Towards Classification of Factors to Improve Social Media Suicide Identification and Prevention

Steven Cracknell (Zenti)
Ben Cannon (Brigham Young University)

This paper proposes a structure for a Risk Matrix of language associated with suicidal behaviors. A Risk Matrix is traditionally used to understand the probability and severity of different outcomes (behaviors) to assist in decision making. The purpose of our Risk Matrix is to (1) understand the broader picture of suicide risk, (2) acknowledge that there are many risk factors that influence suicide, and (3) to prioritize that comorbid risk factors can lead to the greatest risk (Kessler, Borges, & Walters, 1999).

Approach

The following outline can provide the basis for training new classifiers using Zenti's system. The psychometric scales presented below are generally clinician administered or self reported. It is proposed that we adapt these scales and apply them to Zenti subclasses, essentially turning Zenti into the clinician assessing the patient based on their Tweets (or other social media source). There are several challenges to this idea (not enough tweets from one user to complete a questionnaire, overall insufficient data points, etc.), but we think it is possible to build the intuition from these scales into Zenti.

Main Class: At-Risk

- All tweets identified as at-risk for suicide are categorized into this class. Subclasses are then assigned based on the nature of the tweet.
- All types of risk (depression, gun ownership, family abuse, hopelessness, etc.) are categorized under this class.
- Major risk factors as identified by the literature (see Bibliography at end of paper). *Bolded items are constructs that require scales for assessment.*
    - **Suicide ideation**
    - **Hopelessness**
    - **Depression or psychological disorders**
    - Socioeconomic/demographic (age, race, income, gender)
    - Drug abuse
    - Chronic illness
    - **Social support/resiliency**

Subclasses

Many of the subclasses will be simple to set up, as they are fairly simple to identify (e.g. gun ownership, previous suicide attempts, etc.). Others such as depression and hopelessness are broad constructs that will need previously validated scales to quantify and assess presence and severity. The following subclasses provide scales and metrics that can be used to assess the more broad risk factors. It is important to note that many of these scales are from Aaron Beck, who was a psychiatrist and professor at University of Pennsylvania. While many of his scales were developed in the 60's and 70's, they are still widely used today and are some of the few that have predictive validity.

Subclass/Construct: Suicide Ideation

- Scale: Scale for Suicide Ideation, or "SSI" (Beck, Kovacs, & Weissman, 1979), assesses preparation and motivations for suicide.
- Factors/Variables: Measured on a 3-point scale (0 to 2)
    - Wish to live
    - Wish to die
    - Reason for living/dying
    - Desire to make active suicide attempt
    - Passive suicidal desire
    - Time dimension: duration of suicide intention/wish
    - Time dimension: frequency of suicidal language
    - Attitude toward ideation/wish
    - Control over suicide action/acting-out wish
    - Deterrents to active attempts (e.g. family, religion, irreversibility)
    - Reason for contemplated attempt
    - Method: Specificity/planning of contemplated attempt
    - Method: availability/opportunity for contemplated attempt
    - Sense of "capacity" to carry out attempt
    - Expectancy/anticipation of actual attempt
    - Actual preparation for contemplated attempt
    - Suicide note
    - Final acts in anticipation of death (e.g. insurance, will)
    - Deception/concealment of contemplated suicide

Notes: One limitation is that this scale only measures the *current* intensity of a person's attitudes, behaviors, and plans to commit suicide (Brown, 2001, p. 6). It is, however, one of the most widely used scales to assess suicide ideation (Brown, 2001, p. 7). The SSI is one of the few assessment tools that have documented predictive validity for completed suicide (Brown, 2001, p. 7). Concurrent validity with Beck Depression Inventory and Hamilton Rating Scale for Depression (Brown, 2001, p. 6).

Subclass/Construct: Hopelessness

- Scale: Beck Hopelessness Scale (Beck, Weissman, Lester, & Trexler, 1974)
- Factors/Variables: True/False. Answers receive 0 or 1, 0 being an optimistic response and 1 being a pessimistic response.
- Below are statements about each factor, and patients can rank each statement as to whether it represents their feelings or not.
    - Factor 1: Feelings about the future
        - I look forward to the future with hope and enthusiasm
        - In the future, I expect to succeed in what concerns me the most
        - When I look ahead to the future, I expect I will be happier than I am now.
        - I have great faith in the future.
        - I can look forward to more good times than bad times.
    - Factor 2: Loss of Motivation
        - I might as well give up because I can't make things better for myself.
        - When things are going badly, I am helped by knowing they can't stay that way forever.
        - I just don't get the breaks, and there's no reason to believe I will in the future.

        - All I can see ahead of me is unpleasantness rather than pleasantness.
        - I don't expect to get what I really want.
        - I never get what I want so it's foolish to want anything.
        - It is very unlikely that I will get any real satisfaction in the future.
        - There's no use in really trying to get something I want because I probably won't get it.
    - Factor 3: Future Expectations
        - I can't imagine what my life would be like in 10 years.
        - My future seems dark to me.
        - I expect to get more of the good things in life than the average person.
        - Things just won't work out the way I want them to.
        - The future seems vague and uncertain to me.

Notes: Predictive validity is high for this scale. A score of 9 or higher is a predictor of future suicide completion (Beck, Steer, Kovacs, & Garrison, 1985). Beck, et al. (1985) found that 90.9% (total *n*=207, suicide *n*=11) of suicide completers scored 10 or more on the hopelessness scale. "According to Beck's formulation, hopelessness is a core characteristic of depression and serves as the link between depression and suicide. Furthermore, hopelessness associated with other psychiatric disorders also predisposes the patient to suicidal behavior" (Beck, et al., 1985).

Subclass/Construct: Depression

- Scale: Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961)
- Factors/Variables: Measured on a 4-point scale (0 to 3)
    - Mood
    - Pessimism
    - Sense of Failure
    - Lack of Satisfaction
    - Guilty Feeling
    - Sense of Punishment
    - Self Hate
    - Self Accusations
    - Self-punitive Wishes
    - Crying Spells
    - Irritability
    - Social Withdrawal
    - Indecisiveness
    - Body Image
    - Work Inhibition
    - Sleep Disturbance
    - Fatigue
    - Loss of Appetite
    - Weight Loss
    - Somatic Preoccupation
    - Loss of Libido

Notes: The Beck Depression Inventory (BDI) suicide item has moderate concurrent validity with the Scale for Suicide Ideation (SSI) and well established predictive validity (Brown, 2001, p. 25). The BDI suicide item is useful as a screening tool for the SSI (Brown, 2001, p. 25). The Beck Depression Inventory, Hopelessness Scale, and Scale for Suicide Ideation have high convergent validity and thus are ideal when used together. Depression level changes are

significant in suicide risk. Nanayakkara et al. (2013) found that going from no depression or low depression to severe depression increases risk for suicide. Depression severity trends are thus vital to track.

Subclass/Construct: Social Network

- Scale: This is an area where we believe we need to develop tools and metrics for measuring the social aspect of suicide risk.
- Factors/Variables:
    - Exposure to another person's suicide or suicide attempt
    - Positive or negative engagement on suicidal Tweets

Notes: Nanayakkara et al. (2013) found that exposure to suicidal behavior in a friend or family member equates to similar risk of suicide as does severe depression. Does this risk also apply to members of a social network? Ideally we would generate a scale to measure this risk online to see if it correlates to Nanayakkara's findings.

Bibliography with Abstracts

Beck, A. T., Kovacs, M., & Weissman, A. (1979). Assessment of suicidal intention: The Scale for Suicide Ideation. *Journal of Consulting and Clinical Psychology*, *47*(2), 343–352. Retrieved from 10.1037/0022-006X.47.2.343

Describes the rationale, development, and validation of the Scale for Suicide Ideation, a 19-item clinical research instrument designed to quantify and assess suicidal intention. In a sample with 90 hospitalized Ss, the scale was found to have high internal consistency and moderately high correlations with clinical ratings of suicidal risk and self-administered measures of self-harm. Furthermore, it was sensitive to changes in levels of depression and hopelessness (Beck Depression Inventory and Hopelessness Scale, respectively) over time. Its construct validity was supported by 2 studies by different investigators testing the relationship between hopelessness, depression, and suicidal ideation and by a study demonstrating a significant relationship between high level of suicidal ideation and "dichotomous" attitudes about life and related concepts on a semantic differential test. Factor analysis yielded 3 meaningful factors: Active Suicidal Desire, Specific Plans for Suicide, and Passive Suicidal Desire.

Beck, A. T., Steer, R. A., Kovacs, M., & Garrison, B. (1985). Hopelessness and Eventual Suicide: A 10-Year Study of Patients Hospitalized With Suicidal Prospective Ideation. *American Journal of Psychiatry*, *142*(May), 559–563. Retrieved from http://ajp.psychiatryonline.org/data/Journals/AJP/3387/559.pdf

The authors intensively studied 207 patients hospitalized because of suicidal ideation, but not for recent suicide attempts, at the time of admission. During a follow-up period of 5-10 years, 14 patients committed suicide. Of all the data collected at the time of hospitalization, only the Hopelessness Scale and the pessimism item of the Beck Depression Inventory predicted the eventual suicides. A score of 10 or more on the Hopelessness Scale correctly identified 91% of the eventual suicides. Taken in conjunction with previous studies showing the relationship between hopelessness and suicidal intent, these findings indicate the importance of degree of hopelessness as an indicator of long-term suicidal risk in hospitalized depressed patients.

Beck, A. T., Ward, C., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An Inventory for Measuring Depression. *Archives of General Psychiatry*, *4*(6), 561–571. doi:10.1001/archpsyc.1961.01710120031004

The difficulties inherent in obtaining consistent and adequate diagnoses for the purposes of research and therapy have been pointed out by a number of authors. Pasamanick, et. al. in a recent article viewed the low inter clinician agreement on diagnosis as an indictment of the present state of psychiatry and called for "the development of objective, measurable and verifiable criteria of classification based not on personal or parochial considerations, but on behavioral and other objectively measurable manifestations." Attempts by other investigators to subject clinical observations and judgments to objective measurement have resulted in a wide variety of psychiatric rating scales.4,15 These have been well summarized in a review article by Lorr on "Rating Scales and Check Lists for the Evaluation of Psychopathology." In the area of psychological testing, a variety of paper-and-pencil tests have been devised for the purpose of measuring specific personality traits; for example, the Depression-Elation Test, devised by

Jasper in 1930.

Beck, A. T., Weissman, A., Lester, D., & Trexler, L. (1974). The measurement of pessimism: the hopelessness scale. *Journal of Consulting and Clinical Psychology*, *42*(6), 861–865. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/4436473

A scale designed to quantify hopelessness was administered to several diverse samples of patients to assess its psychometric properties. This scale was found to have a high degree of internal consistency and showed a relatively high correlation with the clinical ratings of hopelessness and other self-administered measures of hopelessness. Furthermore, the scale was sensitive to changes in the patient's state of depression over time. An affective, a motivational, and a cognitive factor were extracted.

Brown, G. K. (2001). *A Review of Suicide Assessment Measures for Intervention Research with Adults and Older Adults*. Retrieved from

http://www.suicidology.org/c/document_library/get_file?folderId=235&name=DLFE-113.pdf

The purpose of this review is to provide a systematic examination of the psychometric properties of measures of suicidal ideation and behavior for younger and older adults. Although several of the measures in this review may be utilized with children and adolescents, a more detailed and comprehensive review of suicide measures for these populations is available (see Goldston, 2000). Instruments were selected if they focused on suicidal behaviors or other behaviors that are closely associated with suicidal risk. Hence, the following categories of assessment instruments are reviewed: (1) Suicide ideation and behavior, (2) lethality of suicide attempts, (3) brief screening measures, (4) hopelessness, (5) reasons for living, (6) provider attitudes and knowledge concerning suicide and (7) measures in development. Although some measures do not directly assess suicidal behavior, such as measures concerning hopelessness or reasons for living, these variables have been closely associated with suicide and are potentially modifiable with treatment. Therefore, these measures have been included in the review.

Hall, R. C. W., Platt, D. E., & Hall, R. C. W. (1999). Suicide Risk Assessment: A Review of Risk Factors for Suicide in 100 Patients Who Made Severe Suicide Attempts. *Psychosomatics*, *40*(1), 18–27. Retrieved from

http://www.sciencedirect.com/science/article/pii/S0033318299712673

A study of 100 patients who made a severe suicide attempt suggested that the managed care criteria often applied for approving admission to hospitals for potentially suicidal patients were not, in fact, predictive of features seen in patients who actually made such attempts. Severe anxiety, panic attacks, a depressed mood, a diagnosis of major affective disorder, recent loss of an interpersonal relationship, recent abuse of alcohol or illicit substances coupled with feelings of hopelessness, helplessness, worthlessness, global or partial insomnia, anhedonia, inability to maintain a job, and the recent onset of impulsive behavior were excellent predictors of suicidal behavior. The presence of a specific suicide plan or suicide note were not. Patients with managed care were overrepresented by 245% in the study.

Kessler, R. C., Borges, G., & Walters, E. E. (1999). Prevalence of and Risk Factors for Lifetime Suicide Attempts in the National Comorbidity Survey. *Archives of General Psychiatry*,

56(7), 617. doi:10.1001/archpsyc.56.7.617

Background General population survey data are presented on the lifetime prevalence of suicide attempts as well as transition probabilities to onset of ideation, plans among ideators, and attempts among ideators either with or without a plan. Risk factors for these transitions are also studied. Methods Data are from part II of the National Comorbidity Survey, a nationally representative survey carried out from 1990 to 1992 in a sample of 5877 respondents aged 15 to 54 years to study prevalences and correlates of DSM-III-R disorders. Transitions are estimated using life-table analysis. Risk factors are examined using survival analysis. Results Of the respondents, 13.5% reported lifetime ideation, 3.9% a plan, and 4.6% an attempt. Cumulative probabilities were 34% for the transition from ideation to a plan, 72% from a plan to an attempt, and 26% from ideation to an unplanned attempt. About 90% of unplanned and 60% of planned first attempts occurred within 1 year of the onset of ideation. All significant risk factors (female, previously married, age less than 25 years, in a recent cohort, poorly educated, and having 1 or more of the DSM-III-R disorders assessed in the survey) were more strongly related to ideation than to progression from ideation to a plan or an attempt. Conclusions Prevention efforts should focus on planned attempts because of the rapid onset and unpredictability of unplanned attempts. More research is needed on the determinants of unplanned attempts.

Mościcki, E. K. (1997). Identification of suicide risk factors using epidemiologic studies. *The Psychiatric Clinics of North America*, *20*(3), 499–517. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9323310

Suicide is a complex outcome of multiple, inter-related factors. This article presents the epidemiology of completed and attempted suicide and discusses the known risk factors for suicide within a framework designed to encourage a systematic approach to theory testing and prevention. Mental and addictive disorders, frequently in co-occurrence, are the most powerful risk factors for suicide in all age groups, accounting for over 90 percent of all completed suicides. In combination with proximal risk factors such as access to firearms or other lethal means, recent and severe stressful life events, and intoxication, they can form the necessary and sufficient conditions for suicide.

Nanayakkara, S., Misch, D., Chang, L., & Henry, D. (2013). Depression and exposure to suicide predict suicide attempt. *Depression and anxiety*, *30*(10), 991–6. doi:10.1002/da.22143

OBJECTIVE: To examine the role of depression and exposure to peer or family suicide and their interaction as risk factors for adolescent suicide attempts. METHODS: The study used the public-use data set of the National Longitudinal Study of Adolescent Health (Add Health), which is a nationally representative stratified sample of U.S. high school students. Sample size was 4,719. Analyses predicted suicide attempts from preexisting depression and exposure to suicide of a friend or family member, controlling for previous suicide attempts, exposure, and depression. RESULTS: The greatest risk for future suicide attempts (relative risk = 3.3), was attributable to an attempt in the preceding year, controlling for preexisting and current depression and exposure. There was a main effect of exposure with the next highest relative risk of 3.2. A similar risk ratio, 3.2, was found for the difference between no depression and current severe depression, controlling for past depression and attempts. There was no evidence of an interaction between exposure to a peer or family member suicide attempt and depression.

Supplementary analyses found that exposure to a friend or family member suicide attempt or completed suicide each added significantly to risk for adolescents regardless of depression levels. CONCLUSION: Exposure to suicidal behavior in a friend or family member poses risk equivalent to the risk posed by becoming severely depressed. Attending to such risks could benefit clinical practice with adolescents and public health suicide prevention efforts.