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Contents

Suicide Studies, 2022, 4(2), 2-3

THREE EVOLUTIONARY THEORIES OF SUICIDE AND THEIR IRRELEVANCE FOR INDIVIDUAL SUICIDES IN MODERN SOCIETY

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Abstract: Three evolutionary theories of suicide that have been proposed (Bargaining, Inclusive Fitness and Costly Apology) were applied to a sample of suicide notes from completed and attempted suicides. The variables comprising these three theories were rarely present in the suicide notes, suggesting the inadequacy of these theories for understanding individual suicides in the modern world.

It is popular these days to propose theories of suicide from the perspective of evolutionary psychology. The present paper briefly outlines three current theories and applies them to a sample of suicide notes in order to explore whether they provide insight into the suicidal individuals.

Syme and Hagen (2019) proposed a Costly Apology Model (CAM) which they apply only to non-lethal suicidal behavior. The suicidal behavior appears after a severe transgression and serves as a sincere apology. They note also that there is a bargaining model (BRM) in which non-lethal suicidal behaviour is a costly signal of need when the person faces adversity. In their study, Syme and Hagen performed a content analysis of mentions of suicide in primitive societies from literature assembled in the Human Relations Area Files. They obtained 473 texts from 53 cultures and found at least one of the 8 coding categories for the CAM in24.9% of the texts, while 14.2% had three or more of the coding categories. No text had more than 5 of the coding categories.

Syme, et al. (2016) compared the inclusive fitness model (IFM) in which those who die by suicide are typically those with low reproductive potential or who impose large fitness costs on biological kin, with the bargaining model (BRM), using 474 texts from 53 cultures. Their data presentation is less than ideal, but they concluded that there was poor evidence for the IFM and better support for the BRM.

The problem here is that these models are being tested on texts from reports of suicide in primitive, non-literate for the most part, societies, and the reports come from a variety of sources, including some anthropologists, but also non-professional visitors. Would these theories apply to individuals in modern society?

An attempt to explore this was made using 20 suicide notes from completed suicides and 20 suicide notes from attempted suicides, using a sample reported by Brevard, et al. (1990). Twenty-six coding categories provided by Syme and Hagen (2019) and Syme, et al. (2016) were applied to each of the 40 notes. Reproductive potential was not coded for the IFM or the BRM since all of the women were of child-bearing age, and males can produce children at almost any age.

The results were notable for the absence of the coding categories. None of the 9 coding variables for the CAM were found in any of the 40 notes. One note from a completed suicide did mention that he had committed a felony, but his suicide did not result from that behavior.

For the IFM, only one person, a completed suicide, showed evidence of trying to make others or kin better off.

For the BRM, for the 11 coding variables, 33 of the subjects scored zero, 3 scored 1 and 4 scored 2. All of those scoring 2 (n=4) were completed suicides, whereas the BRM was proposed for non-lethal suicidal behavior.

It appears, therefore, that these three theories (CAM, IFM and BRM) were inadequate for elucidating the motives or determinants of suicidal behaviour in this sample of completed and attempted suicides. Suicide notes are, of course, limited in the information they provide. A better test of these three theories would use biographies of a sample of suicides.

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Suicide Studies, 2023, 4(2), 4-14

THE SUICIDAL BEHAVIOR QUESTIONNAIRE REVISED (SBQ-R): VALIDATION IN IRANIAN PSYCHIATRIC OUTPATIENTS.

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Abstract: The aims of the present study were (a) to investigate the psychometric properties and to explore the factorial structure of the Suicidal Behavior Questionnaire-Revised (SBQ-R) in Iranian psychiatric outpatients, and (b) to examine demographic and clinical differences. The SBQ-R was administered to a convenience sample of 102 Iranian psychiatric outpatients. Cronbach's *a* was 0.87. One factor was extracted, labeled: "Suicidal Behavior". Using CFA, standardized estimates indicated strong factor loadings, and all were of large magnitude and statistically significant. However, the results for model fit were inconsistent. SBQ total scores declined with age but did not correlate with sex or the duration of the psychiatric illness. Unmarried patients and those with low literacy had higher scores. Suicidal behavior did not differ between depressed patients and anxious patients. Group-comparisons between non-suicidal, intermediate risk, and high-risk groups indicated differences by marital status but not by age, sex, or education.

Keywords: Suicidal behavior, The Suicidal Behavior Questionnaire-Revised (SBQ-R), validation, psychiatric outpatients, Iran

Recognizing suicide as a major public health concern, the World Health Organization (WHO) made suicide prevention an integral part of its first psychotherapy program in 2013. The aim was to reduce the suicide rate in countries by 10% by 2020 (WHO, 2014). The global annual average suicide rate is 11.4 per 100,000 population (15 for men and 8 for women). This reported suicide rate is an underestimate because suicides are greatly underreported in some countries (Lew et al., 2022; WHO, 2014). *Officially,* Iran ranks around 124th in the world for its suicide rate, but there is no accurate registration system for suicides in Iran (Gorgi et al., 2016; Kiani Chelmardi et al., 2021; Nazarzadeh et al., 2013).

Suicide is a multidimensional behavior that occurs as a result of various factors including psychiatric disorders, especially major depressive disorder, personal and family history, family conflict, substance and alcohol abuse, hopelessness, bio-neurological factors, and stress (Harris & Barraclough, 1997; Klonsky et al., 2012; Lester & Gunn, 2016; Lester, 2005, 2010). Suicide pathways also vary depending on cultural influences (Park et al., 2017). Suicide risk is calculated based on several indicators: hopelessness, suicidal ideation, hostility-impulsivity, and negative self-evaluation. These factors can distinguish "normal" people from suicidal people (Cull & Gill, 2002).

The presence of suicidal behavior is associated with the wish to be dead, depression, death obsession, psychological distress, loneliness, and general health, but depression and wish to be dead together appear to be the best predictors of current suicidal ideation in psychiatric outpatients (Dadfar, Lester, & Atef Vahid, 2018). Another study found that suicidal behavior was negatively correlated with religiosity and happiness in this sample (Dadfar, Lester, & Abdel-Khalek, 2021). Psychiatric disorders significantly increase the risk of suicide (Lester, 2005), yet the vast majority of people with mental disorders, including those with major depressive disorder, will not attempt suicide and will not die by suicide (Bostwick & Pankratz, 2000).

Despite ongoing efforts to identify risk factors for suicide, the prediction of suicide remains a challenge. A meta-analysis (Franklin et al., 2017) showed that, over the past 50 years, suicide prevention research has identified several new risk factors for suicide, with an ongoing focus on several risk factors such as mental disorder, previous suicide attempts, and demographic factors. Curiously, however, instead of improving the ability of mental health professionals to estimate the risk of suicide, recent research on risk factors typically explained a lower percentage of variance in suicidal ideation (suicidal thoughts) and suicidal behavior (self-harm with the intention of dying) than research conducted 30 years ago (Franklin et al., 2017).

Research on predicting the risk of suicide in patients requires valid measurement of suicidal behaviors. One instrument devised for this is the Suicidal Behavior Questionnaire-Revised (SBQ-R). The aims of the present study were (a) to investigate the psychometric properties and the factorial structure of the Suicidal Behavior Questionnaire-Revised (SBQ-R) in Iranian psychiatric outpatients, and (b) to examine demographic and clinical differences.

Methods

Participants

A convenience sample of 102 Iranian psychiatric outpatients was selected from the psychiatric and psychological clinics at the School of Behavioral Sciences and Mental Health (Tehran Institute of Psychiatry) affiliated with the Iran University of Medical Sciences.

Procedure

The purpose of the study was explained to the patients, and they were assured that the information provided would be kept confidential. Participation was voluntary, and the patients provided written informed consent. The study protocol had been approved by the Institutional Review Board at Iran University of Medical Sciences. The psychiatric outpatients were administered the scale individually, and all completed the scale fully. Inclusion criteria were having at least one of the following psychiatric diagnoses: depressive disorder, anxiety disorder, mixed depressive-anxiety disorder, and personality disorder. Exclusion criteria were psychotic disorder and substance abuse/ addiction. The patients completed a psychiatric interview conducted by psychiatrists. Because of frequent comorbidity between the disorders in this sample, these inclusion and exclusion criteria were considered.

Measure

The Suicidal Behavior Questionnaire-Revised (SBQ-R, Osman et al., 2001) has four items for evaluating previous and future suicidal thoughts and behaviors: the presence and frequency of previous suicidal ideation and attempts, communication of suicidal thoughts to others, and how likely is a future suicide attempt. The first item has often been used on its own in order to assign individuals to a suicidal and a non-suicidal control group for studies. Each question has an individual scale, and each response corresponds to a certain point value. *A* total score of 7 and higher in the general population and a total score of 8 and higher in psychiatric patients denotes significant risk of suicidal behavior (Osman et al., 2001). One main advantage of this scale is its brevity, which allows it to be administered in five minutes. The SBQ-R has shown high internal consistency in American, Chinese, German and Nigerian samples (Aloba, Ojeleye, & Aloba, 2017; Glaesmer et al., 2018; Lew et al., 2020; Osman et al., 2001; Shakeri et al., 2015*)* and high test-retest reliability (Osman et al., 2001). Gómez-Romero et al. (2019) reported that Cronbach's *a* for the Spanish version of the SBQ-R was .81 and the test-retest coefficient was .88. Amini-Tehrani et al. (2020) found high reliability for the SBQ-R, and the SBQ-R correlated with suicide acceptability (SA) and lifetime suicidal ideation (LSI) in Iranian undergraduates.

Data Analysis

The data were analyzed using *jamovi* – a free data analysis software (The Jamovi Project, 2020; R Core Team, 2020). Construct validity was assessed using confirmatory factor analysis (CFA). In order to determine the model fit, X^2, root mean square error of approximation (RMSEA), comparative fit index (CFI), and the Tucker-Lewis index (TLI) were used. A non-significant X^2, a RMSEA less than 0.08, and a TLI and CFI greater than 0.95 are all indicative of good model fit (Browne & Cudeck, 1993; Cangur & Ercan, 2015; Hu & Bentler, 1999; McDonald & Ho, 2002). Additionally, item 1 of the SBQ-R was used to create a categorical variable in which scores of 1 or 2 were categorized as "non-suicidal", scores of 3 were categorized as "intermediate suicide risk", and scores of 4 were categorized as "high suicide risk." Group differences on the adjusted SBQ-R score (summation of items 2-4), as well as descriptive variables (such as age), were then examined using the Kruskal-Wallis test for multiple group comparisons.

Results

Descriptive results

The mean age of the patients was 31.1 years (SD=9.6); the mean duration of their mental disorder was 6.5 years (SD=5.4); 28.4% had a BA degree; 82.4% were female; 49.0% were single; 43.0% were married and 7.0% divorced; 56.7% had a depressive disorder; 31.7% an anxiety disorder; 8.3% a mixed depressive anxiety disorder; 1.7% a personality disorder, and 1.6% had missing data.

The mean score for the SBQ-R was 4.64 (SD=3.8), and Cronbach's alpha was .87. A Principal Component Analysis (PCA) showed one factor (accounting for 76.46% of total variance), labeled: "Suicidal Behavior" (Table 1).

Table 1: Descriptive statistics, Principal Component Analysis (PCA), Skewness and kurtosis results for the SBQ-R

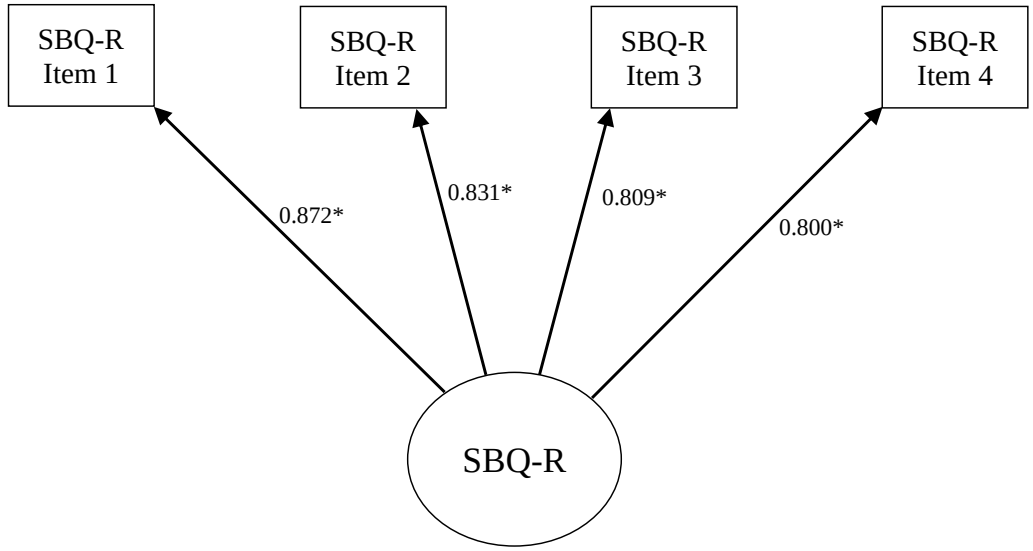
SBQ-R items	Skewness Statistic Std. Error	Kurtosis Statistic Std. Error	Mean (SD)	Factor loading
Item 1: Previous and future suicidal thoughts and behaviors	2.139 .239	3.614 .474	1.42 (.85)	.895
Item 2: The presence/frequency of previous suicidal ideation and attempts	2.633 .239	6.688 .474	1.33 (.80)	.870
Item 3: Communication of suicidal thoughts to others	2.205 .239	3.559 .474	1.25 (.59)	.871
Item 4: How likely is a future suicidal attempt.	2.115 .239	3.832 .474	0.63 (1.28)	.861
SBQ-R total	2.032 .239	3.273 .474	4.64 (3.08)	
Eigenvalue				3.06
% of variance				76.49

Notes: SBQ-R Cronbach's a = .87

CFA results

The construct validity of the SBQ-R was examined using CFA. Standardized estimates indicate strong factor loadings (SBQ-R 1 = .872, SBQ-R 2 = .831, SBQ-R 3 = .809, & SBQ-R 4 = .800) (Figure 1). However, the results for model fit were inconsistent, with chi-square and RMSEA results indicating relatively poor fit (X^2 = 7.71, df = 2, p = .021; RMSEA = .167). However, the results of the CFI and TLI indicating good fit (CFI = .977, TLI = .930).

Figure 1
Confirmatory Factor Analysis (CFA) Results



Notes:
X^2 = 7.71, df = 2, *p* = .021, CFI = .977, TLI = .930, RMSEA = .167
*$p \leq .001$

The SBQ total score declined with age (r = - .45, p < .001) but was not correlated with sex (r =.06) or the duration of the psychiatric illness (r = .24) (Table 2).

The 60 married patients had significantly lower SBQ total scores than those who were single (means 3.83 [SD = 11.96] and 5.94 [SD = 4.11], respectively, t = 3.38, df =93, p < .001).

With regard to education, the SBQ total scores of the 85 patients with 12 years or more of schooling were significantly lower than the scores of the 16 patients who did not have 12 or more years (4.14 [2.35] and 7.31 [4.91], respectively, t = 4.01, df = 99, p < .001).

Table 2: Bivariate associations between study variables

	1	2	3	4	5	6	7
1. Age	-						
2. Sex	.111	-					
3. SBQ-R 1	-.461**	.007	-				
4. SBQ-R 2	-.454**	.129	.753**	-			
5. SBQ-R 3	-.331*	.097	.670**	.676**	-		
6. SBQ-R 4	-.342*	.072	.701**	.615**	.701**	-	
7. SBQ-R total	-.454**	.084	.889**	.851**	.842**	.901**	-

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 3 shows the mean score for the SBQ-R in females and males. Females coded 1 and Males coded 2.

Table 3: Mean, SD and t score for the SBQ-R in females and males

Item	Females	Males	
	M (SD)	M (SD)	t
Sui1	1.43 (0.87)	1.44 (0.82)	0.07
Sui2	1.28 (0.75)	1.52 (0.96)	1.29
Sui3	1.23 (0.56)	1.36 (0.70)	0.97
Sui4	0.59 (1.25)	0.80 (1.41)	0.71
Total	4.52 (3.10)	5.12 (3.17)	0.83

The SBQ scores of the 36 patients with a diagnosis of depressive disorders did not differ from the SBQ scores of the 19 patients diagnosed with anxiety disorder. The other diagnoses were too infrequent to be amenable for statistical analysis.

Group-comparison results

Group-comparisons between our non-suicidal (N = 92), intermediate risk (N = 3), and high-risk groups (N = 7) were done using Kruskal-Wallis. The groups did not significantly differ on age, sex, or education but did significantly differ on marital status (X^2 = 6.91, df = 2, p = .03). However, though there appeared to be a lower presence of married participants in the intermediate and high-risk groups, the pairwise comparisons were not statistically significant.

The difference between groups for the adjusted SBQ-R score was also statistically significant ($X^2 = 36.83$, $df = 2$, $p \leq .001$). Pairwise comparisons reveal that the non-suicidal group ($M = 2.64$, $SD = 1.51$) was significantly different from the intermediate ($M = 7.33$, $SD = 3.06$) and high-risk groups ($M = 9.00$, $SD = 2.00$). However, the intermediate and high-risk groups did not differ significantly, possibly due to the low number of those categorized into either group.

Discussion

The present study indicated that the SBQ-R is a reasonably reliable scale for assessing the suicidality of Iranian psychiatric patients. Interestingly, suicidality scores did not differ between depressed patients and anxious patients. Older patients had lower scores, and single patients had higher scores, but there were no sex differences in suicidality scores. In previous research on Western samples, the SBQ-R differentiated suicidal and nonsuicidal psychiatric inpatients, and high school/university students (Osman et al., 2001), and the SBQ-R may be useful for the same purpose in Iranian samples.

One limitation in the present study is our mixed results with model fit. Although our CFI and TLI scores were indicative of good fit, the chi-square statistic and RMSEA both indicated poor fit. One potential explanation for why these findings are divergent is the sample size and the low frequency of those in the intermediate (n=3) and high-risk (n=7) groups. Both the chi-square statistic and RMSEA can be influenced by sample size. Another limitation was that we had such a small number of males in our sample that we had very low power to detect sex differences.

Conclusions

The SBQ-R scale proved to be a reliable scale for assessing suicidality in Iranian psychiatric outpatients. Future research should explore its use for psychiatric inpatients and for non-clinical groups.

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Conflicting Interests
The authors have no potential conflicts of interest with respect to the research, authorship, and publication of this study.

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Ethics approval and consort to participate

Permission for the study was obtained from the Research Ethics Committee by the Iran University of Medical Sciences, Tehran, Iran.

Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Suicide Studies, 2023, 4(2), 15-25

ACCEPTANCE AND COMMITMENT THERAPY FOR DEATH ANXIETY AMONG IRANIAN FEMALES DURING THE COVID-19 PANDEMIC

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Abstract: Studies have demonstrated that epidemic and pandemic diseases have many psychological effects on the general public and result in anxiety, fear and worry. This study was conducted to determine the impact of Acceptance and Commitment Group Therapy (ACT) on death anxiety among Iranian citizens during COVID-19. This study was conducted on 156 female citizens of Gorgan City. The participants were randomly assigned to experimental and control groups, and the Death Anxiety Scale (DAS) was distributed to them at the beginning of the study. The patients in the experimental group received eight 120-min sessions of ACT intervention. After treatment sessions, the DAS was re-administered to the experimental and control participants. Prior to the intervention, there was no difference between the death anxiety scores of the two groups, but the post-treatment death anxiety score for the experimental group was significantly lower than that for the control group. Based on these findings, ACT can be considered to be an effective intervention for improving psychological health in women during epidemics and pandemics.

In December 2019, the world confronted a new concern, a novel coronavirus (2019-nCoV; Covid-19) that spread to other regions of the world after the outbreak in Wuhan city in the central Hubei province of China. On January 30 2020, the World Health Organization (WHO) declared this disease to be a public health emergency of international concern (Zandifar & Badrfam, 2020). Initially, by January 21, 2022, many people around the world (340,543,962 cases) were infected with the virus, and many died (5,570,193 deaths) (WHO, 2022). The epidemic resulted in, not only the possibility of death from Covid-19, but also negative psychological effects (Brooks et al.,

2020; Cao et al., 2020) in the form of anxiety, anger and confusion (Cao et al., 2020; Dadfar et al., 2021a), post-traumatic stress symptoms (Brooks et al., 2020), emotional disturbance (Yoon et al., 2016), depression (Dadfar et al., 2022; Hawryluck et al., 2004), low mood (Lee et al., 2005), anxiety-induced insomnia (Desclaux et al., 2017; DiGiovanni et al., 2004), fear (Caleo et al., 2018), confusion (Cava et al., 2005), and suicide (Barbisch et al., 2015).

Alongside these problems, fear of falling sick and dying was one of the serious concerns observed among those who were quarantined (Hall et al., 2008; Xiang et al., 2020). Death is a reality that has always existed, but peoples' emotional reactions to death differ (Sherman et al., 2010), but anxiety is common (Singh, 2013). Death anxiety is a complex concept that cannot be easily explained and generally includes the concepts of fear of death of oneself and fear of of death of friends and loved ones. Death anxiety can be one of the most important sources of anxiety in those who live during pandemic(Iverach et al., 2014; Suhail & Akram, 2002), and is an important construct in Joiner's (2005) theory of suicide.

Acceptance and Commitment Therapy (ACT) is one of several new cognitive and behavioral therapies that creates psychological flexibility. ACT aims to develop the individual's ability to contact the present moment more fully as a conscious human being, and engage in values-based action (Davazdahemami et al., 2019). It also increases pain tolerance, reduces negative thoughts and feelings, and improves the quality of life (Shabani et al., 2019). This action-oriented approach, which is a therapeutic intervention based on modern behavioral psychology, uses acceptance processes, mindfulness, commitment, and behavioral change approaches to increase psychological flexibility (Khalifeh-Soltani & Borhani, 2019).

The theory behind ACT is that there are valid alternatives for changing the way people think, and these include mindful behavior, attention to personal values, and commitment to action By taking these steps, clients can eventually change their attitude and emotional state (Mani et al., 2019). ACT has six core processes that revolve around a single core concept. These six processes are Acceptance, Cognitive Defusion, Being Present, Self as Context, Values, and Committed Action. All of these processes together contribute to creating psychological flexibility (Hayes et al., 2012). ACT tries to improve two skills: acceptance of inner experiences and commitment to values-based behaviors (Hoffmann et al., 2018). Collectively, the effectiveness of the ACT method in treating anxiety has been confirmed in many studies. For example, Bayati et al. (2017) showed that ACT can reduce death anxiety and death obsession in the elderly. Keyhani et al. (2019) found that ACT changes the physical and cognitive symptoms of the patient's anxiety. Brow et al. (2016) found that

internet-delivered ACT can reduce anxiety and depression, as well as generalized anxiety disorder (Avdagic et al., 2014; Dahlin et al., 2016), panic disorder (Gloster et al., 2015), social anxiety disorder (England et al., 2012; Rostami et al., 2014), health anxiety (Eilenberg et al., 2016), obsessive-compulsive disorder (Twohig et al., 2015), and mixed anxiety disorder (Arch et al., 2012; Forman et al., 2007; Hancock et al., 2018).

No research has evaluated the effect of ACT on death anxiety during the COVID-19 pandemic, and the present study was designed to evaluate the efficacy of ACT on death anxiety in the general public during the COVID-19 pandemic. This research can help government agencies and healthcare professionals in safeguarding the psychological wellbeing of the community in the face of COVID-19.

Methods

Sample

The target population comprised all the residents of Gorgan, Iran. A sample of 156 female residents was selected for this study.

Research design

The present study was a randomized, single-blinded clinical trial with a pre-test-post-test control group design. A total of 156 women who met the inclusion criteria were randomly selected. Inclusion criteria included: never had ACT therapy before, older than 30 years of age, with no major psychiatric disorder based on DSM-IV, no drug use, and willingness to participate in the study. Exclusion criterion was an acute mental illness. The research goals and procedures were explained to the participants, and informed written consent was obtained from each of them.

They were randomly assigned into two groups: control and experimental (n = 78 in each group). Next, the DAS was completed by both groups. Subsequently, the experimental group underwent ACT for 45 minutes once a week and the control group remained on the waiting list. After the treatment sessions, the participants of both groups were reassessed using the DAS. The content of the eight sessions in shown in Table 1.

Table 1. Description of ACT Sessions.

Session	Session Topic	Session Content
1	Introduction	- Introducing the group members to one another -An explanation about ACT techniques, and treatment goals, a brief explanation about death anxiety. - Number of sessions: 8 sessions - Duration of each session: 45 min.
2	Behavior change and mindfulness	Potential values and selection issues, introducing the concept of behavior change, expressing the difference between thoughts, emotions, practice of mindfulness, and homework assignment.
3	Values	Definition of acceptance, identification of values and discussion about this; acceptance of personal events without being involved with them; mindfulness and homework assignment.
4	Transparency of values	Transparency of values, determining goals and introducing commitment-based action, explaining about avoidance and awareness of mindfulness events, willingness, acceptance, and homework assignment.
5	Discontinuity	Making uniform movement, disconnection and awareness of different sensory receptions, mindfulness, and homework assignment.
6	Commitment-based act	Time lapse, commitment-based acts, mindfulness and practice of self-observation (attention to the content of thoughts, but not fixating on them) and homework assignment
7	Satisfaction	Commitment and barriers to satisfaction, being in the present time, mindfulness during walking, and homework assignment.
8	End of sessions	Transparency of values, conclusions and goodbyes

Because of the prevalence of Covid-19, it was not possible to manage the treatment group in the same way as in the past. Hence, in this study, sending, executing, and completing questionnaires and psychological treatment based on ACT was done through the Internet. For this purpose, the two groups (experimental and control) were formed in the *What's Up* application. Then, the DAS was sent to both groups via the Internet, and the members were asked to return it to the researcher after completion. The eight ACT sessions were then videotaped and uploaded for the experimental group. In each session, the participants' questions were answered and their homework was received via the Internet. At the time of the last session, the death anxiety questionnaire was sent to both groups again, and their answers were received via *What's Up* app.

Measure

A two-part questionnaire was used to collect the data. The first part obtained demographic characteristics. The DAS (Templer, 1970) was used for measuring of death anxiety. This scale has 15 yes/no questions. Scores range between 0 and 15, in which a high score means a high level of death anxiety (Dadfar et al., 2021b, 2021c). This scale was translated into Persian by Rajabi and Bohrani (2001). In their study, the Cronbach's *a* reliability coefficient was 0.79.

Statistical analysis

The data were analyzed with SPSS-19. A two-tailed $p < .05$ was considered statistically significant.

Results

The demographic and selected characteristics of the study population are shown in Table 2. The median age was 40-49 (42%). Also, 93% of the participants were married, 47% had a B.A. degree, and 58% had full-time jobs. The results of chi-square tests for comparing the experimental and control groups indicated no significant difference in age, marital status, education level, and occupation between the two groups.

The data were found to meet the criterion of normality. Using a two-way analysis of variance for repeated measures, the total mean DAS score decreased for the experimental group in the post-test compared to the pre-test, but the DAS score did not change in the control group (see Table 3). It can be concluded that ACT significantly reduced the death anxiety of ACT participants.

Table 2. Participant demographics

Characteristics		Experimental groups		Control groups	
		n	%	n	**%**	n
30-39		23	29.48	26	33.33	49
40-49		35	44.88	30	38.47	65
50-60		20	25.64	22	28.20	42
Married		72	92.31	73	93.59	145
Divorced		0	0	0	0	0
Separated		0	0	2	2.56	2
Widowed		6	7.69	3	3.84	9
Grade 6		9	11.54	8	10.25	17
Grade 12		19	24.35	25	32.05	44
Bachelors		39	50.00	35	44.87	74
Master and PhD		11	14.11	10	12.83	21
	Housewife	19	24.36	23	29.47	42
	Part-time	13	16.66	10	12.83	23
	Full-time	46	58.98	45	57.70	91

Table 3. Mean results of MANCOVA on death anxiety in the experimental and control groups.

Variables	**Experimental Group[a]**		**Control Group[a]**				
	Pre-test[b]	Post-test[b]	Pre-test[b]	Post-test[b]	F	Sig	Eta
Death anxiety	8.40 ± 2.99	6.14 ± 2.69	8.42 ± 2.50	8.35 ± 2.85	61.96	<.001	.57

[a]Number of participants: experimental group (n = 78), control group (n = 78).
[b]Mean ± standard deviation.

Discussion

The main goal of this study was to evaluate effectiveness of ACT on the death anxiety of female citizens of Gorgan, Iran. The present results which found that ACT decreased the death anxiety of the participants are in line with the findings by Ahmadi et al. (2019) and Bayati et al. (2017). Safari Mousavi et al. (2019) also found that ACT can decrease death anxiety in patients. This makes sense because, in this treatment, the goal is to help people experience their disturbing thoughts and to become aware of the ineffective nature of their

cognitive processes. ACT allows people to accept their physical and psychological symptoms. Acceptance is an important alternative to avoidance and helps the patient to actively and consciously accept personal events and to make every effort to achieve this goal. Accepting these feelings reduces attention and hypersensitivity to these symptoms and, thereby, reduces anxiety. ACT decreases psychological inflexibility in two ways; reinforcing mindfulness processes and encouraging people to examine and identify what is important to them in their life. ACT changes the relationship between problematic thoughts and feelings, so that people do not perceive them as symptoms and learn to perceive them as harmless (even if they are distressing and unpleasant).

A number of limitations in the present study should be considered. First, there are other approaches besides ACT which may help reduce death anxiety, and alternative approaches were not used for comparison. Second, demographic variables such as income, family status, literacy level, etc. that might influence how patients react to these conditions.

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Conflict of interest

The authors have no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Informed Consent

The data were collected after acquiring each participant's informed consent.

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Suicide Studies, 2022, 4(2), 26-38

ACCEPTABILITY, FAMILY DISCORD, LOSS SURVIVOR STATUS, AND MOOD DISORDER: RISK FACTORS FOR SUICIDE AMONG SOUTH KOREANS

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Abstract: The aim of the present study was to examine how exposure to suicidal behavior, family strain, and reasons for living influence both acceptability and suicidal behavior in South Korea. Based on 1,599 respondents to the 2009 South Korean General Social Survey data, the study found that acceptability of suicide and depression were the most consistent correlates and predictors of the likelihood of suicidal behavior. Religiosity was the strongest predictor of the approval of suicide, but interestingly a risk factor for suicide for the South Korean general population. These findings pose some important implications about cultural dynamics and cross-cultural differences and for the development of suicide prevention strategies.

Key words: acceptability, depression, family strain, religiosity, suicide exposure, suicidality.

Social attitudes about suicide reflect the value of human life in the society and directly affect individual suicide behavior. Research has revealed that a permissive attitude toward suicide is a risk factor for individuals (Agnew, 1998; Ingram & Ellis, 1995; Stillion & Stillion, 1999), although it is still unclear how this specific cultural dimension is linked to suicidal behavior (Colucci, 2013; Colucci & Martin, 2007; Lester, 1997, 2013). As attitudes toward suicide change, suicidal behavior in the society changes. For example, Boldt (1983) attempted to better understand the increased rate of youth suicide in Canada and found that young people generally held more accepting attitudes toward than had previous generations. It has also been noted that liberalism in the culture was linked to

increased acceptability of suicide (Stack, 2002; Stack et al., 1994). Based on General Social Survey data from the 1980s and 2010s, Tong and Phillips (2018) found that Americans approved of suicide in the 2010s. Stack and Kposowa (2016), using the World Values Survey data, found that a belief in self-expressionism was a significant factor in viewing suicide as more acceptable among the 53,275 individuals residing in 56 countries, while Stack and Kposowa (2011) found that religiosity as well as adherence to Islam, predicted viewing suicide as acceptable.

It is likely, therefore, that a cultural shift to more permissive attitudes toward suicide may shape the risk of individual-level suicide (Boyd & Chung, 2012; Stack & Kposowa, 2016). Social groups in the United States who display a high level of suicide acceptability tend to have high suicide rates as well (Cutright & Fernquist, 2004). Individuals who maintain an approving attitude toward suicide are more likely to die by suicide than those with a disapproving attitude (Agnew, 1998). Thus, research has demonstrated evidence of a positive relationship between an individual's approving attitude toward suicide and suicidal risk factors (Anglin et al., 2005; Feigelman et al., 2014; Joe et al., 2007; Phillips & Luth, 2018; Stack, 1998; Stack & Kposowa, 2008).

Research has also demonstrated that suicide acceptability is a function of one's socialization. For example, some regions in the USA with higher suicide rates have a higher percentage of individuals without religious affiliation (Pescosolido & Georginanna, 1989), while individuals who attend religious services disclosed negative opinions about suicide and less suicidal ideation (Stack & Lester, 1991). Religious involvement thus provides a protective factor because religion both provides a support system through social solidarity and has proscriptions against suicidal acts (Ellis & Smith, 1991).

Research on the social correlates of suicide acceptability has shown that approval of suicide is socially learned by being exposed to beliefs that favor or condemn suicide (Agnew, 1998, 205). However, most of these studies are based on the USA. Furthermore, this research at the societal level has rarely examined the effects of exposure to suicide in their families or social milieu. Exposure to suicidal behavior is a risk factor for an individual's behavior (Colucci, 2010). A study on young New Zealanders found that individuals with a family history of suicidal behavior tended to hold relatively more accepting attitudes toward suicide than those with no such family history (Beautrais et al., 2004), an association conformed in other research (e.g., Mitchell et al., 2004; Roy, 2011). A study of Hong Kong adolescents found that exposure to others who completed or attempted

suicide increased the risk for suicidal behavior (Wong et al., 2005), while Li and Zhang (2010) also found that Chinese individuals who were close to someone who died by suicide were more depressed than the general population, a finding confirmed by other studies (Brent et al., 1994; Bronisch & Lieb, 2008; Melhem et al., 2007).

According to strain theory, individuals who are unable to deal with their problems may experience a raised level of stress (or strain) and consider suicide as a possible solution (Agnew, 1998). Among a wide range of stressful life circumstances, *family discord* is considered to be a significant source of strain that may lead to suicide mortality (Brent et al., 1994). However, family discord has not been tested in the model of suicidal approval. It is thus important to see whether family conflict contributes to the approving attitude toward suicide and suicidal behavior.

Social control theory posits that those who have weak attachments or commitments to others and to groups would be likely to develop permissive attitudes toward suicide. Individuals' weak ties with others would also mean they would be less likely to be taught or exposed to unfavorable beliefs about suicide (Agnew, 1998). Reviewing the literature on the spiritual dimension of suicidal behavior, Colucci and Martin (2008) noted that having a personal meaning or purpose in life (which is intricately tied to one's religious or spiritual experiences) is associated with negative attitudes toward suicide and a lower incidence of suicidal ideation. Having fewer reasons to live may also be construed as lacking meaning or purpose in life, thereby making a person more prone to mood disorders and/or suicidal behavior (Colucci, 2008), and a study of self-reported reasons for living among college students indicates that those who reported fewer reasons for living are more vulnerable to suicidal behavior (Westefeld et al., 1998; Linehan et al., 1983). Thus, it may be assumed that individuals with fewer reasons for living would be more likely to hold approving attitude toward suicide than those who have more reasons for living.

The present research attempts to examine how these overlooked variables in the earlier model of suicidal approval (Agnew, 1998), namely family strain, suicide loss survivor status, and reasons for living, influence individuals' attitudes toward suicide and suicide behavior. This research will use the data to examine the impact of these variables in a Korean socio-cultural context. Demographic variables, such as gender, age, religiosity, residential location, and social class are also included in the analyses. In addition, given that depression has consistently been found to be the most significant psychological variable predicting suicidal behavior, an attempt

is made to examine the influence of symptoms of depression on suicidality in addition to approval of suicide. The implications of the findings in developing social policies to reduce the rate of Korean suicide will also be discussed.

The Korean Context:

The sharp increase in suicide rates in contemporary South Korea has been striking. The official suicide rate has increased more than fourfold over three decades, from 7.3 per 100,000 people in 1991, to 31.7 in 2011. It has fallen slightly since then to 26.9 in 2019. It is also notable that Korean society has faced vast changes recently. At a time when Korean society is undergoing fundamental changes, it is important to look at factors that contribute, not only to the increased suicide rate, but also to approving attitudes toward suicide. More importantly, the South Korean context, in which an increased number of people have been exposed to suicide deaths, provides a setting to examine whether such exposure has affected the shaping of a general attitude toward suicide as well as suicidal behavior. In addition, it is logical to assume that the changes Korean society in recent years has been conducive to increased interpersonal familial conflict which becomes a source of the psychological distress, potentially leading to increased mental health problems. Furthermore, weakened family ties from family discord suggest that these individuals are more likely to have a positive view of suicidal behavior, thereby developing an accepting attitude toward suicide (Agnew, 1998; Stack & Kposowa, 2008).

Jung and Olson (2014) examined the role of religion on suicide acceptability in Korea and supported the findings of earlier studies conducted in North American contexts. In particular, they found that Protestantism in Korea has more protective effects on suicide acceptability than did other religious faiths, perhaps a result of Korean Protestants' higher levels of attendance and engagement in religious events. A study using the 2009 Korean General Social Survey (Lee et al., 2013) examined the effect of suicide loss survivor status on suicidal ideation and found a significant association, particularly for females. Jeon et al. (2013) observed that individuals maintaining permissive attitudes toward suicide with depressive symptoms are at significant risk for suicidal behavior. These studies explored the importance of exposure to suicide and suicide acceptance in predicting suicidal intent within the Korean context. However, given that each study focused on a single variable, the present study will comprehensively examine these variables in the model proposed by Agnew (1998), including variables related to social learning, social strain and social control theories.

Method

Data

The data come from a survey conducted from January to August 2009. The survey design, modelling the US General Social Survey (GSS), was a nationally representative, random sample (n=1,599) selected using a multi-stage cluster probability sampling method, and the data collection was based on face-to-face interviews conducted by the Survey Research Center at Sungkyunkwan University, Korea. The Korean GSS (KGSS) has been conducted each year since 2003. For the first time, the 2009 survey contained a suicide module consisting of items on attitudes towards suicide and suicidal thoughts, attempts, and behavior as well as other items on mental health including stress. The 2009 KGSS data was available from the Korea Social Science Data Archive (A1-2009-0037).[1] The respondents had a mean age of 43.5 (SD = 15.3; range 18-94); 48.1% were male and 51.9% were female.

Measures

Suicidality

The dependent variable, suicidality, is measured by five items, asked as follows: "Over the last month" (1) "Have you ever felt that you would be better off dead or wished to die;" (2) "Have you desired to hurt yourself in any way;" (3) "Have you ever thought about suicide;" (4) "Have you ever planned to commit suicide;" and (5) "Have you ever attempted suicide?" Respondents rated each item on a dichotomous scale of either No or Yes. The dependent variable is the sum of their responses that indicate suicide proneness. Cronbach's alpha, a measurement of the inter-item reliability of the scale, was .65. Higher scores are indicative of a higher level of suicidality.

Accepting Suicide

The respondent's attitude towards suicide was measured with eight items answered on a five-point Likert-scale extending from (1) strongly agree to (5) strongly disagree. Typical items were "Suicide is a very serious moral transgression" and "A person who kills himself or herself in order to protect others should be admired" (reversed scale). The measure is the sum of responses that

[1] The Institutional Review Board of Samsung Medical Center approved the 2009 KGSS (2010-07-254-001). The authors have no conflict of interest to declare.

indicate accepting attitudes toward suicide. Cronbach's alpha for the scale was .76. Higher scores are indicative of higher acceptability of suicide.

Exposure to Suicide

Exposure to suicide was measured with the following three items: "I know someone close" (1) "who has thought about committing suicide;" (2) "who has attempted suicide;" and (3) "who died by suicide." Respondents rate each item on a dichotomous scale of ether No or Yes. Cronbach's alpha for the scale was .65. Higher scores are indicative of the higher level of survivor status.

Family Strain

The respondent's stress stemming from family relations was measured with the following item: "I feel much stress stemming from family relations, namely with spouse, child(ren), parents, or other close members." Respondents rate the item on a five-point Likert scale extending from (1) strongly disagree to (5) strongly agree.

Reasons for Living

The measure of "reasons to live" in this study is the sum of responses that indicate attitudes toward one's life as reflected in four items, including "I still have many things to achieve in my life" and "I have a future plan that I want to accomplish." Respondents rate each item on a dichotomous scale of either Yes or No. Cronbach's alpha for the scale was .65. Higher scores are indicative of lower reasons to live.

Depression

Depression is measured with nine items from the Patient Health Questionnaire. The questions used for this measure begin with a time-limiting introduction ("Over the last two weeks, how often have you been bothered by any of the following problems?") and then covered various topics such as "Little interest or pleasure in doing things" and "Thoughts that you would be better off dead or of hurting yourself in some way." These items were scored on four-point Likert scale extending from (1) not-at-all to (4) nearly every day. The measure is the sum of responses to nine items that indicate depressive attitudes. Cronbach's alpha for the scale was .84.

Demographic Variables

Demographic variables included gender (0=male; 1=female); age (the actual age in years; social class (subjective ranking from 1=highest to 10=lowest); religious faith (subjective rating from 0=strong; 2=moderate; 3=little; 4=none); and

residential location (1=metro; 2=suburbia; 3=small city/town; 4=rural village; and 5=remote area).

Data Analysis

Multivariate regression analyses using SPSS (version 21) were performed to examine both relative and confounding effects of selected variables on the dependent variable of suicidality. The variables included depression, reasons for living, attitude toward suicide, exposure to suicide, and family strain, as well as demographic variables. An additional multiple regression analysis was performed to examine the effect of these selected variables and demographic variables on suicide approval. The mean scores (and standard deviations) of the measures are presented in Table 1.

RESULTS

The results of the correlational analysis are presented in Table 1. Correlations with suicidality are most consistently associated with suicide approval, exposure to suicide, family strain, reasons for living, social class, and depression. Depression was the variable most strongly associated with suicidality ($r = .368$, $p < .001$). Statistically significant associations were also found with suicide approval ($r = .185$, $p < .001$); family strain ($r = .226$, $p < .001$); exposure to suicide ($r = .116$, $p < .001$); reasons for living ($r = .084$, $p < .001$); and social class ($r = .113$, $p < .001$). In addition, females, older persons, people with weak or no religious faith, and living in rural regions were more vulnerable reported more suicidal behavior than were males, younger age persons, people being highly religious, and living in metropolitan areas, but the associations were not statistically significant.

The results of multiple regression analyses are also shown in Table 1. A high level of depression, family discord, approving attitudes toward suicide, and exposure to suicide were significant predictors of suicidality among the general Korean population. However, it is important to note that, unlike in the correlation analysis, reasons for living ceased to be a significant predictor and being highly religious became a risk factor of suicidality although it was not statistically significant.

Table 1: Predictors of Suicidality and Acceptability in Multivariate Analysis

Variables	Mean score	SD	Correlations with suicidality	Multiple regressions (beta coefficients) suicidality	accepting suicide
Suicidality	5.32	0.85			
Accepting Suicide	18.35	5.29	.185***	.129***	
Exposure to Suicide	0.42	0.79	.116***	.046*	.021
Family Strain	2.89	1.35	.226***	.130***	.066*
Reason to Live	4.51	1.00	.084***	.016	.083**
Depression	13.47	4.49	.368***	.304***	.078**
Gender	0.52	0.50	.047	.021	-.050*
Age	43.5	15.3	.008	.011	-.095***
Social Class	6.50	1.57	.113***	.041	.042
Religious Faith	3.03	1.01	.040	-.008	.181***
Residential Location	2.24	1.03	.036	.025	-.002
R				.423	.271
R Square				.179	.074

* two-tailed $p < .05$; ** two-tailed $p < .01$; *** two-tailed $p < .001$

Given the previous research findings that approving attitude toward suicide as a social psychological variable was predicted by both social and subcultural factors, an additional regression analysis was performed with acceptance of suicide as the dependent variable. The results of the multiple regression analysis indicated that exposure to suicide, which was a significant predictor of suicidality, ceased to be significantly associated with accepting attitudes of suicide. However, fewer reasons for living was significantly associated with a permissive attitude toward suicide. Family strain and depression appeared to be significant predictors of both acceptability and suicidality. It is notable that religious faith was a strong predictor of acceptability ($p<.001$), implying that while people with weak or no religious faith display approving attitudes of suicide, they are not at risk of suicide as indicated in the multiple regression analyses on suicidality. It is also important to note that being male ($p<.05$), of younger age ($p<.001$), or living in metro/city area were significant predictors of holding permissive attitudes towards suicide, while being female, older age, or rural living predictors of suicidal behavior.

Discussion

The present study found that having an accepting opinion about suicide was a correlate of suicidality for the South Korean general population. However, while fewer reasons of living and a measure of social control theory were not associated with suicidality, they were significantly correlated with approval of suicide. This indicates that Koreans who have weak attachments to life or others develop approving attitudes of suicide but are relatively less likely to engage in suicidal behavior. Exposure to suicide, a measure of social learning theory, and family discord, a measure of social strain theory, appeared to be significant predictors for the likelihood of suicidality. Only family discord appeared to be the significant predictor for both suicidality and suicide approval. What these findings seem to suggest is that, in the context of increased suicidal behavior in contemporary Korean society, people's tolerant attitudes are not significantly associated with experiencing someone close to them who has attempted or completed suicide, but are associated with direct experience of interpersonal conflict or problems in their social relationships. As expected, depression appeared to be the strongest and most consistent correlate and predictor of the likelihood of suicidality and suicide approval, confirming the findings reported by Jeon et al. (2013).

What is interesting in the results of this study is that religiosity was the strongest predictor of suicide approval. People with strong religious faith are likely to develop less tolerant attitudes toward suicide than those with weak or no faith, as prior studies have reported (Stack & Wasserman, 1992; Stack & Kposowa, 2011; Boyd & Chung, 2012; Jung & Olson, 2014). However, strong religious faith appears to be a risk factor, instead of being a protective factor, for suicidal behavior among the general Korean population, as found in prior research (Stack, 1983; Stack et al., 1994; Stack & Kposowa, 2011). Thus, the relationship between religion and suicide approval reported in North American contexts seem to be generalizable to Korean society.

Regarding socio-demographic variables, it is notable that older individuals are slightly more prone to suicidality than younger persons, but the younger population holds significantly more accepting attitudes towards suicide. This finding may suggest changing cultural values in Korea, which supports the findings of a Canadian study (Boldt, 1983) in that young people generally held more liberal attitudes toward suicide than had previous generations. It is plausible to infer that such liberalism in the culture may have contributed partly to the steady increase of youth suicide (ages, 15-29) in contemporary Korean society, but confirmation of this hypothesis requires further research. It is also interesting to find that females appear more suicidal than do males while males are significantly more approving of suicide than are females. Additionally, people living in a rural

or remote town are more prone to suicide and to approve of suicide than those living in metropolitan areas, although this was not a statistically significant relationship. This finding supports Park and Lester's (2012) finding that suicide rates in 2005 in South Korea were highest among those over the age of 60 residing in rural areas.

Implications for Suicide Prevention

The findings of this study suggest that the risk factors of suicide are multidimensional, as proposed earlier by Shneidman (1985). Suicide, then, appears to be associated with individual psychiatric disorder mediated by social and cultural forces. Therefore, treating depression is certainly an important prevention tactic. However, only a small fraction of depressed individuals die by suicide. A more targeted approach would be to create an outreach program for suicide loss survivors that provides necessary assistance, such as psychotherapy or self-help groups, to help them come to terms with the suicide and to prevent them from engaging in future suicidal behaviors themselves.

In addition, given that a permissive attitude towards suicide is significantly connected to suicidality, a community-based suicide awareness program can be an important preventive measure. This type of program would create an environment where people can freely explore a range of issues, such as personal values, health, self-esteem, and developmental concerns. More importantly, properly trained staff hired for this program should be able to identify those who are depressed, have survived a suicide attempt, have a close acquaintance who had thought about or attempted or completed suicide, and who suffer from family conflict. Because people's experience of family discord has been found to be a significant source of both suicidality and suicide approval, it is critical to provide help to those who have strained relationships with their family members. However, helping a person to find solutions for dealing with family strain without the family's involvement would yield limited success. For this reason, a community-based approach that can address suicide risk factors and identify high risk individuals and families is key (Serna et al., 2005). A community-based model of suicide prevention may be more important in rural areas where people seem to be more vulnerable than their counterparts in metropolitan areas.

Limitations of the Study

The most important finding in this study concerns several overlooked socio-cultural determinants of suicide approval in a model comprised of social learning,

social strain, and social control theories, which are inconsistently linked to suicidality in the Korean sample. Because of the limited number of variables in the secondary data used for this study to measure various dimensions, we were able to test them only indirectly. One's approval of suicide, exposure to suicidal behavior, and family discord are all significant socio-cultural factors contributing to suicidality, but only family strain and reasons for living were significant predictors of suicide approval. Considering that gender, religiosity, and residential region had reversed associations on suicidality and suicide approval, it is necessary to examine more deeply the socio-cultural or subcultural dynamics that engender these different patterns. Thus, future research needs, not only to examine how one's social locations and experiences are linked to the development of attitudes towards suicide, but also explore the impact of one's attitude towards cultural traditions, including religious/spiritual meanings on suicidal behaviors.

Another limitation of the study is that some measuring devices used in this study were different from established ones developed in the West. As a result, it is difficult to compare the present findings with findings in other cultures. For example, since the measure of reasons for living was different from the one developed by Linehan (1983), we were not able to test the cross-cultural generality of Linehan's measure. It is important for future studies to conduct cross-cultural comparisons with the same measures to examine how social and cultural aspects impact acceptability and suicidal behavior in different societies.

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Suicide Studies, 2023, 4(2), 40-47

THE ECONOMIC COSTS OF SUICIDE: A REVIEW OF CITATIONS TO "RECALCULATING THE ECONOMIC COST OF SUICIDE"

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Abstract: An analysis of 91 citations for an article by Yang and Lester (2007), which argued that suicides result in savings to the society, showed that only 9 reported Yang and Lester's thesis correctly, and only one article conducted a serious discussion of the issues raised by Yang and Lester.

Viscusi (1984) argued that the financial savings from the premature deaths of those who smoke cigarettes (as a results of reduced nursing home care costs and pension and social security payouts) were greater than the costs of medical care and life insurance. Viscusi calculated that each pack of cigarettes sold saves the society $0.72.

Yang and Lester (2007) applied Viscusi's arguments to those who die by suicide. Suicides results in savings from healthcare and nursing home costs later in life, as well as pension and social security payouts. When estimating the loss from future earnings by suicides, researchers typically forget that suicides may not be the most productive members of society. Many psychiatric researchers (e.g., Robins, 1981) argue that almost all suicides merit a psychiatric diagnosis, often a severe and disabling psychiatric disorder, and so their future earnings may be far lower than those of average citizens. Their psychiatric disorder may also incur large economic costs for psychiatric treatment had they lived.

Yang and Lester estimated the cost of suicides in 2005 in the USA to be $16.83 billion, the savings from not having to treat the psychiatric disorders of the suicides had they continued to live to be $8. 11 billion, the savings from pensions and nursing home care to be $12.99 billion, and the savings from assisted suicide to be $0.80 billion, giving a net savings from the suicides to be $5.07 billion in 2005 dollars.

As of the time of writing this article, Yang and Lester (2007) had 91 citations noted in Google Scholar. That seems to be impressive. The present review examined these 91 citations to see how they cited Yang and Lester.

Reviewing the Citations

Google Scholar examines a variety of writings for citations, including, of course, articles in scholarly journals and books, but also dissertations, blogs and unpublished papers uploaded to websites such as ResearchGate. This is an impressive achievement, but Google Scholar citations are, therefore, not restricted to scholarly publications.

Thirteen of the citations were not in English and so not examined for this review. Five authors simply included a reference to Yang and Lester is a list of references without mentioning the article in the text, and two "citations" did not contain any reference to Yang and Lester.

On six occasions, the same article was included twice, for example, as a pre-print on a university website and as the published article.

Seven articles misquoted Yang and Lester. For example, Savage (2018) said that Yang and Lester discussed the rationality of suicide. This was not the focus of Yang and Lester. Other misquotes were made by Fredette (2014), Li and Zhang, (2010), Ring, et al. (2015), Rivera, et al. (2017), Saleh (2016), while others simply included a non-specific citation to Yang and Lester in a series of cites, such as 1-21 (Poduri, 2016).

Yang and Lester reviewed briefly research on the estimated costs to the society of attempted suicide, although Yang and Lester did not present new calculations, and 20 articles quoted Yang and Lester for the estimated costs of attempted suicide (Barrigan, et al., 2022; Bolton, et al., 2015; Brann, et al., 2021; Francisco, et al., 2020; Ghahramanlou-Holloway, et al., 2012; Gysin-Maillart, et al., 2016; Keefner & Stenvig, 2021; Kim, et al., 2022; Kochanski, 2012; Lee, 2016; Lynch, 2014; Mickle, 2011; Milner & De Leo, 2010; Murrell, et al., 2014; Myrick, et al., 2017; Polits, 2016; Rothes, 2014; Sheftall, et al., 2013; Shepard, et al., 2016; Woodland, 2014).

Twenty authors cited Yang and Lester for saying completed suicide incurs costs for the society, which is the opposite of what Yang and Lester argued

(Bermeo, 2019; Bolton, et al., 2015[2]: Brann, et al., 2021; Dunn, 2013; Johnston, 2013; Kim, et al., 2022; Kirigia, et al., 2020; Layden, 2017; Lynch, 2014; Moutier, 2014; Murphy, et al., 2021; O'Brien, 2010; Onoya, et al., 2021; Rothes, 2014; Sand, 2012; Sels, et al., 2021; Sheehan, et al., 2019; Singer, et al., 2022; Tondo, et al., 2008; Vannoy[3], et al., 2010). These 20 authors do not appear to have understood Yang and Lester's thesis.

Kinchin and Doran (2017, 2018) looked at the cost of suicide in Australia. As well as calculating the cost of the legal and medical procedures following a suicide (direct costs), they also estimated the loss of economic productivity resulting from the lost years of life, but they admit that they ignored the savings discussed by Yang and Lester. A similar tactic of ignoring the essence of Yang and Lester's analysis was made by Shepard, et al. (2016)[4] and Alfonso-Sánchez, et al. (2020). Others simply ignored Yang and Lester without mentioning that they were ignoring their argument (Lyszczarz, 2021).

Seven authors cited Yang and Lester correctly, admitting that suicides can result in an economic benefit for the society (Gunn, 2019; Ohayi, 2019; Snow, et al., 2016; Sueki, 2016; Torp, 2014; Ying & Chang, 2009; Zak, 2015). Luckily, two self-citations also correctly reported the results of Yang and Lester. Two more researchers cited the thesis of Yang and Lester correctly and did additional calculations (see the next section).[5]

Research on the Economic Cost of Suicide

Sarma (2018) estimated the economic cost of suicides in India is 2015 and did consider both economic losses and gains resulting from those suicides, but he calculated that the losses far exceeded the gains.

The most complete discussion of Yang and Lester's article was made by Stack (2007). Stack drew attention to three issues. First, although it is true that suicides, by dying at a younger age than those dying from other causes, save on the direct costs of healthcare (medical and psychiatric), the longer people survive, the more healthcare jobs created. In this regard, suicides incur a cost to the society.

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[2] Already cited above.
[3] Vannoy, et al. (2010) and Kim (209) had the authors' names incorrect.
[4] Already listed above.
[5] Three additional citations in English were unobtainable.

Second, the costs incurred by those grieving for those who died by suicide may differ from the costs incurred by those grieving for those dying of other causes. Stack noted that suicides are typically sudden deaths, a factor which may affect grieving. On the other hand, suicides typically have smaller social networks than those dying from other causes, and so there are fewer people grieving.

Third, Stack argued that Yang and Lester overestimated the costs of healthcare for suicides. In his discussion, Stack focused on what percentage of suicides sought mental health treatment in the last year of their life. However, Stack also noted that the average age at death was 45 for suicides, and so they avoid roughly 30 years of life. It is during these 30 years that healthcare costs may be large.

Discussion

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The present analysis of citations to our article indicates that citations may not be a valid measure of the significance of an article. Only nine researchers cited Yang and Lester's article correctly, and only one (Stack, 2007) conducted a serious discussion of the issues raised by Yang and Lester. In the years since 2007, the thesis of Yang and Lester's article has died a natural death.

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DETECTING SUICIDAL TEXT USING NATURAL LANGUAGE PROCESSING[6]

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Abstact: Using Natural Language Processing (NLP), we are able to analyze text from suicidal individuals. Thiscan be done using a variety of methods. I analyzed a dataset of a girl named Victoria who died by suicide.I used a machine learning method to train using a different dataset and tested it on her diary entries to classify hertext into two categories: suicidal vs non-suicidal. I used topic modeling to find out unique topics in each subset.I also found a pattern in her diary entries. NLP allows us to help suicidal individuals, their family members and their close friends.

Key Words: Natural Language Processing, TF-IDF, Singular Value Decomposition, Machine Learning, Topic Modeling; Suicide.

Introduction

According to a study done by The Harris Poll, 93%of Americans believe that suicide can be prevented[7]. For something that the vast majority of citizens believe can be prevented, why is there a death by suicide every 11 minutes [4]? What are we to do about it?

The motivation for this research came primarily from my desire to make more of a direct impact on those around me. This could not have hit closer to home than when my cousin took her own life. I went from not really knowing or caring what I did for my research to knowing exactly what I wanted to do. Using the skills that I acquired in the two semesters immediately preceding her death, I used various methods to detect suicidal clues in a text with the hope that one day it will be used, not as a post-death research exercise, but as a prevention weapon to combat this cruel mental disease.

Many papers have been published about using Natural Language Processing (NLP) to research suicidal text. In a study done by Gema Castillo-Sanchez, it was found that 50% of research articles used various types of data mining techniques to research suicidal text, including but not limited to, Linguistic Inquiry, Word Count, Latent Dirichlet Analysis (LDA), Latent Semantic Analysis (LSA) and Word2Vec [2].

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However, the vast majority of these studies used data from social media platforms from individuals, often hundreds. John Pestian asked 66 individuals, 33 suicidal and 33 non-suicidal to write suicide notes. He then classified each of those notes as suicidal or not with 70% accuracy [6]. Glen Coppersmith published a paper in which he analyzed suicidal notes from 186 social media users [3]. Andrea Fernandes used over 500 individuals to classify their text as suicidal or non-suicidal using both rule-based programming and machine learning [5]. There are many additional research papers that have been published using similar methods.

These research papers were not analyzed at a personal level, largely because of the lack of availability of diaries. It is hard enough to find a diary to analyze. It is even harder to find a diary to analyze from someone who is suicidal. If one is available, the owner has to be extremely brave to give it up as it often reopens fragile and sensitive wounds. In the case of my cousin, my aunt and uncle are still coping with what has happened. For this reason, I searched elsewhere and was lucky enough to find one dataset from a girl named Victoria.

Using machine learning techniques, I classified each of her diary entries as "suicidal" or "non-suicidal", but, I did not want only to classify entries, I wanted to find a pattern and figure out why. After many futile attempts of doing so (using TextBlob, Syntatic Dependencies, Word Count, Word2Vec, LSA and LD.), I was able to find one using a different training dataset to test on her diary. I then used topic modeling on those two subsets to determine what the main topics were that she was writing about when she was "suicidal" versus when she was "non-suicidal". This was all done using Python. The training model that I used classified suicidal text with 70% accuracy.

Analysis

Datasets

Victoria's dataset was found on Kaggle [8]. It contains 62 rows, each being an entry in her diary. There are 4 columns:

- **vic detail:** States what kind of entry
- **journ entry:** Her journal entry

stage: Numbered 0-6. Her family attached a number to each entry to show the regression of her mental health

notes: Any notes the family has for each entry

The following is what the dataframe structure looks like for Victoria's diary:

Figure 1: Dataframe Structure of Victoria's Diary

	Vic detail	journ entry	stage	notes
0	final group text to her friends	Love you all; sorry guys	0	-
1	letter meant for Grace	I just meant to say that it has been an honor…	0	-
2	letter meant for Grace	If you ever feel sad or lonely	0	-
3	no time stamp	I don't want other kids to feel like freaks	0	-
4	poem	She had her head on the pillow beside me.	0	-

The training dataset that I found also came from Kaggle. It is a suicide detection dataset that has 232,074 rows. Each entry came from "SuicideWatch" and "depression" subreddits of the Reddit platform between 2008-2021. There are 2 columns: text: text entry class: Classification of each text entry as "suicide" or "non-suicide". Following is what the dataframe structure looks like for the training dataset.

Figure 2: Dataframe Structure of Training Dataset

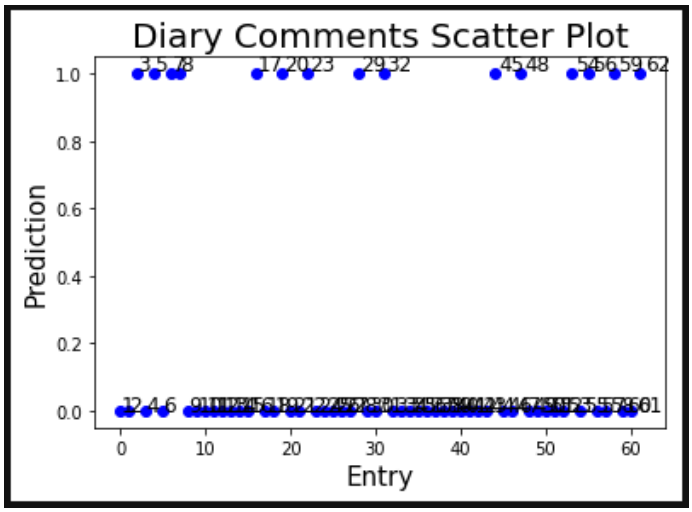
	Text	Class
0	Ex-wife threatening suicide: Recently, I left my	suicidal
1	Am I weird. I don't get affected by compliments	non-suicidal
2	Finally 2020 is over, so I can never	non-suicidal
3	I need help; just help me; I'm crying so hard	suicidal
4	I'm so lost. Hello. My name in Adam	suicidal

Method

The preferred method of text classification up until the 1990's was to hard-code conditions. Machine Learning was frowned upon because it was not seen as "robust" in order to get "perfect" outputs from hard- coding [1]. In my simple text classifications, I tried doing this, and it became extremely time consuming. The 1990's is when Machine Learning started to gain traction because it saved so much time provided you had a dataset to train your model. This was the approach I used to classify my text.

I took 80% of the data and trained it. I then used that model to test on the remaining 20% to see how good of a model it would be. It was 70% accurate. I then used this model on Victoria's diary. I created a scatterplot where each of her suicidal comments has an output of 1. If it was non-suicidal, it returned an output of 0.

Figure 3: Suicide Text Classification Plot



I finally found a pattern! I found that Victoria's suicidal diary entries occurred in clusters. She had around 3-5 suicidal comments that all occur within around 7 entries and then it seems she is "fine" for another 7 entries or so before she has another suicidal diary entry.

I then wanted to find out what it was she was talking about in the suicidal text that was unique compared to her other entries. This is where Topic Modeling is used. There are many Topic Modeling methods. I used the most common 3: Latent Semantic Analysis (LSA), La- tent Dirichlet Allocation (LDA), and Term Frequency, Inverse Document Frequency (TD-IDF). Any Topic Model requires the same basic 3 assumptions:

1. Each document contains a variety of topics
2. Each topic contains a collection of words
3. Documents with similar topics will contain the same words and patterns

This is how they differ:

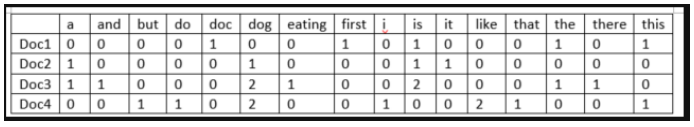
1. **LSA:** This is the most traditional method. It uses an idea of a distributional hypothesis. This means that words and expressions that occur in similar pieces of text will have similar meanings. It is the most easily implemented.
2. **LDA:** This is considered to be the Baysian version of LSA. It is better at generalizing topics.
3. **TD-IDF:** This method gives each word a "score" based on how frequently it appears uniquely in each document. This method is most useful when you are trying to figure out the differences in each document.

After researching the most common methods used in Topic Modeling, I decided to use TD-IDF because I wanted to know what the unique topics were between her suicidal entries and her non-suicidal entries.

Singular Value Decomposition

After counting how many words appear in each document, our matrix will have a structure similar to the following:

Figure 4: Initial matrix structure



	a	and	but	do	doc	dog	eating	first	i	is	it	like	that	the	there	this
Doc1	0	0	0	0	1	0	0	1	0	1	0	0	0	1	0	1
Doc2	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0
Doc3	1	1	0	0	0	2	1	0	0	2	0	0	0	1	1	0
Doc4	0	0	1	1	0	2	0	0	1	0	0	2	1	0	0	1

This causes problems though because, the more documents you include, the greater number of terms it will have, and the size of this matrix can become too large to deal with. This is where Singular Value Decomposition (SVD) is used.

Before we can use (SVD), we need to preprocess the text. This is done by tokenization (putting each word in a list), lemmatization (changing each conjugation of a word back to its root form), removing punctuation and stop words removal (removing unnecessary words such as "the, and, in, etc." Then we create a matrix.

After we preprocess the text, we then use Singular Value Decomposition. This allows us to break up a large matrix, often with hundreds or thousands of unique words (columns), into 3 separate matrices.

$$M = U \Sigma V$$

M is our original matrix similar to that in Figure 4. It is a *mxn* matrix with *m* files/documents and *n* terms. But there are only so many topics. So, we know that *n* contains a certain number of important topics, *r*. *U* is a *mxr* matrix and is called the document-topic matrix. It has the following structure:

Figure 5: Structure of the matrix *U*

	Topic 1	Topic 2	Topic 3	Topic 4
Doc1	0.9	0.8	0.1	0.05
Doc2	0.3	0.7	0.1	0.1
Doc3	0.03	0.02	0.8	0.1
Doc4	0.1	0.2	0.1	0.9

But there is not a way for us to determine what each of these topics represent. That is where the matrix *V* becomes useful. It is the term-topic matrix that is *rxn*. It allows us to determine what each of the topics may be. It looks like the following:

Figure 6: Structure of the matrix *V*

	Topic1	Topic2	Topic3	Topic4
a	0.77	0.48	0.40	0.13
and	0.89	0.04	0.80	0.58
but	0.28	0.52	0.17	0.92
do	0.86	0.97	0.60	0.35
doc	0.84	0.85	0.44	0.95
dog	0.07	0.46	0.88	0.48
eating	0.52	0.09	0.95	0.98
first	0.76	0.41	0.10	0.16
i	0.07	0.26	0.50	0.46
is	0.43	0.32	0.07	0.96
it	0.74	0.23	0.58	0.52
like	0.35	0.43	0.82	0.93
that	0.84	0.96	0.26	0.36
the	0.52	0.24	0.99	0.08
there	0.32	0.99	0.24	0.57
this	0.15	0.72	0.34	0.77

For each of the topics, we can order each of the rows from descending value. The topics contains the rows with the highest values. Σ is a diagonal matrix that is rxr that allows us to complete the matrix multiplication

TD-IDF

In TD-IDF, if a word occurs many times in a document, we give it a high score. However, if given many documents, and the word occurs frequently across all of them, this does not reveal very much information. Thus, we give that word a low score.

As an example, if we are given a book about horses and each chapter covers a different horse breed, TD-IDF will not return the word "horse". It will return words such as "thoroughbred", "quarter", "percheron", "appoloosa", etc. Because those words appear uniquely in each of their respective chapters (documents). The formula is the following:

$$w_{i,j} = tf_{i,j}.log(N/df_i)$$

where $tf_{i,j}$ are the number of times a word i appearsin a document j, df_i are the number of documents that contain i, and N is the total number or documents. We provide an example. Suppose we have the following two documents with their respective term frequencies:

Figure 7: Term Counts for each document

Document 1

Term	Term Count
this	1
is	1
a	2
sample	1

Document 2

Term	Term Count
this	1
is	1
another	2
example	3

If we want to find the TF-IDF of the word "this", we have the following:

$$tf('this', d_1) = 1/5 = 0.2$$

$$tf('this', d_2) = 1/7 = 0.4$$

$$idf('this', D) = log(2/2) = 0$$

$$tfidf('this', d_1, D) = .2x0 = 0$$

$$tfidf('this', d_2, D) = .14x0 = 0$$

Because the word "this" appears roughly the same number of times in both documents, under TF-IDF, it does not give us any useful information in the differences

between the two. Thus, we give that word a score of 0 for both documents. We try the word “example”:

$$tf('example',d_1) = 0/5 = 0$$

$$tf\ \ ('example',d_2) = 3/7 = .429$$

$$idf('example',D) = log\ (2/1) = .301$$

$$tfidf('example',d_1,D) = 0x.301 = 0$$

$$tfidf('example', d_2,D) = .429x.301 = .1290$$

Thus, we give the word “example” a score of 0 in Document 1 and a score of .129 in Document 2. This tells us that Document 2 used “example” more than did Document 1.

Results

After performing SVD and TF-IDF, we obtained the following results for Victoria’s diary.’

Figure 8: Top Topics for Suicidal Comments

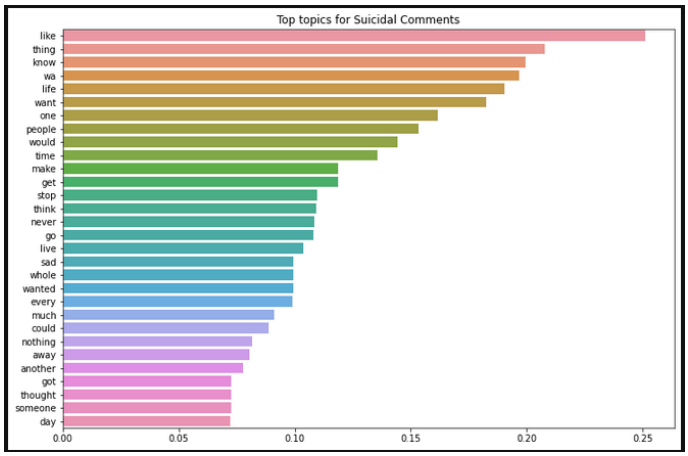
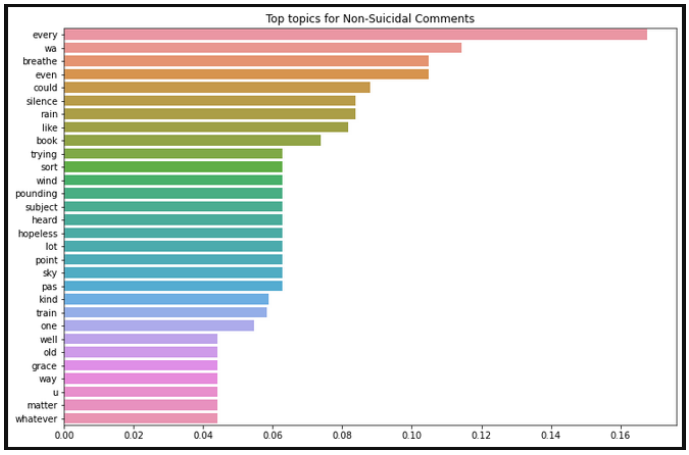


Figure 9: Top Topics for Non-Suicidal Comments



We see in Figure 8 that, for Victoria's suicidal comments, her top topics were like, thing, know, want, one, people would, time, etc. Assuming her writing would not vary while we analyze her diary, we would tell her family that when she uses those words in her writing, she is in a suicidal state. In this way, the family can be aware without nagging her and wonderingif she is "okay" or not. From Figure 3, we would also tell her family that these suicidal entries occur in cluster of about 7 and then her suicidal entries will not return until roughly 7 entries later.

Conclusion

Using Natural Language Processing is extremely useful when researching ways to help those who are suicidal. Medical professionals are not the only ones who are able to help. Mathematicians can do it as well. Using machine learning, I was able to train a model to test each of her entries and classify them as suicidal or non-suicidal. I then used topic modeling to find words she used when she was suicidal versus when she was not. If I were to explain my conclusions to her family, I would tell them when she uses certain words or topics in her writing, she is in a suicidal stateand that it will be that way for about a week beforeshe comes out of it. Families should be supportiveat every stage, but this helps them be aware of the process.

I hope in the future to be able to develop some kindof app that can send notifications to family membersif a loved one is in a suicidal slump. The majority of teenagers spend a lot of time on the internet and social media, and so I would develop a model that it took in what they are reading on the internet or texts they write to others. This would be conditional on the users allowing accessto this kind of information. With every little step, we can make progress towards what 92% of Americans believe is preventable - suicide.

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