Creating Connections through Data:
Exploring use of mHealth for Mental Health Support

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Abstract

Through research and interviews with health professionals and students, we have gained an understanding of how mobile health applications can best be used to improve student health. By looking at what is currently used, what each side wants to get out of such applications, and what opinions are on benefits and risks, we have determined what types of information would be valuable and in what forms. Following this research and a period of designing and testing, we propose a prototyped application that allows for consistent student practice of biofeedback and other prescribed behaviors as well as the sharing and utilization of the resulting data.

Keywords

Mental Health, Biofeedback, Mobile Health, Mindfulness

Introduction

Nearly 27 percent of young, college aged people ages 18- 24 suffer have suffered some level of diagnosable mental health issue, yet professional mental health services are infrequently used. At Carnegie Mellon specifically, students frequently cite not seeking mental health services due to the continuing stigma of mental health or their own perceived lack of availability to attend mental health services. The use of mobile devices to track personal health data, including mental health indicators, is increasingly prevalent, particularly among this age group. Students are also often interested in learning more about their mental and physical health but often lack the expertise in interpretation and reflection. However, most practicing mental health clinicians have limited experience or ability to help their patients best use apps as support outside the office. As therapy sessions are focused on collaborative working together between therapist and student, clinicians do want to encourage positive behavior in and out of sessions. This forms the problem of how mobile health data can be best used by both patients and mental health professionals in improving mental health.

User Research: Students

We developed and administered an online survey to a small sample of 15 students, inquiring into both their experience with mobile health apps for physical and mental health, and their perceived willingness to extend the usage into a more formal clinical setting. We questioned students on if they've ever used smartphone apps for mental health or wellness, which ones and why if so, and asked what they're most interested in gaining from a health app. Additionally, we asked about previous experience to seek support for mental health, whether they would they be willing to share data with professionals if collected by a health app, and how often have they seen a professional about any aspect of health (physical and mental).

Findings

In our sample, 50% of students have seen a mental health professional regularly, 33% have never, and the remaining 27% have sought mental health support infrequently. This data indicates that our sample had

more experience seeking mental health support than the overall sample of students at CMU, of which 33% report seeking mental health support during college. However, from previous research in User-Centered Research and Evaluation, many students have stated that Counseling and Psychological Services (CaPS) is difficult to schedule appointments with and is relatively unhelpful, so many students seek mental health services from outside providers. This indicates that students are seeking a certain standard of professionalism, collaboration, and availability from mental health providers, which we wanted to incorporate within our prototype.

 In terms of mobile health usage, 66% have found benefits to using another health application before (physical or mental), and 83% would "maybe" be willing to share health application information with a professional. Additionally, we asked for qualitative statements on what students liked or disliked about the apps.
"Makes me more aware of my activity level and sometimes motivates me to improve."
"Cool, never tried it for mental health, so would love to try it out."
"Helped me keep track of the days in a row that I hadn't hurt myself, which was motivating. Rise up forced me to recognize when I didn't eat enough food, which helped me stay on track eating food."

User Research: Health Professionals

Our initial plan was to work with mental health professionals as our primary partners, including them in the design process fully. However due to their own time constraints, we were only able to do more limited user research. We were able to gain insight from two mental health professionals on limitations and opportunities that they perceived for using mobile technology as part of a clinical psychology settings. We were interested in how often they typically see the average patient, if they see an advantage in having more data about daily activities, what activities do they suggest outside of appointments and how do they evaluate if such activities are done. Additionally, we inquired as to how they currently get data versus how they would like data. Specifically on health applications, we wondered if they had ever recommended a health app as well as whether or not it was useful and why if so. This led to what they would find useful in a health app as well as whether or not they use health apps themselves.
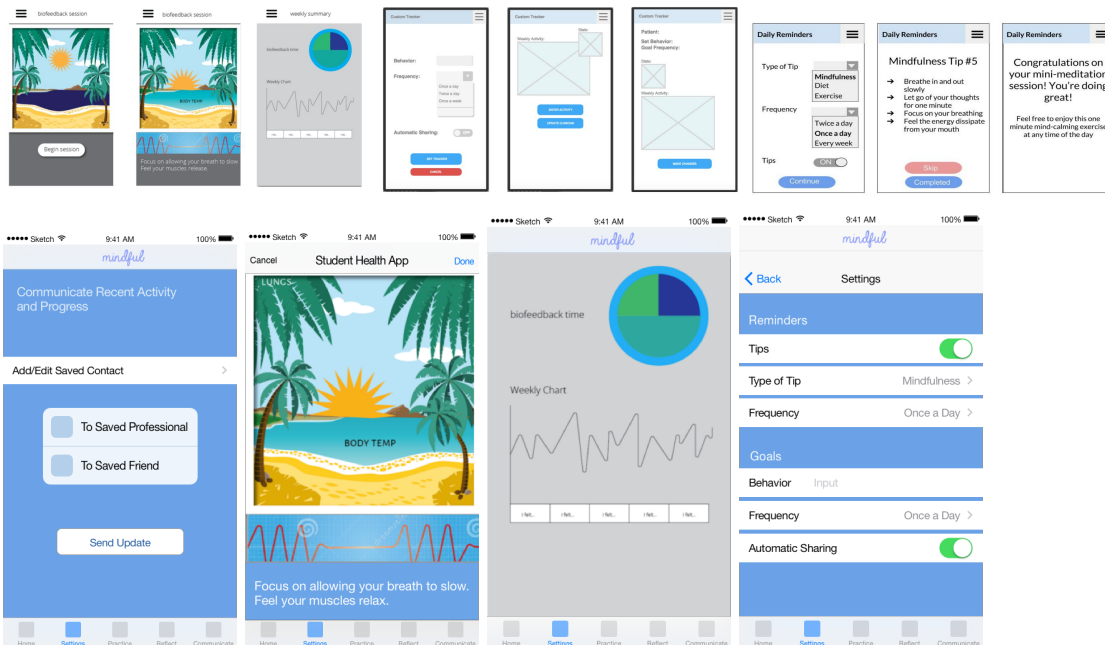
Findings
Responses indicated that, in a clinical setting, focus is put on mindfulness and reflection to improve mental health, and both biofeedback practice as well as positive reinforcements through automatic feedback on tracked behaviors can assist in these. As stated by one of the professionals, "Clinicians teach patients skills, introduce them to the mind/body connection, and through the use of biofeedback, relaxation training, mindfulness, and clinical hypnosis, help patients to learn self-regulation strategies that they can implement in their daily lives." The use of health applications in this work has been limited, partially due to the desire to avoid getting data from the patient indirectly. From the viewpoint of clinicians, the idea of having health data feeding into therapy is good for monitoring progress or risk, but can work against the therapeutic forces of the treatment relationship.

Initial Prototypes

The very first prototypes provided basic wireframes for three separate application ideas: biofeedback practice, progress sharing, and health reminders. Biofeedback is a technique that trains people to improve their health by controlling certain bodily processes that normally happen involuntarily, such as heart rate, blood pressure, muscle tension, and skin temperature. By incorporating shared elements into individual biofeedback for clinicians, the patient experience could potentially be better understood. The first application providing means to practice biofeedback would be usable throughout the day, letting students make goals and pre-reflect before coming into a mental health session. The second application would allow for data sharing with professionals before, during, or after the session to prepare both sides and/or support discussion. This gives the professional a general sense of the student's state as they come into a session, allowing them to adjust it accordingly. The app provides visual representation of weekly data for both sides. They can jointly set the behavior(s) and frequency being tracked, which can be adjusted and looked at later based upon session conversations. The third application incorporates nudges and positive feedback to reinforce prescribed behaviors, supporting clear, daily small goals for patients. Nudges are anything that influences our choices. Many positive nudges have been used to promote good behavior and healthy habits. However, we still want to offer the option of choice to a user.

Following feedback, it was recognized that each of these applications contains a useful idea that does not overlap with the functionality of another yet can support. Thus, the three applications were adjusted to be features and pages within a single, more comprehensive application, Mindful. Each had previously had a basic, yet distinct design style, so this too was adjusted so that all areas of the Mindful prototype were consistent in visual design.

User Research: Interviews
To investigate our initial survey data findings, we conducted a series of interviews using our initial prototypes on the interest and perceived future use of mental health apps. We aimed to gain feedback on the flow of the application prototype as well as what terminology on linked text would be most clear and

indicative of functionality. This feedback along with further competitive analysis led the development of the final prototype.

Competitive Analysis

Mobile health developers are focused currently on developing for consumers, marketed as general health improvement. While there are opportunities for clinicians to recommend particular apps, there is a lack of well designed tools that allow clinicians to maximize utility of their patients data. Part of this is due to the increased regulation on mobile apps that make medical claims, which would be a necessity for an app being promoted by a health-care professional. The use of mobile health apps as part of medical and therapeutical practice is an ill-defined area that is gaining interest, but with minimal research based practices.

Existing health-related applications are numerous, for both physical and mental aspects. Those targeted towards students are often university-specific or meant to keep track of ids, insurance data, and other static information. Apple Healthkit and similar applications track general health data but do not easily allow for export. Iodine allows for the setting of goals, tracking of progress, and periodical progress reports, but it's meant specifically for those that are depressed and trying out different antidepressant medications in order to find which one best improves how they feel.

Happify uses a scientifically-determined happiness indicator to determine a base score and assist users in improving it. The user chooses a track such as savor, thank, or aspire to work through reminders on how to avoid negative thoughts and sessions in serenity scenes. Periodically, it provides a report on overall happiness and life satisfaction, but, again, it does not allow for external sharing. Its aesthetics are appealing, and reviews are generally positive when the application itself is not breaking.

Headspace is an application that helps users in practicing mindfulness techniques. It also has tracks like foundation, health, and relationships, where one contemplates different elements for 10 minutes each day. It provides limited statistics in terms of times spent in and number of sessions completed. Sharing with friends is limited to seeing those simple statistics. The practice is not actual biofeedback, and the reminders only occur when a user nudges a friend to get back into a regular routine of sessions. The color scheme varies in and across pages, and icons are unusual.

Looking into these specific examples of existing competitive applications provided an idea of designs, functionalities, and user responses with varying success rates. None clearly encapsulate all elements of our desired application with its unique exact combination of features, but their feedback and design were useful as development continued.
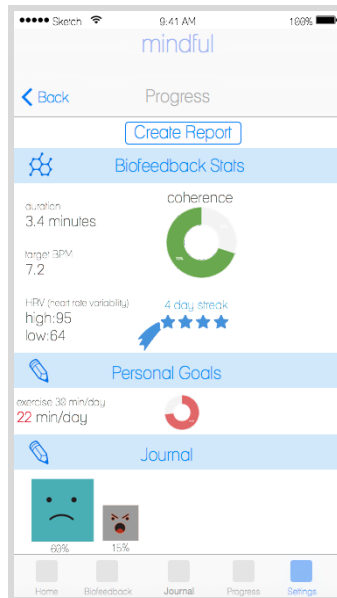
Final Prototype

The final prototype of Mindful encompasses the desire to use data to foster communication for the improvement of mental health. Included features allow for auto-sharing data between the student/patient and the recipient(s) of their choice. This can be their health professional, family members, or even trusted friends. In the case of the health professional, both sides can prepare for sessions and work within them by reviewing progress reports of practiced behaviors and biofeedback. From the previous prototypes, the interface has been simplified, and the features have been put forth in clearer sections.

The home page on the final prototype greets the user and has a display that clearly labels the biofeedback, journal, progress, settings. You can see how much progress has been made for the biofeedback exercise for the day. The user can also explore their own biofeedback stats, their personal goals, and their journal. The journal also contains the faces for the emotions that the user is feeling. The journal uses the accepted universal emotions so that users can choose from a wide range to explain how they are feeling.
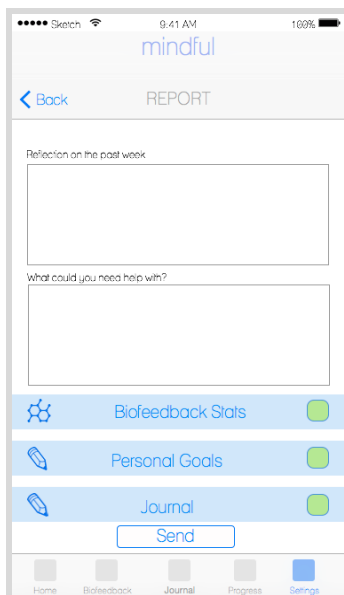
Additionally, the users have complete control over who they share their data with. They can see at any time who they are sharing the data with and what data they are sharing.
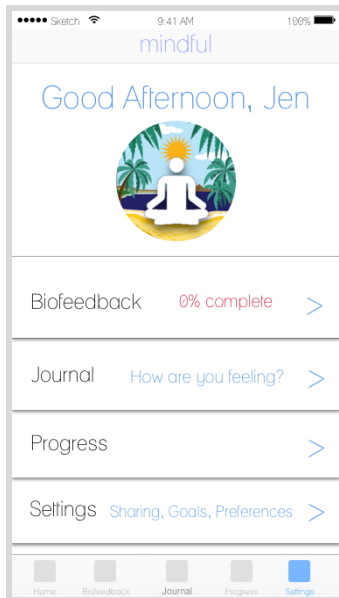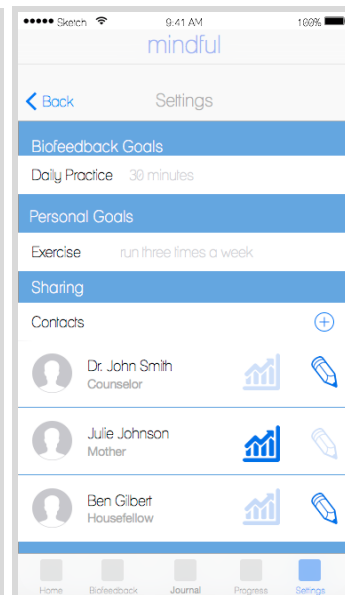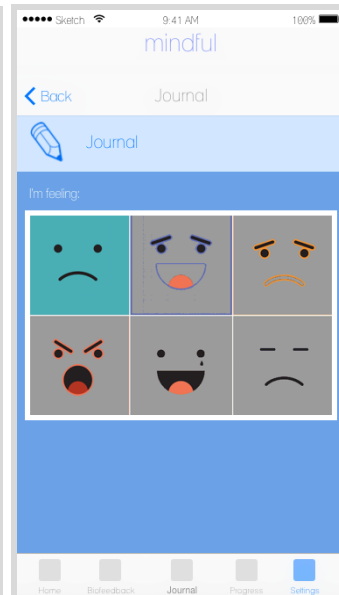

Home page   Progress page

Report allows users to add comments   Settings with custom sharing   Journal tracks emotional state

User Testing
Several students were tested with the final prototype to help us better understand the level of engagement students could potentially have with our application if it were a completely functional and available application. We had the students go through the application as if they were performing a think-aloud, so they mentioned everything they were thinking about while going through the app, and we were able to get a lot of excellent feedback.

One student specifically said that she felt very positively about the application because she has applications that follow a similar style, specifically an application called "Clue" which is an application for women to track their menstrual cycle and are able to track their emotions, form of birth control, energy, pain, etc. throughout the month. She likes this application because it lets her keep track of her own health on her own terms. The autonomy of being able to choose what information is important to track was satisfying, and she reacted positively to the idea that she would have complete control over what she was inputting and sharing.

Some feedback that we received for further improvement was that the application might be confusing for first time users who aren't familiar with the concept of mindfulness and biofeedback. Another participant suggested that potentially we could implement a tutorial or further explanation.

Overall, we didn't have a chance to user test many people outside of the CMU student demographic. This demographic is definitely a biased and limited source, but it is helpful to look at the student population since they are our target audience. In the future, testing this application with a different demographic or health care professionals would be a great next step for the user testing. Healthcare professionals could inform us about any of the legality or practicality issues they've encountered with our prototype.

Future Work
As the research and development detailed here has resulted in a high-fidelity prototype, future steps focus on bringing it to completion as a fully functional and accessible application. This includes full development of the interactive biofeedback experience and a market strategy focusing on patient adoption with clinician support. Once a significant level of usage is reached, the impact of using this data to mediate conversation and improve retention can be evaluated. A simple study to track usage would involve volunteers who regularly connect with a professional using the app, and comparing their long and short term outcomes with other patients and averages. The metrics important in evaluating the success of the product are their perceived self-reported "success" at changing habits, recurrence of mental health crises and their perception of how useful their therapy sessions were (measured by how well the patient and doctor felt that they understand one another). The goal is that the app would increase self-reported measures of positive habit-formation, backed up by tracked metrics, increase the perceived value of the psychotherapy sessions, and decrease the likelihood of future mental health deterioration.

Acknowledgements

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