

Utilization of Frequent Client Feedback to Minimize Suicide Risk: An App Approach to Supplement Mental Health Therapy

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Submitted for Publication: 05/25/2020

Abstract

As the rate of suicide caused by depression increases, the need for psychological professional help is increasing. After evaluating several existing methods of mental health therapy, we decided to create an app that fills the gaps in between mental health therapists and best utilizes suicide prevention hot lines. A digital mood tracker and emergency alarm for major depression patients is developed. In the form of an app, we created the platform for major depression patients to record the magnitude of their psychiartric signs. An algorithm is invented to turn the magnitude of psychiartric signs into three different zones of patients' mental state.

1.0 Introduction

Major depression is one of the most common mental disorders in the United States. According to the National Institute of Mental Health, in 2017, about 11 million U.S. adults(18 or older) had at least one major depressive episode with severe impairment. About 65% received care by either a health professional or medication treatment. (National Institute of Mental Health, 2019). Traditionally, health professionals and patients diagnosed with major depression set up face-to-face treatment meetings, with meeting frequency dependent on the needs of the patients. However, nearly 31% percent of patients who have attempted suicide once repeat their attempt before their next scheduled face-to-face treatment meeting(Christiansen & Frank Jensen,2009). Even weekly appointments are not enough to ensure a patients' well being in between appointments. This project plans to fill in this "between treatment gap" by offering a voluntary

collection of self-assessment data that could potentially be used by professional caregivers to enhance treatment.

1.1 Currently available mental health App

Currently, there are a lot of existing mental health apps available to caregivers and the public. The features of popular mental health apps fall into three categories: mood trackers, chat boxes and physical sensors.

1.1.1 Mood tracker: The sole function of the mood tracker is to record the mood of users, some of them are in questionnaire form and some of them are like a journaling app. Apps like Daylio, eMoods, Smiling Mind, and many similar apps are working as a digital journal that asks users to record their daily mood by evaluating their depression, sadness, irritability, anxiety, etc. And the system would store the data and draw a graph to document the user's change in mood.

1.1.2 AI chatbot: The second category is AI chat box apps for cognitive behavior training (CBT), which is a trending type of mental health apps. For example, Youper and Replika use artificial intelligence technology to mimic real therapists chatting with the users, but the functions of this type of apps are very limited.

1.1.3 Physical Sensors: The third type of mental health apps is sensors on the phone that collect physical data, which is used to analyze users' emotional status.

Mental health is gaining increasing attention from app developers since the mental health issue has become a severe problem but traditional psychological support is still not accessible for the majority of people. The huge market in mental health issues leads to the rise of mental health apps. However, app developers have to encounter many issues like privacy and health insurance

while bringing mental health support to their users(Bush, Armstrong & Hoyt, 2019). A review from National Center for Telehealth and Technology suggests that “the future of the psychological health app should move toward a more platform-agnostic merging of technologies in which the consumer shares more of their health management with their clinicians, including symbiosis of electronic health records; remote diagnosis; treatment and prescription through telehealth, algorithms, and artificial intelligence; mobile devices; electronic homes; and wearables”(Middleton, Gunn,Bassilios, & Pirkis, 2014). Therefore, going beyond self-management, our app aims to strengthen the connection between patients with major depression and their therapists. The combination of professional help with frequent self-care is what reviewers from the National Center for Telehealth and Technology predict the future of psychological health app should be.

1.2 Rationale

The high suicide rate in America, the traditional approaches suggests that traditional approaches (therapist counseling and crisis hotlines) can no longer fill the rising needs. Online mental health monitors as an auxiliary tool may help reduce the stress of resource shortage. Our project is a prototype that explores the possibility of using a voluntary, online mental health monitoring for early detection of suicidal signs and the prevention of dangerous behavior. The data from the monitoring app can keep track of patients’ mood variations between professional mental health appointments so that the counselors are able to know patients’ mental condition better and make treatment plans more effective.

2.0 Methods

In consultation with three psychology professionals working in different areas: Mrs. Gallant, the Director of Psychological Counseling and Services on campus and part-time

therapist; Mr. Badzey, Honor Psychology Research Instructor on campus and part-time therapist; and Dr. Lisa Finlay, full-time therapist. Meeting with these experts as well as journal review leads us to set up a series of criteria for the project device.

2.1

The first criterion we set up is to employ the evaluation criteria that have been commonly used in the suicide assessment process during psychiatric/therapist counseling. The major criteria are specific psychiatric signs and symptoms (level of hopelessness, anxiety, fearfulness), past suicidal behavior and self-injury act, patient's current crisis (financial or legal difficulties, relationship losses, pressure from sexual orientation, unemployment, educational failure, humiliation, etc), and family background (Jacob, plus et al. 2003). This information allows the professionals to address the patient's immediate safety and determine the most appropriate setting for treatment and develop a multiaxial differential diagnosis to further guide the planning of treatment. In order to effectively transplant this assessment process to the digital platform, a simplified version was employed in the digital platform, which contained three essential parts: psychiatric signs, past suicidal behavior and self-injury act, and the current crisis. The level of hopelessness, sadness, and loneliness as the psychiatric signs, ten common crisis events, and six common self-harm behaviors was selected. Because high-risk patient's mood and mental condition are largely unstable, the risk evaluation will take place at least one time per day. The frequency will increase for more severe patients.

Prototype version 1.0 contains two parts: first check in questionnaire and daily check-in questionnaire. In the first check in questionnaire, the first six questions ask the user to evaluate his/her level of hopelessness, sadness, and loneliness in his/her normal days and during his/her

last suicidal attempt from 0% to 100%. The value each user put in creates a unique threshold line, which is calculated as $\text{threshold index} = 60\%[(\text{hopelessness in normal state} + \text{hopelessness during last suicidal attempt})/2] + 20\%[(\text{sadness in normal state} + \text{sadness during last suicidal attempt})/2] + 20\%[(\text{loneliness in normal state} + \text{loneliness during last suicidal attempt})/2]$. The midpoint between the user's normal state and suicidal state is used as the threshold index because it can be seen as the point where the patient has formed early suicidal thoughts but not yet had a clear plan and determination to commit it. It is too risky to wait until the user actually reaches the suicidal level to send out the alarm. Level of hopelessness is weighted the heaviest because psychological professionals we interviewed agreed that it is the major negative feeling that leads people to suicide. So, more than half of the threshold value is decided by the index on hopelessness. Two other psychiatric signs, sadness and loneliness are selected since they are two other common suicidal emotions for major depression people. The rest of the questions in the first check-in document the trigger of the user's suicidal thought, self harm behavior and preferred coping behavior, which will be used in daily check-in.

2.2

When the suicidal tendency is detected, active prevention needs to take place immediately. Therefore, our second criterion is that when the patient is considered under high risk, alarm messages, phone calls or emails, will also be sent to designated contacts. In consultation with therapists and family members, Individuals' contact lists will be developed, which may include the therapists, family members, emergency hotlines, etc. A therapist is unlikely to give an immediate response to every emergency case because a therapist usually has multiple patients at the same time and other work to do. It will be too much work for the

therapist's side. Family members and friends are reliable sources to give the patient immediate help and support in an emergency. Crisis hotlines are also very useful since they have experienced workers available 24 hours. The hospital remains as an added on option due to its high cost.

2.3

The third criterion is that the therapist would actively participate in the evaluation process. The therapist assists the patient with his/her first-time online evaluation to give clarification and instruction. The therapist can use the patient's daily recorded data to create more effective and personalized treatment plans.

After finishing the first check-in, the user will be led to a daily check-in questionnaire and do this part daily. The user is asked to evaluate his/her current level of hopelessness, sadness and loneliness from 0% to 100%. The data will be used to assess the user's current suicidal risk: $\text{today index} = 60\%(\text{hopelessness today}) + 20\% (\text{sadness today})/2 + 20\% (\text{loneliness today})$. If the today index is lower than the threshold index, the user is assigned to the green zone and no further question will be asked. If the index is higher than the threshold index, the user will be asked with a follow-up question whether he/she has done self harm behaviors or experienced triggering events that the user has selected during the first check in questionnaire. If the answer is "no", the user is assigned into the yellow zone. In the yellow zone, additional suggestions about coping behavior are provided. If the answer is "yes", the user is assigned to the red zone. In the red zone, alarming messages will be sent to designated contacts. Due to the time limit, the actual set up of the automatic text and email sending server is moved into phase two. Right now, we only have a nonfunctional interface as the red zone. The standard of categorizing into a

specific zone is unique for every user, which is why we spent the majority of our prototyping time working on data storage. Our prototype has the function to store all users' first check-in and daily check-in information.

2.4

The final criterion is that to encourage frequent feedback, an overlay of a petting game is employed in the system. The evaluation process will be simulated as taking care and playing with the pets, and the user can gain virtual currency to buy more pets and game props through finishing daily evaluation. Notification (emails, text messages, app notifications) will also be sent as reminders. Due to the limit of time, gaming mechanics, as well as server development, will be achieved in the prototyping phase two.

2.5

After setting up the basic criteria, the prototyping phase is started. In our original planning, we were looking for an app that users are able to access from their phones. When prototyping was started, App Lab was chosen as our platform to create this App.

2.6

After we finished the prototype, we started our validation process. The first stage of validation is debugging. After an initial round of debugging, we started a simulation blind trial and invited five student volunteers to participate. We created three different profiles of high school students who had recurring suicidal thoughts and each participant was assigned with one profile randomly. The first part of the profile is the character's background information, which describes the character's personality and what happens during her last suicidal attempt. The participant will use this information to fill out the first check-in questionnaire. The second part of

the profile describes the character's change of mental state in three days when the character faces a significant crisis. The participant will complete the daily check-in for three times based on how the character reacts toward the crisis in three days. All information in the profile was provided with implicit descriptions instead of the direct data. The participant will complete all the check-ins based on her own understanding of the profile character. At the end of each daily check-in, the participant will be assigned to either green, yellow or red zone. At the end of the trial, a total of 15 zones will be recorded. We will compare the 15 recorded zones with the characters' change of mental state in the profiles

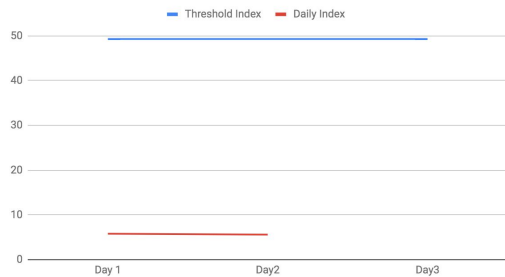
3.0 Results

The chart below shows the results of five test subjects who participated in a three day blind test as described in section 5.3. The profile description is a summary of the profile provided to test subjects, the recorded zone is a red/yellow/green indicator based on the today index from daily check-ins and its comparison to the threshold index resulted from the first check-in. The red and yellow zones are indicated when the today index is above threshold index and green is when the today index is below the threshold index. .

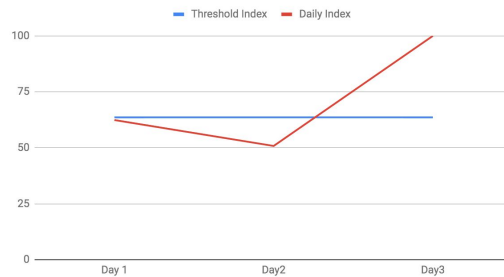
Ellis Chen	profile description	recorded zone	Index
DAY0	Initial Checkin to Set Threshold	/	49.3
DAY1	have nice day with friends	green	5.8
DAY2	recieve acid comment on social media	green	5.6
DAY3	get friends' consolation	Unrecorded	Unrecorded
Dory Miller	profile description	recorded zone	Index
DAY0	Initial Checkin to Set Threshold	/	63.6
DAY1	waiting for college result	green	62.4
DAY2	getting more nervous	green	50.8
DAY3	get rejected by Dream School	red	100

Margret Twillis	profile description	recorded zone	Index
DAY0	Initial Checkin to Set Threshold	/	44.4
DAY1	have nice day with friends	red	61.2
DAY2	receive acid comment on social media	yellow	52.2
DAY3	get friends' consolation	yellow	48.6
Sara	profile description	recorded zone	Index
DAY0	Initial Checkin to Set Threshold	/	96.2
DAY1	have big fight with boyfriend	green	81.6
DAY2	boyfriend wants to break up	green	61.4
DAY3	go to Disneyland with family; still think about boyfriend	green	33.6
Jane Wallace	profile description	recorded zone	Index
DAY0	Initial Checkin to Set Threshold	/	79.5
DAY1	waiting or college result	green	63.6
DAY2	getting more nervous	yellow	66
DAY3	get rejected by Dream School	red	93.8

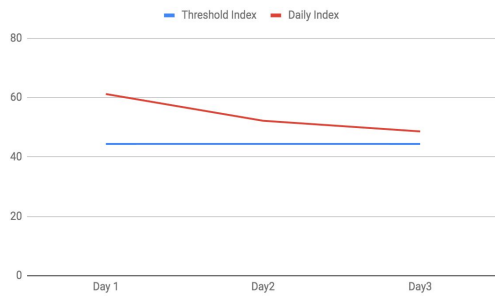
Ellis Chen



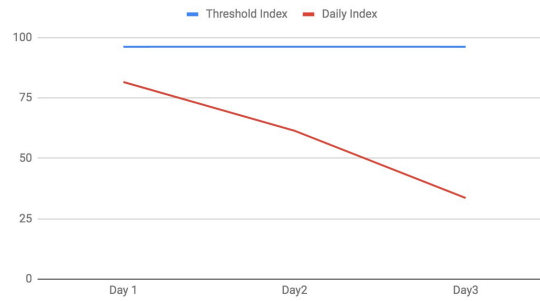
Dory Miller



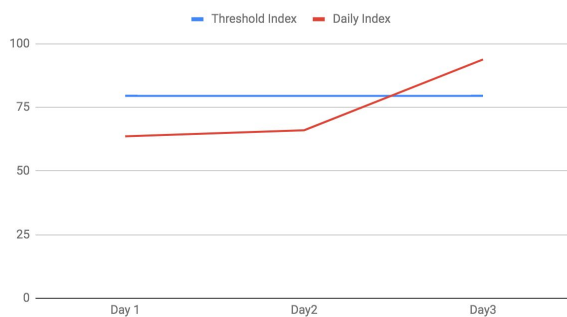
Margret Twillis



Sara



Jane Wallace



4.0 Discussion & Conclusion

The trial results show that the algorithm in our App is able to accurately reflect the user's change of mental state. This is seen in the case of Jane Wallace, in which the change of today index and assigned zones responded with increased warning levels. In the other cases, the trial reveals the limitations of the process. Without medical provement, we cannot test our App on actual suicidal patients and have real data. So, we asked student participants to imitate suicidal patients based on the profiles we gave them. However, our interpretation of profile characters may be different from the participants'. When we think that the character is having a mental breakdown, the participants may consider it a small case and enter a low level of hopelessness/sadness/loneliness. In the case of Ellis Chen, the participant entered a very high

value in the first check-in questionnaire, creating a threshold line of 49.3. But her today indexes in all three daily checks-in are under 10 even the profile character faces life crisis and commits self-harm behavior. It can be assumed that this participant does not use a consistent scale throughout. The same problem happens to the participant Sarah. In Sarah's first check-in questionnaire, her level of hopelessness, sadness, and loneliness in both normal state and suicidal state is above 90, which also creates a high threshold index of 96.2. In her daily check-in, the highest value, the level of sadness and loneliness on day one, is 84. Therefore, her today indexes in all three daily check-ins can not exceed the threshold line, making all of her status green zones. From the cases of Elis and Sarah, we can see the necessity of building a consistent understanding of the scale when using the app. When new patients are doing their first check-in questionnaire and first few daily checks in, it is important that the therapists give them clear instructions and help them establish consistency. If we continue to use simulated data in future trial validation, larger participant pool, more detailed profiles, more training on the participants and professional therapist's assistance are necessary. But still the most effective validation would still be having real suicidal patients as our participants. For more effective validation in the next phase, we would consider visiting local mental health institutions and local therapist clinics for volunteers.

This App as presented is functional in the basic form and able to record and provide feedback to the user input. To continue this project, the following additional work should be pursued.

1. Set up servers to make the yellow/red zone alert and daily notification
functionable

2. Set up therapist account that allows the therapists to view their patients' check in result
3. Set up a chart or report function that allows patients to view their own check-in result.
4. Incorporate gaming mechanics into the check-in process.
5. Develop training process on trial participants
6. Improve instruction on check-in questionnaires.
7. Bring in real suicidal patients and therapists as volunteers.

5.0 Conclusion

In response to the high suicidal rate in America, a suicide prevention app was developed that reinforces the connection between psychological professionals and suicidal patients. Based on the user's self report daily check in, the App can evaluate the user's suicidal risk and send out alarm messages to designated contact. The first prototype was built on App Lab and a blind trial validation was conducted. The discrepancy shown in the result is mostly caused by lack of therapists' instruction to help users build up the consistent understanding of the scale as well as the limitation of the validation process itself. Future work in the second phase are updates in both software and validation processes.

6.0 References

Bush, N. E., Armstrong, C. M., & Hoyt, T. V. (n.d.). Smartphone apps for psychological health: A brief state of the science review. *Psychological Services, 16*.

- Clinical Mental Health Counseling. (n.d.). What Is Clinical Mental Health Counseling, and Why Is It Important? [Blog post]. Retrieved from Wake Forest University website:
<https://counseling.online.wfu.edu/blog/what-is-clinical-mental-health-counseling-and-why-is-it-important/>
- Frazer, G., & Morales, P. G. (2019, June 18). Suicide among teens and young adults reaches highest level since 2000. *PBS News Hour*. Retrieved from
<https://www.pbs.org/newshour/nation/suicide-among-teens-and-young-adults-reaches-highest-level-since-2000>
- G. Jacobs, M.D., D., Baldessarini, M.D., R. J., Conwell, M.D., Y., & Fawcett, M.D., J. A. (n.d.). Assessment and Treatment of Patients With Suicidal Behaviors. Retrieved from https://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/suicide.pdf
- Lewis-McChord, J. B. (2019). Smartphone apps for psychological health: A brief state of the science review. *Psychology Service*, 188-195. Abstract retrieved from
<https://www.ncbi.nlm.nih.gov/pubmed/30407057>
- Middleton, A., Gunn, J., Bassilios, B., & Pirkis, J. (2014). Systematic review of research into frequent callers to crisis helplines. *Journal of Telemedicine and Telecare*, 20(2), 89-98. Retrieved from <https://journals.sagepub.com/doi/10.1177/1357633X14524156>
- NIMH. (n.d.). National Institution of Mental Health. Retrieved December 19, 2019, from <https://www.nimh.nih.gov/health/statistics/major-depression.shtml>

Reynolds, K. (Ed.). (2019). Retrieved November 17, 2019, from Informed Choices of

Depression website:

<https://depression.informedchoices.ca/types-of-treatment/counseling-or-therapy/how-much-does-therapy-or-counseling-cost/>

UCSC COUNSELING & PSYCHOLOGICAL SERVICES. (n.d.). Depression and Suicide.

Retrieved from <https://caps.ucsc.edu/resources/depression.html#Chapter4>

Erik Christiansen & Børge Frank Jensen (2007) Risk of repetition of suicide attempt, suicide or

all deaths after an episode of attempted suicide: a register-based survival analysis,

Australian and New Zealand Journal of Psychiatry, 41:3, 257-265, DOI:

10.1080/00048670601172749

7.0 Appendix

https://drive.google.com/drive/u/0/folders/14L7PRVPK_JZkn7XgKJo9uaxHyZsucvDP