Developing Design Considerations for Mobile and Wearable Technology

m-Health Applications that can Support Recovery in Mental Health Disorders

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***Abstract*—In this paper we explore the benefits of incorporating m-Health technology into the occupational therapists' established recovery processes. Treating mental disorders has become a client-oriented, goal setting practice in which therapists work with their clients to set, monitor and support goals that reinforce client self-monitoring and self-assessment in combination with recovery-based therapeutic techniques. While m-Health technologies are beginning to help shape the therapist-client recovery process, little research has been done to develop explicit design considerations for such technologies, particularly in the area of mental health. Our contribution to m-Health research is the articulation of technology design consideration for both design process and design principles. Based on semi-structured interview data gathered from six occupational therapists, we sought to understand where the gaps lay in therapist-client interaction and communication, particularly in the everyday activities of the client that exist outside of a therapy session. This data helped us to understand opportunities for technological support for recovery. Our data helped us to discover and outline the challenges occupational therapists experience when supporting their clients with mental disorders through the recovery process. Our analysis of therapist-client design opportunities can provide insight to assist with the development of more effective m-Health technologies for people with mental disorders.**

Keywords—Mental disorders; occupational therapists; m-heath; wearable technology; mobile; design

I. INTRODUCTION

Although m-Health technologies are beginning to help shape the therapist-client recovery process, little research has been done to develop explicit design considerations for such technologies, particularly in the area of mental health recovery. m-Health can be defined as wireless "mobile computing, medical sensors, and communication technologies for health care" [1, 2]. m-Health technologies are mobile technologies that can be used by the client alone or in collaboration with healthcare providers, both inside medical facilities and out in everyday life. Examples of m-Health technologies include mobile applications, wearable technologies incorporating non-screen based wearables and virtual and augmented reality systems. Doherty et al. created an overall technology guideline for mental health [3]. We extended Doherty's guideline in consultation with occupational therapists (OTs). Our contribution is the articulation of technology design considerations for both design process and design principles specifically for m-Health technologies. While there is emerging research that focuses on OTs' use of therapeutic technologies, we focus on the experience of the client.

Mental disorders are described as the incapability to manage thoughts, emotions, and behaviours [4]. Mental disorders "disrupt people's capacity to think and feel in a way that is normal for them, interfere with the ability to make decisions and shatter people's sense of well-being" [5]. Current research has indicated that clients are better able to cope with encouragement and assistance from healthcare workers, family and friends, and that such constructive cues can support key behaviour transformation that can help to integrate education, medication and rehabilitation into their daily lives. Healthcare practitioners continue to encourage clients to realize their "own abilities [to] cope with the normal stresses of life, [to] work productively and [to be] able to make a contribution to [their] community" [5, 6].

Currently, negative motivational complexities associated with treating mental disorders include the "effects of medication, poor community care, the pessimistic attitude of mental health workers, stigma, adoption of the patient role and loss of hope" [7]. The evolution of alternate methods of treatment to help strengthen the recovery process, and the use of m-Health applications to provide behavioural monitoring and assessment can greatly improve the lives of people suffering from mental disorders.

Contemporary m-Health technologies can be used to manage a client's condition and can be integrated into solutions for alternate methods of treatment that promote health and well-being. Benefits of m-Health technologies include decreased costs of healthcare, prevention of increased symptoms, more control over the individual's health, the feeling of independence, and increased self-management [8, 9]. In our research we want to explicitly explore how incorporating m-Health into the practice of healthcare professionals can assist their clients with mental health recovery. By designing technology specifically for the

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recovery process, healthcare professionals will be better equipped to understand the mental health challenges their clients experience when outside of their care. The data collected from mobile or wearable technologies could potentially augment the established practice and ameliorate individualized recovery for the healthcare professional's client. In this paper we explore the benefits of incorporating m-Health technology into the OTs' established recovery process. The OTs we interviewed do not currently use m-Health technologies but are interested in using them in their practice. We begin by providing a review of the literature on mental health recovery processes, and the OTs' role in these processes.

II. METHODOLOGY

There are many different mental health recovery models. In this paper we use the five-stage recovery model, but the ideas presented for m-Health can be incorporated into other recovery models as well. We conducted six individual forty-five minute open-ended interviews with the OTs recruited through emails and word of mouth. The incentive for the OTs to participant included new knowledge of technology that could assist their clients. Two coders independently coded the interview transcripts using thematic analysis [10] and grouped them into challenges that could be supported by m-Health technology. We used the data to understand where the gaps lay in therapist-client interaction and communication and as an extension of Doherty's guidelines. This data helped us to understand opportunities for technological support for recovery. Our data helped us to discover and outline the challenges OTs experience when supporting their clients with mental disorders through the recovery process. Utilizing the five-stage recovery model, we focussed on specific challenges that emerge in each recovery stage. We identified key design considerations that articulate design process and design principles. A new understanding of therapist-client design opportunities can provide insight to assist with the development of more effective m-Health technologies for people with mental disorders.

III. RECOVERY IN MENTAL HEALTH

Recovery is a very individualized process. Motivation and success of each stage can differ for each person. The symptoms are completely dependent on the individual. Recovery processes and treatments evolve daily. Today, people suffering from mental disorders are treated with medication, support from healthcare professionals, and with regular scheduled appointments and group classes [11]. Recovery is not a linear process and sometimes people in recovery experience setbacks. Managing a mental disorder requires a balance between self-monitoring and assistance from friends, family, and healthcare professionals. Key points to monitor include watching for triggers, coping mechanisms, fulfilling bodily needs of nutrition and sleep, and quality of life. Usually the diagnosis of a mental disorder is discovered after a crisis [8].

There are many recovery models available for people working in mental health. These recovery plans were created as "a means to change organizational culture and to plan and deliver mental health services" [8]. Transition roles of healthcare providers are slowly changing to support the recovery process, but healthcare providers still have to continue evolving their practice to assist clients in recovery [8]. The purpose of the recovery process is to find a balance between work, family, friends, and leisure activities [11].

Leamy et al. looked at 97 different qualitative studies that reviewed clients' trajectories in mental health recovery. Leamy concluded that there were five recovery stages, which include precontemplation, contemplation, preparation, action, and growth [12]. Below is a summary of the five-step model Leamy proposed.

A. Precontemplation

According to Leamy, The first stage in the recovery process precontemplation. The beginning of this stage is defined by an existential crisis that may include interventions from health care professionals and other care workers [7, 8]. People suffering from mental disorders are often overwhelmed by the disability, and dependent and unaware of what is happening to them [12]. Once a person has been diagnosed with a mental disorder, they can begin their journey of recovery.

B. Contemplation

The second stage involves a struggle with the disability, including finally accepting help from health care professionals. People in the contemplation stage of recovery are able to expect goal attainment, but they may not have established any clear goals. They are aware of their health issues and still struggle with their disability, but are ready to take control of their life [7, 12]. This is the turning point of the recovery process.

C. Preparation

The third stage, preparation, occurs when a person suffering from mental illness experiences a new awareness of their signs and symptoms, has the insight to understand what aspects of their life are controlled by the illness, and is capable of challenging these feelings. Clients work with their health care professionals on skills and learning about their mental disorder, develop goals and tasks, and experience greater confidence in managing their illness [7, 12]. Patients may experience positive effects of medication, such as a renewed ability to make rational treatment decisions [7]. The individual's newfound awareness enables them to restructure their life and enjoy a newfound independence [12].

D. Action

The fourth stage, action, involves the individual's initial discovery of the keys to well-being [12]. This stage is marked by the individual's capacity to apply the skills developed in treatment to rediscover their identity [7]. The individual experiences sensations of value, better understanding, and motivation to build and maintain a healthy independence [12].

A hallmark of the action stage is the individuals' transition from a state of withdrawal, which characterizes the earlier stages, to one of greater understanding and engagement[12].

E. Growth

The final stage of recovery includes growth and maintenance. The person finally feels confident with a new established and positive sense of self. They have enthusiasm and goals for the future that were never possible in the earlier recovery stages. The final stage is characterized by "resilience, wisdom and flourishing" growth [7]. Once a person reaches the growth stage, they are able to live beyond their disability, maintain community integration, successfully go to school or have a career, have active positive coping mechanisms, higher self-esteem and an improved quality of life [12]. The five recovery stages illustrate what a person experiences when recovering from a mental disorder. Sometimes clients never reach the growth stage but scientists, doctors, and researchers are working on solutions to help all people suffering from mental disorders to successfully overcome the challenges of their mental health issues. We refer to the five stages of recovery throughout the paper to help organize the challenges OTs face when working with their clients and prospects of incorporating m-Health into the recovery process.

IV. Occupational Therapy Practice in Mental Health

OTs are an essential part of the team of healthcare professionals that assist with the recovery process. The goals of OTs are to enable people suffering from mental disorders to take care of themselves (proper hygiene or eating healthily), participate in meaningful community engagement (paid or volunteer work or school), and enjoy everyday activities. OTs are concerned with their clients' well-being and ensure that they live and enjoy life in a meaningful and engaging way [13]. In this study, six OTs from Vancouver, Canada and Hamilton, Canada were interviewed using qualitative semi-structured interviews about the potential use of m-Health with their clients. Their clients had a range of mental disorders including schizophrenia, bipolar disorder, severe anxiety disorders, and obsessive-compulsive disorder. The OTs interviewed are community care workers, meeting with their clients out of the hospital and assisting them with activities of daily living. As mental disorders require a number of health care professionals, the challenges of current practices are limited to the views of how OTs can use m-Health to augment their already established therapy practice.

V. Challenges and Prospects in Current Practices

In this section, we explain the "challenges" that the OTs face on a daily basis and suggest m-Health "prospects" that may support the struggles when assisting with rehabilitation. This research is intended to inspire the design and implementation of m-Health technology and foster a deeper understanding of the issues of conducting m-Health research in a mental health domain. In Hamilton, Ontario, the Common Assessment of Need (OCAN) is the tool used to regulate and determine which rehabilitation stage a client is in, and in Vancouver, British Columbia, the Occupational Therapy Performance Measure (COTPM) is used. Both are voluntary surveys, usually completed by clients every 6 months. The OTs explained that because many of their patients work with their clinic over a period of years, they find the questionnaires repetitive and often opt out of them.

The OTs that were interviewed work in community-based programs. Their practice is a client driven, collaborative healthcare approach. Clients are given personal goals that are created in collaboration with the OTs, and it is the OTs responsibility to help instil client confidence to meet their goals. They work on personal rehabilitation goals in productivity (work and/or school and childcare), activities of daily living (sleep schedule, eating properly, personal hygiene, etc.), social leisure, and housing and positive relationships with friends and family. Some clients need assistance with all areas of their life, while others only need assistance in specific areas. OTs' aim to improve their clients' quality of life by addressing their clients' specific illnesses and symptoms and ensuring that their clients' engage in meaningful activities.

A. Precontemplation

After a person experiences a crisis and is diagnosed with a mental disorder, OTs begin their involvement with their clients' recovery. The OTs relationship with clients begins at the end of the precontemplation stage when their clients are out of hospital and ready to start community engagement.

During this stage, the OTs offer their clients insight and education about their disorder. The OTs interviewed in the study explained that some clients eventually develop insight and others are never able to gain a deep understanding of their disorder. Many of their patients in this stage are in a gray area of just being well enough to be out of the hospital. The main goal of the OT at this stage is to enable a client to safely live in the community, engage in meaningful activities, and ensure they do not isolate themselves at home. OTs try to reintegrate clients into the community by working with an established support team and linking them to community agencies. Usually clients in the precontemplation stage are not ready to set goals, so the OTs' focus is on regulating and assisting clients with their thoughts, medication, and problem solving.

1) Challenges: There is a huge stigma associated with mental disorders and unless there is an existential crisis, some people are never diagnosed [14]. The treatment for mental disorders varies, with a variety of education, medication, and community engagement. One treatment method OTs use is individual and group CBT (Cognitive Behaviour Therapy) to assist their clients while other OTs use EOM (Environmental Occupational Model). In the precontemplation stage, there is a lot of experimentation with different therapy practices and medication for individuals can prove to be a tremendous challenge [11].

The precontemplation phase keeps the OTs on high alert. Challenges include monitoring psychosis (if present), getting their clients off their couches and moving, and working with clients to disprove their fears. Psychosis is a condition that is characterized by loss of contact with reality and "can

dramatically change a person's thoughts, beliefs, perceptions and/or behaviours" [15]. Signs include delusions, hallucinations, voices speaking to them, thought disorders, thought withdrawal or insertion, thought reading, experience of control, and thought broadcasting [15]. With psychosis, often the patient feels as if they are being followed or fear being recorded.

OTs spend a lot of time monitoring their clients' mental status for crisis and high levels of stress, and use semi structured interviews to understand their clients' needs. They attempt to enrol their clients in social recreation groups so they can meet the team and other people facing similar challenges, and learn how to manage their disorder. Finally, clients have one-on-one meetings with the OT to focus on building skills and community engagement. All the OTs interviewed agreed that giving wearable technology that records bodily data to clients who suffer from paranoia or psychosis would negatively affect their rehabilitation. Wearable sensors would not be useful for the precontemplation stage of rehabilitation.

2) Prospects: The prospects for precontemplation are limited compared to the other stages of rehabilitation. Psychosis may be managed with antipsychotic medication and has limited need for technology interventions.

Patients are not independent in the precontemplation stage of rehabilitation. One OT suggested a simple piece of technology that could get their client off the couch would be beneficial. An accelerometer to track steps or how often their client moves would prove useful. The simple wearable device could include a counter so that the client will see numbers move in a positive direction when they are actively moving their body. For example, the OTs could give their clients a goal of walking or moving until the device registers 1000 each day. The OT could augment their therapy sessions with the use of this device, and assist their client to actualize a desired goal.

Technology may also be useful when disproving fears. One OT discussed a clients' belief that her house is constantly being broken into. With the use of technology, the OT suggested that it might be useful to get her patient to record the situation. With the video evidence, she may be able to assist her client by disproving that people are trying to break into her house. The OT cannot be with her client when the breakins are occurring. The OT feels she may be better able to help her client if she had a better understanding of the situation. Technology may provide the OT with a more objective account of what is happening, and assist in disproving paranoid beliefs and separating the beliefs from reality.

B. Contemplation

In the contemplation stage the OTs' sessions evolve. They monitor pressing issues such as a crisis or periods of high stress. Significant life changes may also be a relevant factor. Clients who have become more comfortable with their mental disorder are able to spend more time in the community with their OT. The clients also spend time participating in group therapy classes. Common OT practices in this stage include mindfulness meditation and CBT.

The doctors who work with the clients may be changing the clients' medication. It is the job of the OTs to monitor the side effects of the medication changes and assist their clients' everyday activities. One OT explained that they help clarify and prioritize their client's goals, bringing awareness to those that are most important. For example, one client was interested in losing weight but the OT suggested that they need to work on hygiene practices before attempting weight loss.

In this stage, OTs begin working with a clients short term goals. Once their clients are successfully meeting these goals, longer-term goals may be implemented.

1) Challenges: There are three challenges in the contemplation stage: medication compliance, successful community engagement, and locational awareness. The first challenge that was brought to our attention was compliance with medication. Medication compliance issues may be due to clients rejecting their illness, forgetfulness, unwanted side effects, or they may think their medication is poisoned or has been tampered with. If people suffering from mental disorders stop taking their medication, their symptoms that were under control with medication become unmanageable.

Another challenge raised by the OTs during this phase is the difficulty in knowing if their clients are successful in their everyday life. They mentioned it would be beneficial to know that their sessions are having a positive impact on the lives of their clients. One OT mentioned that she enjoys being invited to activities with her client in the community. She understands the stigma attached to bringing an aid worker to a community event; however, the knowledge that her client is engaged in meaningful activities provides feedback to the OT on the effectiveness of the therapy sessions.

The last challenge that was discussed during the interviews for the contemplation stage was that sometimes OTs are unaware of their clients' daily activities. One OT mentioned that one of their clients leaves his or her house early in the morning and returns late at night. In their sessions, the client explains that they are with friends all day. The OT and other health care aids involved with the client are unaware of any friends and would be better equipped to assist the client if they knew the truth.

2) Prospects: Several technological developments may assist OTs and their clients with the challenges of the contemplation stage. Mobile devices have been used to check up on medication use and provide reminders to take medication. Sachpazidis et al. created a home care application for medication monitoring and assessment. The piece of mobile technology can remind a client to take their medication and record the time they took it. Medical staff are notified if there are any abnormalities in taking the medication [16].

Daily client self-assessments may also be beneficial. Having clients check in to an application to record how they feel, what they are doing, and where they are might provide beneficial data to health care workers. The devices could show OTs visualizations of the data during their appointments with

the client. Sometimes a client might forget where they were or how they were feeling at a specific time. If they write it down, it may be beneficial for the OTs to understand what triggered specific symptoms. Matthews et al. solution to assist clients was with the use of a mobile device that tracks mental well-being. Wearable sensors can measure the clients physical activity, social engagement, and sleep [17].

Finally, OTs (barring some potentially important concerns about privacy and data monitoring) would want to attach a GPS onto some of their clients to track their location. The addition of locational awareness has to be done very carefully, with the knowledge that the client has the option of not telling his or her aid worker where they are at any given time. Clients would have the option to pick and choose what data they send their OT. However, the idea of picking and choosing what data to send might make using location awareness irrelevant and unhelpful.

Krumm and Rouhana created a smartphone application for location awareness and used general terms such as "home", "work" and "school". These terms might be a better solution as they discovered that clients preferred friendly labels for locations much more than specific numbered location data. The researchers created Placer, which identifies places labeled using simple demographics of the user [18]. Not knowing an exact location may reassure the client their OT is not following their every movement and give the OTs the benefit of some location awareness to better assist their client.

C. Preparation

In the preparation stage of the recovery process, the OT works on positive coping mechanisms with their clients. They spend a lot of time in the community helping their clients enrol in school, begin volunteer or paid positions, and assist them with their goals. Client group sessions include how to manage stress, how to write resumes, and how to rebuild their lives. OTs will also educate their patients on how to recognize symptoms of their illness and how to separate their unfounded fears from reality. The OTs also help clients develop long-term goals.

1) Challenges: The preparartion stage presents several challenges to OTs. These are: tracking sleep, stress management with locational awareness, and shifting focus.

The first of the OTs' concerns in the preparation stage was that many of their clients were concerned with the number of hours spent sleeping. Clients became distressed and felt that they could not function unless they had at least ten hours of sleep. In addition, sleep deprivation can cause a client to experience distress and increased the problematic symptoms.

The second challenge that was discussed in the interviews with OTs included the clients' inability to recognize the symptoms of stress. The symptoms of stress include a state of arousal in direct conjunction with increased heart rate, blood pressure, and perspiration [19]. The OTs believe they can teach their clients to have an objective account of their symptoms; however, too much emphasis on stress symptoms can cause clients to over-monitor them. For example, learning that elevated pulses signal stress can provoke clients to constantly monitor their pulse. Nonetheless, the OTs realize the value of teaching clients how their bodies react to and indicate stress. The OTs believe that this awareness would be useful for people who have symptoms of panic disorders and OCD-type behaviors. One challenge that OTs face is judging whether telling a client about the physical symptoms of stress would provide the client with a constructive new way of understanding their experiences or would prompt the client to excessively self-monitor.

The clients of OTs are at opposite ends of the spectrum regarding understanding where stress occurs in their daily life. Some clients excel at understanding the symptoms of stress and where they occur. For example, they know the exact moment they will hear voices when they are stressed because of a planned visit with family members. Other clients are aware of the symptoms, but the time and location are blurry. They are unable to distinguish and separate the symptoms of their mental disorder with reality. Solutions to assist clients with stress include getting reassurance from their healthcare networks and using learned coping mechanisms. During a stressful time, some clients may feel the symptoms but do not know what triggered them. It may be difficult for them to evoke positive coping mechanisms on their own and they may need assistance with their anxiety and stress.

2) Prospects: Researchers have developed many different solutions for the challenges in the preparation stage. Two different solutions are proposed from Sanches et al. and Lu et al. for stress management and Min et al. for tracking sleep quality.

Sanches created an application for a stress management biofeedback mobile service. Symptoms are tracked by skin conductance, heart rate, and accelerometer sensors, and sent to a mobile phone in real time [19]. Lu created StressSense that recognizes stress from the human voice using a mobile phone [20]. Most stress applications are not specifically designed for people suffering from mental disorders but augmenting the already available developed applications might be beneficial for this community.

Sleep applications are also quite common in m-Health. As described above, Matthews et al. incorporated sleep into their tracker application [17]. Applications specifically designed to track sleep patterns are also being used. Min et al. describes a smartphone application that tracks sleep quality [21]. The applications that track sleep quality could be extremely beneficial to those clients struggling with sleep deprivation.

D. Action

In the action stage, the job of the OT is to begin planning long-term goals with their clients. The OTs will assist their clients with more community engagement and with recognizing the importance of everyday activities. The OTs assist clients with rediscovering their identity and purpose in life. They also encourage their clients to volunteer with other individuals with a mental disorder who have not progressed as

far in the recovery model as they have, and help them successfully reach their potential.

1) Challenges: In the action stage, there is a higher level of educational support. Giving their clients accurate, objective feedback can be difficult if they are not with their clients. In this stage the clients are very aware and have an understanding of their illness that was not present in the lower levels of recovery. OTs feel the biggest challenge is the need to give their clients objective feedback and alert them early on if they are digressing back into earlier stages of recovery. Sometimes, clients are unable to differentiate symptoms from reality.

OTs are outspoken about how training tools help their clients cope with stress and anxiety. Things such as positive self-talk, mindfulness, yoga, the gym, music, walking, and reality checking are very useful in this stage. For some clients, using these positive coping mechanisms are not enough. For example, one OT expressed the concern that one of her clients has over two pages of positive coping mechanisms at her disposal, but still struggles with stress. They feel optimistic that these challenges could be alleviated with technology.

2) Prospects: The OTs feel optimistic that technology could address many of the challenges in the action stage. Concerns include being able to get objective feedback from m-Health sensors and incorporating training tools into their practice.

Jyoti Joshi researched a multi-model approach using sensors to give objective feedback to patients with depression [22]. If technology could give the clients objective feedback, the OTs believe that this may offer the reassurance needed in situations where clients are unable to connect with their healthcare network. Mobile and wearable sensors may assist clients with reality checks and help them focus their attention on the task at hand.

Verstappen et al. have created an application for the Acceptance and Commitment Therapy (ACT) program at Trillium Healthcare Centre in Toronto, Canada [23]. Other technologies that are in the initial stages of research to assist people with mental disorders include virtual and augmented reality and distractions such as mobile video games [24]. Systems like the inexpensive cardboard Google VR Kit may also be modified to assist people with mental disorders.

E. Growth

In the final stage of growth, the OT is not as directly involved in their clients' lives as they previously were. Maintenance is an important aspect of the final stage and the OTs explained that clients who successfully overcome their mental disorder do not generally need as much attention. Their main focus is to check in on the clients to make sure there is no digression in stages. The main goals of the client are to engage in meaningful activities, cope with their illness, and take their medication.

1) Challenges: Limited challenges characterize the growth stage. Clients have finally reached the final stage of recovery and what is most important is that the client does not digress. It is vital that the OT nurtures the maintenance phase and keeps a healthy relationship with their client.

2) Prospects: In the growth stage, many m-Health applications suggested in previous stages might be beneficial. These include applications that manage stress, distractions, and positive coping mechanisms. Sensors that record and visualize physical activities, social engagement, and sleeping patterns may also prove useful. Once m-Health applications have been successfully integrated into the client's life, it is important that the client continues to use the application to assist with maintenance and monitoring of symptoms.

VI. DESIGN CONSIDERATIONS FOR M-HEALTH

The research conducted from the semi-structured interviews with OTs and Doherty's guidelines have identified design considerations that technology designers need to consider when working with the mental health community. The design guidelines are split into two different groups: design process and design principles. Design process includes considerations and cautions that evolved from the interviews with the OTs' suggestions and Doherty's guidelines, including technological responsibility, participatory design, symptom management, and integration. Design principles include social stigma, feedback, privacy, simplicity, maintenance, and cost. With the use of these considerations, additional technologies can be developed to empower this community.

A. Design Process

1) Technological Responsibility: OTs are optimistic about the integration of m-Health technologies but felt that technology might not be useful for all their clients in the early stages of recovery. OTs are concerned that recording data for some of their clients might exacerbate their symptoms. For example, one client counted the number of times they went to the bathroom. Other clients have fears of being tracked or recorded by government agencies. Giving clients access to technology that records or encourages them makes the OTs apprehensive about their negative symptoms. It might also be helpful to look at ways m-Health technology can alert and assist clients without giving them data.

2) User Centered Design: Our findings bolster Doherty's [3] user centered design guideline and thus make a stronger argument for the implementation of m-Health technology for this community. OTs spend a lot of time with their clients and they can give designers an understanding of what technologies might be beneficial to assist with the recovery process. m-Health technology should evolve as the clients move through the recovery process. Each OT uses different therapy techniques to assist their clients. For example, one OT uses individual CBT (Cognitive Behaviour Therapy) to assist their clients while another uses EOM (Environmental Occupational Model). It might also be useful to create technologies that can be customized by the OTs themselves.

3) Symptom Management: m-Health technologies can be used to help clients gain insight and better understand their illness. As clients develop the ability to increase their agency

and insight, they will be able to better manage their symptoms. OTs expressed the need to integrate technology into their therapy sessions and to assist clients in using the equipment.

4) Integration: The OTs were optimistic in trying new technology. Nevertheless, the OTs voiced concerns of their older clients and people not as familiar with technology. Integrating technology into their lives will be very difficult. Integrating m-Health technology will be easier for younger clients who are familiar with wearable and mobile technology and clients in later stages of the recovery process. It is suggested that any technology be gradually integrated into the client's life in an evolutionary process. First, the m-Health technology should only be used at the OT's office when appropriate. When the client and OT are comfortable with the m-Health equipment, it can then be incorporated into outings into the community with the client and OT. Finally, if the client is comfortable, the m-Health technology should be integrated into the client's daily life.

B. Design Principles

1) Social Stigma: Social stigma, defined as a "prejudical attitudes and discrimination behaviour directed towards individuals with" [25] mental disorders can be a huge factor to overcome. It is important to design m-Health technology that is unobtrusive, invisible, fashionable, and comfortable. With these wearability factors in mind, it might make clients more willing to wear the device. Doherty [3] adds to social stigma by stating that considerations should also include social and cultural backgrounds, learning difficulties, and the use of technology that is familiar to the client.

2) Feedback: m-Health technology can provide various kinds of feedback, including text, light, sound, or vibration. Doherty [3] adds that feedback options might be a useful way to give the OTs and client some control over the technology. Time of feedback can also be dictated by the client and OTs (for example, everytime client is stressed, every hour, every day, etc.). Designers need to design m-Health technologies that do not rely heavily on giving the clients data but rather using feedback as a gentle reminder to encourage positive coping strategies to help with clients handling their symptoms. False positives are common in any sensing system in m-Health technology. Although advances in AI and machine learning algorithms have reduced the likelihood of false positives, designers should enable clients to alert the system of false-positives. In turn, clients need to be aware of the system and understand that if false positives do increase stress, they can turn off the technology.

3) Privacy: Location awareness and recording biophysiological data in m-Health might be useful for some clients. However, designers need to be aware of privacy issues and understand that clients are not obligated to reveal any data to their OTs. The OTs and Doherty [3] emphasized that research also needs to be conducted on the safety and security of the data.

4) Simplicity: Mental disorders are very complex with many contributing variables. Designers must begin by addressing symptoms that can be recorded using existing m-Health technologies. Symptoms of stress can easily be recorded with current technologies. More complex symptoms of mental disorders, including paranoia and hallucinations, cannot be easily measured using biosensors and further research is needed to develop m-Health technologies for complex symptoms. Another aspect of simplicity that both Doherty [3] and the OTs addressed, was that people suffering from mental disorders might take longer to develop a new skill then the average person. Therefore, technology design and usability needs to be simple and lack complication.

5) Maintenance: Minimal maintenance will be beneficial with this group because the technology could be perceived as a burden. Many cognitive deficiencies come with the illness and designers need to be aware that devices may be left in a store or a coffee shop. It is important to be mindful of the executive functioning impairments that go along with the illness, and incorporating a lost mode or sending an alert signal to the user if the device has been left behind may be needed.

6) Cost: Finally, consideration must be given to the cost of the m-Health device. Clients of OTs are usually unable to work and are therefore in a lower income bracket. The device must be affordable to be of any benefit to the user.

VII. Conclusion

The paper is an initial exploration of the potential for the integration of m-Health technology into the OTs established mental disorder recovery process. Our contribution to m-Health technology research is the articulation of technology design considerations for both design process and design principles. Interviews with six OTs revealed a number of challenges and ideas related to designing m-Health technologies for clients as they progress through the recovery process. Using thematic analysis, we coded our data to help us discover and outline the challenges OTs experience when supporting their clients with mental disorders through the recovery process. Applying the five-stage recovery model, we focussed on specific challenges that emerged in each recovery stage. We identified key design considerations that articulate design process (technological responsibility, user centered design, symptom management, intergration) and design principles (social stigma, feedback, privacy, simplicity, maintenance, cost). However, more work is needed to support OTs clients with m-Health technology.

We have presented ideas for advancing the work in this area. We foresee that these ideas will inspire research on how m-Health can augment therapy practices in the future. It is essential to continue working with OTs and others in the healthcare community to asses the role that m-Health technology will play in the future. A number of issues need to be discussed in detail in both the design process and design principles. Through our research, we have learned that OTs are receptive to using m-Health for patients with mental health issues and actively seek new ways to assist their clients with

the recovery process. OTs, healthcare workers and technology designers can collaborate to create innovative solutions that will improve the quality of life for people with mental disorders.

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