number of individuals receiving workers' compensation due to mental stress was highest among those in their 30 s in 2009 [16].

Additionally, according to the Fire and Disaster Management Agency of Japan, the number of suicides between January and November 2008 involving hydrogen sulfide exceeded 1,000, which was 35 times greater than the number (29 cases) reported for a comparable period in 2007 [14]. Thus, previous and present findings establish a link between Internet searches for specific suicide-related terms such as hydrogen sulfide, hydrogen sulfide suicide, and suicide hydrogen sulfide and the incidence of suicide in Japan. However, the reason for the 11-, 5-, and 6-month time lags remains unclear because the present findings were based on a correlational study.

The present study has several practical implications. First, Internet suicide searches may be an early indicator of the risk for suicide among Japanese individuals in their 20 and 30 s in Japan. This study's finding of the dramatic rise in the use of terms that lead to specific methods for committing suicide (i.e., hydrogen sulfide, hydrogen sulfide suicide, and suicide hydrogen sulfide) may become clinically relevant if clinicians were to routinely ask young people about Internet use, visits to suicide-related websites, and query terms when evaluating suicide risk.

Second, the ethical questions raised by as well as the legal legitimacy and technical feasibility of regulating suicide-related websites are under discussion in many countries [18]. However, only the link between Internet searches and suicidal acts has been supported by empirical data, and no confirmation of an association between accessing Internet suicide sites and suicide attempts has been provided. Thus, legal and ethical concerns demand that restrictions on suicide sites be voluntary [18]. The present study found an association between Internet searches related to hydrogen sulfide and the incidence of suicide among Japanese men and women aged 20–29 and 30–39 years. We believe this finding has practical implications for the stricter regulation of suicide-related websites, which may reduce the incidence of suicide among young people.

The present study had several limitations. First, we had suicide-related data only for men and women in their 20 and 30 s and not for suicide victims who used a specific method. It is clear that the proportion of suicides relying on a specific method, such as hydrogen sulfide, constitutes a fraction of all suicides committed by people in their 20 and 30 s. If hydrogen sulfide-related Internet searches were related to

hydrogen sulfide-related suicides, we would expect to see a strong association between Internet searches and suicides caused by hydrogen sulfide. Conversely, an analysis of suicides in which hydrogen sulfide was not used should show no association with hydrogen sulfide-related Internet searches. Such studies may strengthen the conclusions of the present report. Second, the use of Google to search for websites may lack specificity. Many people may conduct Internet searches related to an event that was highly publicized in newspapers, the radio, or TV. Thus, engagement in Internet searches is not the same as engaging in suicidal ideation or activities. Third, we used the frequency of queries per month to assess the number of searches for suicide-related terms because this measure has been reported to be highly accurate [11]. However, the Internet search data were normalized so that the highest value was equivalent to 100; thus, we do not know either the actual values or the number of additional suicide cases that were related to the unit frequency (e.g., 10,000 times) of Internet suicide-related searches [12, 13]. Fourth, the model we used did not consider other possible or known risk factors for suicide such as increased alcohol use, drug use, domestic violence, or inadequate mental health care [3, 17]. However, we used the ARIMA transfer function model because it produces the most reliable assessment of time series data for evaluating the relationship between two time series at the population level. The Box–Jenkins transfer function models are well suited for this purpose and provide rigorous tests of association. Our findings should be confirmed by future studies based on different models that include other relevant variables.

In conclusion, the results of the present study showed that (1) Internet searches using the terms hydrogen sulfide, hydrogen sulfide suicide, and suicide hydrogen sulfide at (*t*-11) were significantly related to the incidence of suicide among individuals 20–39 years old. (2) Internet searches using the terms BBS on suicide at (*t*-5) and suicide by jumping at (*t*-6) were significantly associated with the incidence of suicide among people in their 30 s. This study was the first to show that Internet searches for specific suicide-related terms were related to a subsequent increase in the incidence of suicide in people 20–39 years old.

Conflict of interest None.

References

1. Alao AO, Yolles JC, Armenta W (1999) Cybersuicide: the Internet and suicide. Am J Psychiat 156:1836–1837
2. Alao AO, Soderberg M, Pohl E, Alao AL (2006) Cybersuicide: review of the role of the Internet on suicide. CyberPsychol Behav 9:489–493
3. Altamura AC, Dell'Osso B, Berlin HA, Buoli M, Bassetti R, Mundo E (2010) Duration of untreated illness and suicide in bipolar disorder: a naturalistic study. Eur Arch Psychiatry Clin Neurosci 260:385–391
4. Asahi Shimbun (Tokyo Head Office), Asahi Shimbun (newspaper), February 18, 2008, morning edition, p 34
5. Baume P, Cantor CH, Rolfe A (1997) Cybersuicide: the role interactive suicide notes on the Internet. Crisis 18:73–79
6. Becker K, Mayer M, Nagenborg M, El-Faddagh M, Schmidt MH (2004) Parasuicide online: can suicide websites trigger suicidal behaviors in predisposed adolescents? Nord J Psychiat 58:111–114
7. Becker K, Schmidt MS (2004) Internet chat rooms and suicide. J Am Acad Child Psy 43:246–247
8. The Cabinet Office, Government of Japan. A survey report on hikikomori. Tokyo, The Cabinet Office, Government of Japan, July, 2010
9. Chetwynd J, Coope P, Brodie RJ, Wells E (1988) Impact of cigarette advertising on aggregate demand for cigarettes in New Zealand. Brit J Addict 83:409–414
10. GA-Pro Search engine and portal sites share ranking in Japan at March 11, 2010. Available: http://www.webcreate.ga-pro.com/search.html. Accessed 11 Mar 2010
11. Ginsberg J, Mohebbi MH, Patel RS, Brammer L, Smolinski MS, Brilliant L (2009) Detecting influenza epidemics using search engine query data. Nature 457:1012–1015
12. Google Insights for Search. Available: http://www.google.com/insights/search/#. Accessed 10 Oct 2009
13. Google Insights for Search. How is the data scaled? Available: http://www.google.com/support/insights/bin/answer.py?answer=87282&cbid=-1alf1kky849f9&src=cb&lev=answer. Accessed 10 Oct 2009
14. Jiji Press Ltd The number of suicides by hydrogen sulfide between January and November, 2008 exceeds 1,000 (Jiji Press Internet news delivered at 14:34, 11 Dec 2008)
15. Jisatsu-houhou (Methods for committing suicide). Available: http://www.google.com/insights/search/#. Accessed 12 Dec 2008
16. Mainichi Shimbun (Tokyo Head Office), Mainichi Shimbun (newspaper) June 8, 2009, morning edition, p 33
17. Mergl R, Havers I, Althaus D, Rihmer Z, Schmidtke A, Lehfeld H, Nikkewski G, Hegerl U (2010) Seasonality of suicide attempts: association with gender. Eur Arch Psychiatry Clin Neurosci 260:393–400
18. Mishara BL, Weisstub DN (2007) Ethical, legal, and practical issues in the control and regulation of suicide promotion and assistance over the Internet. Suicide Life-Threatening Behav 37:58–64
19. Parsons LJ, Schultz RL (1976) Marketing models and econometric research. American Elsevier publishing company, Inc, NY, pp 88–167
20. Pindyck RS (1989) Rubinfeld DL. Econometric models and econometric forecasts. Irwin/McGraw-Hill, Boston
21. Radfar M The effect of advertising on total consumption of cigarettes in the UK
22. Rajagopal S (2004) Suicide pacts and the Internet. BMJ 329:1298–1299
23. Institute SAS (1993) Inc. SAS/ETS user's guide. SAS Institute Inc, Cary, NC
24. Sher L, Vilens A (2009) (eds) Internet and suicide. Nova Science, New York
25. Statistics and Information Department, Minister's secretariat. ministry of health, labour and welfare, vital statistics of Japan (Ministry of Health, Labour and Welfare, Tokyo), 2002. Available: http://www.mhlw.go.jp/toukei/saikin/old/k-jinkou.html. Accessed 19 Dec 2008. [in Japanese]

26. Summerskill B (2009) Online social networks and wellbeing. Lancet 374:514
27. Yaffee R, McGee M. Introduction to time series analysis and forecasting with applications of SAS and SPSS. San Diego, CA: Academic Press, 2000:425–466
28. Yahoo Japan. Search ranking. Available: http://searchranking.yahoo.co.jp/. Accessed 11 Mar 2010
29. Yoshida K (1993) Suicides and mass media. Kikan-Seishinka-Shindan-Gaku. 4:185–93. [in Japanese]