

Online Community and Suicide Prevention: Investigating the Linguistic Cues and Reply Bias

Hsiao-Ying Huang

Illinois Informatics Institute
University of Illinois at Urbana-Champaign
hhuang65@illinois.edu

Masooda Bashir

Graduate School of Library and Information Science
University of Illinois at Urbana-Champaign
mnb@illinois.edu

ABSTRACT

With the rise of Internet technology over the past decade, a new approach to suicide prevention shifts focus to online communities. However, due to the various and dynamic ecosystems of an online community, its effects on suicide prevention remain largely unknown. To investigate this issue, we use linguistic analysis and selected SuicideWatch, a forum on reddit as our research context and investigated whether an online crowd may have reply bias to users who post about suicide. Our findings indicate an important phenomenon that users' replies could be biased by linguistic cues given in the title of posts. The findings and approach proposed in this study offer insights for developing innovative online approaches to suicide prevention.

Author Keywords

crowdsourcing; online forum; mental health; signal

ACM Classification Keywords

H.5.3. Group and Organization Interfaces; Asynchronous interaction; Web-based interaction

INTRODUCTION

Suicide remains a serious public health issue worldwide. According to the World Health Organization [25], suicide is the fifteenth leading cause of death generally and the second leading cause of death among young people (15-29). More than 800,000 individuals are a victim of suicide and countless others everyday attempt suicide. Although national efforts have been made to reduce suicide risk, evidence for effective suicide intervention remains limited in clinical and school contexts [21]. A comprehensive strategy for suicide prevention is urgently needed.

Significantly, the rapid growth of Internet technology makes suicide an even more complicated issue. The increasing use of online media may have either positive or negative influences on users, especially for vulnerable individuals [5]. Several studies indicated that online users could search information for suicide methods [1,9,18], look for suicide pacts [19], or broadcast their suicide [4] online. On the other hand, online communities could function as support groups and bring positive outcomes for individuals

with suicidal thoughts or attempts [3,10,11,12,24]. Moreover, the anonymity afforded by online communities makes suicidal individuals more open to disclose personal feelings and experiences [5,24]. Thus the online community could become a new venue for suicide prevention.

While previous studies addressed a range of benefits for using an online community as a tool for suicide prevention, its effect on users remains unknown. The variety and anonymity of the online community makes it even more difficult to assess the influence of online replies on individuals, such as the level of distress alleviation and emotional state [5,21]. In addition, unlike traditional telephone communication, which provides immediate conversation, the online community typically facilitates asynchronous discussion. The question becomes, will individuals receive different levels of attention when posting to an online community?

To explore these issues, we focus on a forum on reddit called "SuicideWatch" as our research context. SuicideWatch (SW) is described as an online version of a telephone crisis hotline [13], which is also the largest community (40,419 subscribers) among suicide-related forums on reddit. Users on SuicideWatch may post their thoughts on suicide or scroll through others' posts and comments and either "upvote" or "downvote" them. In light of the text-based content of the forum, we employ linguistic analysis as our research approach, which has been broadly adopted in suicide-related research [6].

The aim of this study is to investigate whether users have reply bias to the language used in posts. We assess the correlation among linguistic cues, the number of upvotes, and comments. Our research question is addressed as follows:

RQ: What type of linguistic cues from the original post may influence users' replies to the post?

The remainder of this paper is organized as follows: in the Related Work section, we review the relevant literature pertaining to online community and suicide prevention by linguistic analysis. In the Methodology section, we present our research procedure and measurements. We then present our results and discuss the findings and its applications and limitations. We conclude and summarize the contributions of this study.

RELATED WORK

The online community becomes a place where users participate via personal narratives and collective discussions [5]. For individuals with suicidal ideation, the online community offers a space to develop connections with others, seek empathy and support, and share feelings and experiences with people who share similar problems without being judged [3,12,22,24]. However, there was no consensus on whether support from online communities enhance suicide prevention or not [15].

Several studies found that participation in an online community increases positive behaviors, such as seeking medical professionals for help, reciprocal help among users, and alleviation of psychological distress [2,12,17,22]. However, other studies found that online communities become a source for sharing suicide methods, finding suicidal company, and increasing hopelessness that may result in suicide contagion [7,14,16].

Although the influence of an online community on suicide prevention remains unclear, researchers found that the majority of online replies to suicidal posts show caring, empathy, or calls for help [8]. Gilat, Tobin & Shahar [10,11] further found that trained volunteers and lay individuals exhibited different strategies to offer support. Volunteers used more techniques and responded with more strategies of empowerment, interpretation, and cognitive change, which were rarely used by lay individuals. On the other hand, lay individuals used more emotional support by disclosing personal experiences in their replies.

These studies provide different insights on suicide prevention and the online community, including its positive and negative effects, and language strategies adopted by users. The online community, unlike a traditional and immediate-response telephone crisis line mainly operates in an asynchronous way. Does any potential bias exist to influence users' replies to suicidal posts? Our research question aims to investigate what types of linguistic cues, that are shown in suicidal posts, may influence users' reply behaviors, including voting and comments.

METHODOLOGY

Data Collection and Procedure

We used reddit's official API to collect posts, comments, and relevant metadata from the subreddit "SuicideWatch". The crawl of the subreddit in this study is employed from 22 to 23 November 2015 and the timeframe for collected post is from 4 to 22 November in 2015. The procedure of data collection includes three aspects: original post, comment, and users. For original post, we collect the title and content of the post, username, posting date, number of comments, and number of upvote and downvote. For each post, we record if the original subject posting responds to his/her own post, which is termed as "responsive post". We also document the average reply time to the initial post. For comment, we collected the content of the comment,

username, date, number of upvote and downvote. We further categorized comments into four types: self-reply, reply to respondent, the first respondent, and secondary respondent. We then divided users into two categories: users who post about suicide and users who respond to the suicidal post. After completing data collection, the researchers examined the data and deleted two administrator posts generated by the board manager and its relevant comments. The details of the data are exhibited in Table 1.

Total Original Post	977
Responsive posts	523 (53.5%)
Non-responsive posts	454 (46.5%)
Total Comment	4990
Self-reply	20 (0.4%)
Reply to respondent	1633 (32.7%)
First respondent	902 (18.1%)
Secondary respondent	2485 (48.8%)
Unique users	1647
Users who post about suicide	893
Users who respond to suicidal post	754
Average Daily Original Post	51.42
Average Comment	7.47 (SD=5.36)
Average Upvote	4.89 (SD=6.57)
Average Downvote	0
Average Reply Time to Initial Post	1.94 hours (SD=4.63)

Table 1. General Information of Data.

Measurement

Our question is to explore what are the readers' replies based on the language used in the post. We employ the psycholinguistic lexicon LIWC 2015 [20], which has been widely used in prior suicide research [6,26,27]. LIWC 2015 includes 90 variables to examine the language used in the posts and comments. We select several variables from LIWC 2015, including word count, 4 summary language variables (analytical thinking, clout, authenticity, emotional tone), 8 standard linguistic dimensions, 41 word categories of psychological processes, 6 personal concern categories, and 5 informal language markers as our measurements. A total of 65 variables are examined in this study.

FINDINGS

We conducted correlational analysis to explore which type of language that was used in the title and content influences users' upvote and comment behaviors. We did not include downvote behavior because no posts received downvotes.

According to Table 2, we found that 15 variables are significantly correlated with the number of upvotes. All

variables have positive correlation with the number of upvotes, except for *emotional tone*, *positive emotion*, and *cognitive process*. This means that titles displaying more positive tone, positive emotion, and cognitive process have less upvotes. The results show that the number of comments has significant positive correlation with 5 types of cue, including *word count*, *anger*, *relativity*, *time*, *home*, and *assent*. Titles with more words and that exhibit more relevance to *anger*, *relativity*, *time*, *home*, and *assent* prompt more comments.

	Title (N=977)		Content (N=977)	
	Number of Upvote	Number of Comment	Number of Upvote	Number of Comment
Word Count	.065, <i>p</i> =.043	.073, <i>p</i> =.022	-.031	-.042
Emotional Tone	-.095, <i>p</i> =.003	.043	.044	.042
Personal pronouns	.075, <i>p</i> =.019	.020	.013	-.014
She/He	.117, <i>p</i> =.000	-.018	.061	-.055
Positive Emotion	-.076, <i>p</i> =.018	-.006	.016	.021
Negative Emotion	.072, <i>p</i> =.024	-.023	-.036	-.027
Anger	.137, <i>p</i> =.000	.072, <i>p</i> =.024	.002	-.005
Family	.108, <i>p</i> =.001	-.003	.017	.009
Male	.169, <i>p</i> =.000	.037	.059	-.015
Cognitive Processes	-.076, <i>p</i> =.018	-.028	-.064, <i>p</i> =.045	-.034
Perceptual Processes	-.026	-.038	-.022	-.078, <i>p</i> =.015
Feel	-.033	-.052	-.031	-.066, <i>p</i> =.041
Body	.063, <i>p</i> =.048	.007	-.021	-.002
Sexual	.063, <i>p</i> =.048	.022	.013	.012
Reward	-.038	.024	-.003	.085, <i>p</i> =.008
Relativity	.048	.071, <i>p</i> =.027	.012	-.059
Time	.097, <i>p</i> =.002	.085, <i>p</i> =.008	-.008	-.064, <i>p</i> =.044
Home	.001	.139, <i>p</i> =.000	.076, <i>p</i> =.018	.028
Death	.091, <i>p</i> =.004	.036	-.011	-.016
Swear word	.063, <i>p</i> =.048	.037	.038	.006
Assent	.012	.086, <i>p</i> =.007	-.001	.014

Table 2. Correlational Analysis of Linguistic Cues.

Compared to the title, only two linguistic variables of content significantly correlate with the number of upvotes. The results show that *cognitive process* has negative correlation, and conversely, *home* as personal concern has positive correlation with upvote. Also, we found that *perceptual processes*, *feel*, and *time* have significant negative correlation with the number of comments. In contrast, the *reward* has positive correlation with comment. The correlational analysis indicates that the linguistic cue in the title of the post has a greater influence on the users' behavior of upvotes and comments than the content.

DISCUSSION

This study investigated the reply bias on a reddit forum, SuicideWatch, by examining linguistic cues in original posts and comments. The results reveal that more linguistic cues in the title show significant correlation with the number of upvotes and comments than cues in content. This indirectly suggests that the title, as the first "impression", will influence users' replies more than the content. We classified linguistic cues in the title into five categories: length, threat, emotion, relationship, and rationality (Table 3), which we will explain in the following paragraphs.

For length, the longer the title is, the more users upvote and comment. A possible explanation is that the longer title provides more information to users so they have more understanding about the situation of the subject who posted. With the confidence of understanding, users are more willing to respond. Considering the context of suicide, users are also more aware of the title with threat signals, such as body (e.g., wrists, head, throat), sexual (e.g., pregnant, rape), and time (e.g., end, birthday, forever). Threat signals inform users that subjects posting may be suffering from suicidal thoughts with immediate danger, which urges them to respond.

Category of Signal	Cue
Length	Word Count (+)
Threat	Body (+), Sexual words (+), Time (+)
Emotion	Emotional tone (-), Positive emotions (-), Negative emotions (+), Anger (+), Swear word (+)
Relationship	Personal pronouns (+), She/He (+), Family (+), Home (+), Male references (+), Relativity (+)
Rationality	Cognitive process (-)

Table 3. Category of Linguistic Cues in Title. (Symbol "+" means positive cues getting more replies; symbol "-" means negative cues getting less replies.)

Users also tend to respond to the title with more negative and angry emotions, suggesting that emotion is an important signal for users to decide whether the users posting needs help. This also indicates that emotions may represent the impulsive action to users that more negative emotions signal a high possibility of suicide [23]. In addition, our findings show that users respond more to the title with relationship cues, such as family (e.g., parents, brother), home (e.g., apartment, home), and male references (e.g., husband, boyfriend). This result seems support previous findings that social isolation and family conflict signal the danger of individuals' suicidal ideation and behavior [14,23]. Perhaps because the relationship issue is a common discussing topic, users may feel more familiar with it and have more empathy.

The linguistic cues of cognitive processes indicate the rational thinking of an individual. In a comparison to replies related to emotions, users have fewer replies to the title

with more rationality. This may imply that users may have a bias that a more rational individual will act more rationally. The rationality displayed in the title may send a signal that the subject posting is not in danger.

Application of Findings

We believe there are many potential applications of this work. For example, the SW forum may detect the potential reply bias through linguistic cues presented in the title. Then, for those ignored posts, SW can further detect which posts may need urgent reply based on its content and adjust its algorithmic ranking. In this way, SW can increase the exposure and reply rate of ignored posts. Also, we may redesign the interface of the online forum to increase users' reply by highlighting the urgent posts. This study can be a stepping-stone to establish predictive model for evaluating the efficacy of online suicide prevention.

Limitation and Future Directions

This study only focuses on users on a forum of reddit. We acknowledge that our findings are restricted and may be only applied to a specific online community. We encourage future studies to apply machine-learning methods to examine this phenomenon in other online communities and to compare their differences. In addition, although the semi-anonymous setting of reddit allows users to express their thoughts without being identified, we have limitations to ensure how many unique individuals are participating in the community because an individual may own several accounts. Questions remain about how online anonymity influences suicide prevention.

CONCLUSION

Online communities have changed the scope of suicide prevention in the past decade. However, its effects on suicide prevention remain unclear. To address this gap of knowledge, this study investigated users' reply bias to posts about suicide. We found that the title is a critical signal for users' replies and further identified five types of linguistic cues that are influential. The contribution of this study is to provide a different approach for assessing the potential bias of using online community as suicide prevention mechanism. This paper is our first step for investigating the effect of the online crowd as a suicide prevention tool. In our follow-up study, we are examining whether online crowds actually have a positive influence on suicide prevention. We will plan to publish the results in the near future. We believe that online crowds could be an innovative and effective approach for suicide prevention. However, we need further investigations for understanding its potential effects and bias. This study offers a beginning to deliver such insights.

REFERENCES

1. Alao, A. O., Soderberg, M., Pohl, E. L., & Alao, A. L. Cybersuicide: review of the role of the internet on suicide. *CyberPsychology & Behavior*, 9(4), (2006), 489-493.
2. Barak, A. Emotional support and suicide prevention through the Internet: A field project report. *Computers in Human Behavior*, 23(2), (2007), 971-984.
3. Baker, D., & Fortune, S. Understanding self-harm and suicide websites: a qualitative interview study of young adult website users. *Crisis*, 29(3), (2008), 118-122.
4. Birbal, R., Maharajh, H. D., Birbal, R., Clapperton, M., Jarvis, J., Ragoonath, A., & Uppalapati, K. Cybersuicide and the adolescent population: challenges of the future?. *International journal of adolescent medicine and health*, (21), (2009), 151-159.
5. Daine K., Hawton K., Singaravelu V., Stewart A., Simkin S., Montgomery P. The Power of the Web: A Systematic Review of Studies of the Influence of the Internet on Self-Harm and Suicide in Young People. *PLoS ONE* 8(10), (2013).
6. Kumar, M., Dredze, M., Coppersmith, G., & De Choudhury, M. (2015, August). Detecting changes in suicide content manifested in social media following celebrity suicides. In *Proceedings of the 26th ACM Conference on Hypertext & Social Media* (pp. 85-94). ACM.
7. Eichenberg, C. Internet message boards for suicidal people: a typology of users. *CyberPsychology & Behavior*, 11(1), (2008), 107-113.
8. Fu, K. W., Cheng, Q., Wong, P. W., & Yip, P. S. Responses to a self-presented suicide attempt in social media. *Crisis*, (2015).
9. Gunnell, D., Metcalfe, C., While, D., Hawton, K., Ho, D., Appleby, L., & Kapur, N. Impact of national policy initiatives on fatal and non-fatal self-harm after psychiatric hospital discharge: time series analysis. *The British Journal of Psychiatry*, 201(3), (2012), 233-238.
10. Gilat, I., Tobin, Y., & Shahar, G. Offering support to suicidal individuals in an online support group. *Archives of Suicide Research*, 15(3), (2011), 195-206.
11. Gilat, I., Tobin, Y., & Shahar, G. Responses to suicidal messages in an online support group: comparison between trained volunteers and lay individuals. *Social psychiatry and psychiatric epidemiology*, 47(12), (2012), 1929-1935.
12. Greidanus, E., & Everall, R. D. Helper therapy in an online suicide prevention community. *British Journal of Guidance & Counselling*, 38(2), (2010), 191-204.
13. Hess, A. "Please Do Not Downvote Anyone Who Asked for Helps" How Reddit Is Changing Suicide Intervention. (2015). Available on December 4, 2015 at: http://www.slate.com/articles/technology/users/2015/03/reddit_and_suicide_intervention_how_social_media_is_changing_the_cry_for.html
14. Joiner Jr, T. E., & Van Orden, K. A. The interpersonal-psychological theory of suicidal behavior indicates specific and crucial psychotherapeutic targets. *International Journal of Cognitive Therapy*, 1(1), (2008), 80-89.
15. Jones, R., Sharkey, S., Ford, T., Emmens, T., Hewis, E., Smithson, J., ... & Owens, C. Online discussion forums for young people who self-harm: user views. *The Psychiatrist*, 35(10), (2011), 364-368.
16. Katsumata, Y., Matsumoto, T., Kitani, M., & Takeshima, T. Electronic media use and suicidal ideation in Japanese adolescents. *Psychiatry and clinical neurosciences*, 62(6), (2008), 744-746.

17. Mitchell, K. J., & Ybarra, M. L. Online behavior of youth who engage in self-harm provides clues for preventive intervention. *Preventive Medicine*, 45(5), (2007), 392-396.
18. Musshoff, F., Kirschbaum, K. M., & Madea, B. An uncommon case of a suicide with inhalation of hydrogen cyanide. *Forensic science international*, 204(1), (2011), 4-7.
19. Naito, A. Internet suicide in Japan: implications for child and adolescent mental health. *Clinical Child Psychology and Psychiatry*, 12(4), (2007), 583-597.
20. Pennebaker, J.W., Boyd, R.L., Jordan, K., & Blackburn, K. The development and psychometric properties of LIWC2015, (2015). Austin, TX: University of Texas at Austin.
21. Robinson, J., Cox, G., Bailey, E., Hetrick, S., Rodrigues, M., Fisher, S., & Herrman, H. Social media and suicide prevention: a systematic review. *Early intervention in psychiatry*, (2015).
22. Smithson, J., Sharkey, S., Hewis, E., Jones, R. B., Emmens, T., Ford, T., & Owens, C. Membership and boundary maintenance on an online self-harm forum. *Qualitative Health Research*, (2011).
23. Van Orden, K. A., Witte, T. K., Cukrowicz, K. C., Braithwaite, S. R., Selby, E. A., & Joiner Jr, T. E. The interpersonal theory of suicide. *Psychological review*, 117(2), (2010), 575.
24. Westerlund, M. Talking Suicide. *Nordicom Review*, 34(2), (2013), 35-46.
25. World Health Organization. *World Suicide Prevention day Media Release: Suicide Prevention*, (2014). Available on December 4, 2015 at: http://www.who.int/mental_health/suicide-prevention/exe_summary_english.pdf?ua=1
26. Chung, C., & Pennebaker, J. W. (2007). The psychological functions of function words. *Social communication*, 343-359.
27. Pennebaker, J. W., Francis, M. E., & Booth, R. J. (2001). Linguistic inquiry and word count: LIWC 2001. *Mahway: Lawrence Erlbaum Associates*, 71, 2001.