

**DEVELOPMENT OF A CHATBOT TO PROMOTE ACTIVITY PARTICIPATION FOR
PEOPLE WITH SERIOUS MENTAL ILLNESS**

by

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ABSTRACT

Background. People with serious mental illness living in the community often encounter difficulties in engaging in meaningful activities. Sustained disconnection from meaningful activities, significant others, and community create the force of “inertia” that keeps them from making positive changes in day-to-day lives. Their passive, isolated, and resource-restricted lifestyle has been associated with poor well-being and adverse recovery outcomes. Action Over Inertia (AOI) is one of the few interventions explicitly addressing activity health for people with serious mental illness. The AOI intervention emphasizes the power of enabling clients to make quick changes, which create momentum to break the force of “inertia.” However, making changes, even a small step, can be challenging for people who are long-term disengaged. Additional supports are therefore needed to promote participation.

Given the advance of technology, the chatbot application is an emerging eHealth approach to assist people in promoting health. The most significant advantage of such technology is its ability to offer real-time feedback, facilitate access to information, promote intervention adherence, improve doctor-patient communication, and support intervention in remote areas.

Aims. This research's primary purpose was to develop and evaluate a chatbot prototype, which was designed to serve as a companion to the AOI intervention. The specific objectives include (1) understanding the activity needs of people with serious mental illness who lives in Edmonton, Canada; (2) developing a chatbot prototype that supports people with serious mental illness to actively participate in activities; and (3) examining the usability and technology acceptance of the proposed chatbot.

Methods. This research is comprised of four phases. In Phase One, a needs assessment was conducted to understand people with serious mental illness' activity participation and collect activities that fit the cultural- and physical- environment in Edmonton. An activity bank, serving as the chatbot database, was created based on the results of the needs assessment. In Phase Two, the chatbot's design structure and principles were outlined to ensure the chatbot features were consistent with the intervention goal. In Phase Three, interviews with three service providers and usability tests (followed by a questionnaire and interview) with nine people with lived experience were conducted to explore user experiences and perceptions of using the chatbot. In Phase Four, the identified issues and suggestions identified were prioritized and addressed.

Results. The findings of Phase One indicate that participants overall considered productive, social, community, and physical activities to be important but that they insufficiently participated in them. The analysis also demonstrates how people of different ages and gender prioritized their valued activities. Also, activities that people commonly participate in in the local context were listed. By integrating the findings, an activity bank consisting of 60 activity ideas was developed. In Phase Two, a chatbot prototype was built on Facebook Messenger. The chatbot offered users with activity ideas of categories

include physical activity, social interaction, access to the community, activity ideas based on age and gender, and random activity ideas. The results of Phase Three indicate the potential of applying the chatbot application in time use intervention for people with serious mental illness. No major usability issue was found, and the results of the questionnaire show high technology acceptance (average 6.34 out of 7 points). Several themes that discuss the strengths, limitations, and other suggestions emerged from the interviews. In Phase Four, 18 issues/suggestions were prioritized based on their impacts on intervention quality and the effort required to address them. Finally, eight issues were fixed in the refined chatbot.

Conclusions. In general, people with serious mental illness lack participation in important activities. Age and gender might have influences on how people value different activities. Also, people with serious mental illness overall held a positive attitude toward using the chatbot to find activities for participating in. Despite some limitations related to the content and functionality, the chatbot was overall considered as useful in inspiring activity ideas for participating, easy-to-use, and empowering people with serious mental illness to make their own activity choices. This research demonstrated the potential of utilizing a chatbot in time-use intervention for people with serious mental illness. Future research is needed to replicate the findings on a larger scale and with a more rigorous research design to validate the effectiveness and feasibility of this innovative intervention approach.

Keywords: Serious mental illness, chatbot, activity participation.

PREFACE

This thesis is original work by Huei-Tsz Liu. The research project entitled “Development of a Chatbot to Promote Activity Participation for People with Serious Mental Illness”, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board (Pro00087965, March 13, 2019; Pro00099631, May 01, 2020; Pro00101961, July 08, 2020).

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1 INTRODUCTION

1.1 GENERAL INTRODUCTION

People with serious mental illness tend to live disengaged, marginalized, and occupation-deprived lives (Bejerholm & Eklund, 2007; Krupa et al., 2003). Their time is often dominated by passive, isolated, and monotonous activities like sleeping, smoking, and watching TV, or they may spend most of their time visiting mental health day centres (Bejerholm & Eklund, 2004). The lack of participation in activities that contribute to health and well-being is one of the major obstacles to their recovery (Borg & Davidson, 2008).

To date, several assessments and interventions related to time use issues have been documented in the occupational therapy literature. Common therapeutic strategies include analyzing clients' occupations, capacities, and barriers; grading activities and setting manageable task goals; educating clients and their families; providing skills training; modifying their environment; and seeking the best match among people, environment, and occupations (Krupa, Fossey, et al., 2009). Occupational Questionnaire, Profiles of Occupational Engagement in Schizophrenia, Time geography, Time and Space Use Inventory, and Activity Configuration are some of the instruments used to assess or log clients' time-use pattern (Bejerholm et al., 2006; Hunt & McKay, 2015; Kroksmark et al., 2006; McNulty et al., 2009). Action Over Inertia (AOI) is one of the first time-use intervention approaches that provide clear, systematic insights into the profoundly disrupted patterns of activity participation among people with serious mental illness (Krupa et al., 2010).

The work of this thesis was built upon the foundation of AOI intervention. Given the potential of utilizing innovative technology in healthcare practice, this thesis developed a chatbot to complement the AOI intervention, aiming to motivate clients to make activity changes and increase their accessibility to resources for participation.

1.2 PROBLEM STATEMENT

The major problem addressed in this thesis is the challenge of making activity changes for people with serious mental illness who are long-term disengaged. Both the personal barriers such as low motivation and environmental barriers such as lack of access to resources restrict their opportunities to experience a wide range of activities that enrich their quality of life (Eklund et al., 2009; Guthrie, 2002). The sustained disconnection from meaningful activities; friends and family; and community creates the force of “inertia”. For people with serious mental illness, the idea of making changes in life may be too overwhelming to bear in addition to their struggle with mental illness (Yarborough et al., 2019). In other words, the ongoing disengagement itself is another cause of disempowerment of people with serious mental illness to make positive changes.

The AOI intervention particularly emphasizes the issue of “inertia” and proposes a step-by-step approach to support people to overcome their disengaged lifestyle. One of the early moves is making quick activity changes; this is especially critical for creating momentum and disrupting the “inertia”. The goal of making quick changes is to enable the person to experience the benefits of activity participation. The AOI intervention suggests that service providers can support clients to identify and expand possible choices of activities and increase opportunities for activity participation.

Given the advance of technology, it has become more feasible to use information technology to assist people in maintaining and promoting health (Michie et al., 2017). Chatbot, often conceptualized as a chatting robot, is one of the emerging eHealth approaches (i.e., healthcare practice with the use of information and communication technology) for delivering healthcare. Literature has shown the applicability and effectiveness of using chatbots in assisting consultation, promoting physical activity, suggesting nutrition consumption, supporting new-skill-learning, improving disease management, and increasing

access to online health information (Brixey et al., 2017; Fadhil, 2018a; Gabrielli et al., 2018; Huang et al., 2018; Laranjo et al., 2018; Rhee et al., 2014; Tanaka et al., 2017). The most significant advantages of using such technology is the facilitation of interactive access to information and resources at anytime and anywhere and the potential to empower users through self-directed actions (Brandtzaeg & Følstad, 2017; Nadarzynski et al., 2019).

To our understanding, however, research on using chatbot for time-use intervention for people with serious mental illness is sparse. Several studies of chatbot have focused on supporting mental health such as depression, anxiety, and PTSD, but few of them were designed specifically for people with serious mental illness (Fitzpatrick et al., 2017; Laranjo et al., 2018; Ly et al., 2017). It is unclear to what extent this population responds to using chatbot as a medium in time-use interventions.

1.3 RESEARCH PURPOSE, QUESTIONS, AND DESIGN

The purpose of this thesis is to develop and evaluate a chatbot prototype which is designed to serve as a complementary tool to the AOI intervention. Specific objectives include:

- (1) understand the activity needs of people with serious mental illness living in Edmonton, Canada;
- (2) develop a chatbot prototype that supports people with mental illness to actively participate in activities; and
- (3) present the usability and technology acceptance of the chatbot through quantitative and qualitative investigation.

This thesis seeks to answer two overall research questions: (1) what activity areas are valued by people with serious mental illness? and (2) to what degree do the target users, including people with serious mental illness and occupational therapists, perceive the chatbot to be useful in the context of promoting activity participation?

The overall research design was based on the person-based approach proposed by Yardley et al. (2015). The person-based approach emphasizes the variety of people's needs in various situations and takes user perception as the main focus throughout the development of eHealth intervention. Four stages of intervention development were suggested: planning;

design; development and evaluation; and implementation. Adapted from the person-based approach, this research is comprised of four phases: (1) Phase One: needs assessment; (2) Phase Two: chatbot development; (3) Phase Three: evaluation of usability and technology acceptance; and (4) Phase Four: chatbot refinement.

Table 1-1. Person-based approach research activities.

Yardley’s Stages of Development	Main purpose	Research activity undertaken in this study
Stage 1 Planning	Identify key issues and needs	Phase One: needs assessment
Stage 2 Design	Identify key design features	Phase Two: chatbot development
Stage 3 Development and evaluation of acceptability and feasibility	Evaluate and optimize intervention from user perspective	Phase Three: evaluation of usability and technology acceptance Phase Four: chatbot refinement
Stage 4 Implementation and trialling	Implement and evaluate intervention in real-life context	Not within the scope of this thesis study - Expect for future research

1.4 DEFINITION OF KEY TERMS

In this thesis, *serious mental illness* includes schizophrenia, bipolar disorder, delusional disorder, and other psychiatric disorders that involve prevalent and persistent psychosis symptoms. People living with serious mental illness typically experience severe disruptions to self-care, work, building social connections, and other daily functions (Schinnar et al., 1990).

Activity is defined as “a set of tasks with a specific endpoint or outcome that is greater than that of any constituent task” (Townsend & Polatajko, 2007, p.19) and is “a more general, culturally shared idea about a category of action” (Pierce 2001, p.138); *Participation* is “simply doing without ascribing a positive or negative value” (Morris & Cox, 2017, p.159). On the other hand, an *occupation* is a form of activity with given value and meaning (Canadian Association of Occupational Therapists, 2009); *Engagement* refers to “a sense of involvement, choice, positive meaning and commitment” (Creek, 2010, p.166). In this thesis, *activity participation* was used to describe the intended interventional outcome instead of *occupational engagement* as the latter concept involves experiences of personal meanings and qualities that are unique for those engaged in occupations (Hammell, 2009). Facilitating

quick activity participation, in this thesis, is viewed as the entry point into occupational engagement (Morris & Cox, 2017). Another term, *time use*, describes the way people use and organize their daily lives and is commonly used as a fundamental means of evaluations or interventions regarding one's activity participation or occupational engagement (Edgelow & Krupa, 2011). For example, Action Over Inertia is a systematic time-use intervention for people with serious mental illness.

Chatbot is a computer program that conducts online conversations with human users through text or text-to-speech. There are two types of chatbots: rule-based chatbot and AI (artificial intelligence)-based chatbot. Rule-based chatbots use constrained user input (e.g., multiple-choice options) to have linear conversations, while AI-based chatbots are able to process unconstrained language input (Fadhil, 2018b). The chatbot system developed in this thesis, Anita, was rule-based.

1.5 ORGANIZATION OF THE THESIS

This thesis is organized into eight chapters.

Chapter 1 – Introduction provides overall background information, research purpose, and the design of this research.

Chapter 2 – Literature Review reviews literature related to activity health in the context of serious mental illness, time-use intervention for serious mental illness, and the application of chatbot in the healthcare field.

Chapter 3 – Methods Overview provides an overview of the methods used in this research.

Chapter 4 – Phase One: Needs Assessment describes the methods and results of a needs assessment, including two surveys and a website search to understand the activity needs of people with serious mental illness and the available assets in the local context.

Chapter 5 – Phase Two: Chatbot Development presents the principles of chatbot development and the functionality features of the chatbot prototype.

Chapter 6 – Phase Three: Evaluation of Usability and Technology Acceptance includes detailed information about the methods and findings of the chatbot pilot-tests and interviews.

Chapter 7 – Phase Four: Chatbot Refinement demonstrates how the identified issues and suggestions were prioritized and addressed.

Chapter 8 – Discussion and Conclusion summarizes the overall findings, limitations of this thesis, and implications for future research.

2 LITERATURE REVIEW

This chapter reviews the literature of the following topics that are relevant to the thesis: (1) activity health in the context of serious mental illness, (2) overcoming inertia, and (3) chatbot application in healthcare. The goal of this chapter is to provide an overview of current knowledge on the disruptions to activity participation experienced by people with serious mental illness and the complex factors influencing the participation. The review also identifies the relevant theories, methods, and gaps in the existing research.

Studies included in the review were identified through a combination of search strategies available via the academic database and search engine at the University of Alberta Library, including PubMed, PsycINFO, MEDLINE, EmBase, and Google Scholar. Combinations of the following terms and their variations were used for searching relevant literature: *serious mental illness, schizophrenia, psychiatric disabilities, psychosis, activity, occupation, participation, engagement, therapy, behavioural change, time use, health, well-being, recovery, community mental health, chatbot, and eHealth*. Specific literature related to each phase of the thesis, such as the implementation of needs assessment, chatbot system development, and usability test, are reviewed in the corresponding chapters.

2.1 ACTIVITY HEALTH IN THE CONTEXT OF SERIOUS MENTAL ILLNESS

2.1.1 Activity participation in relation to health, wellbeing, and recovery

Activity participation has long been considered a crucial contributor to health and well-being. The International Classification of Functioning Disability and Health (ICF) situates

both activity (execution of a task or action) and participation (involvement in a life situation) as important constructs determining the person's functioning (World Health Organization, 2001). This notion has been supported by a rich body of evidence. For example, participation in meaningful activities was found to be associated with positive mood, perceived vitality, life satisfaction, and a sense of purpose (Hooker et al., 2019). Volunteering provides opportunities to promote mental health by fostering a sense of self, sense of belonging, confidence, self-esteem, and social supports (Black & Living, 2004). Among women of working age, those who experienced higher manageability and personal meaning in daily occupations tend to report higher satisfaction in life (Håkansson et al., 2009). Also, seniors can build their social supports, positive sense of self, motives to keep going, and autonomy through group activity (Maidment & Macfarlane, 2009).

The benefits of activity participation apply to all populations including people with serious mental illness, playing a key role in this group's journey of recovery. Previous research on the value of activities to people with serious mental illness indicates that activity participation provides opportunities for building a positive sense of self, social connection, skill/personal development, and pleasure (Hancock, et al. 2015). Performing productive activities can promote a sense of normalcy, connection, and empowerment (Borg & Davidson, 2008). Immersing in personal- and community-valued activities, such as engaging in helping, contributing, or sharing roles, provides opportunities for individuals to foster a sense of belonging and find a "place" in the community. Furthermore, community participation helps individuals to be active in valued roles, make one's own choices, and empower themselves in multiple aspects of life. It is also found to improve quality of life and facilitate recovery (Burns-Lynch et al., 2016).

2.1.2 Activity participation among people with serious mental illness

Despite the significant health benefits of activity participation, people with serious mental illness tend to live a disengaged lifestyle and are marginalized from the community (Bejerholm & Eklund, 2007; Krupa et al., 2003). According to Bejerholm & Eklund's (2004) research on time use among people with schizophrenia in Sweden, the participants' daily lives were characterized by passivity, low level of structure, and isolation. On average, they spent most of their time sleeping (8.5 hrs/ day), smoking (5 hrs/ day), and passive activities

(e.g., watching TV, listening to the radio, sitting, lying, looking at other people or objects; 2.8 hrs/ day). In terms of geographic environment, they spent most of their time at home (19.2 hrs/ day), at day-care centres (0.4 hrs/ day), or around the neighbourhood to buy cigarettes and foods (1.7 hrs/ day). Additionally, most of them seldom spoke to anyone other than day-care centre staff (time spent alone: 17.4 hrs/ day). Another time-use study by Krupa et al. (2003) in Canada indicates that clients of assertive community treatment spent much time sleeping (9.46 hrs/ day) but spent little time engaging in productive activities (3.43 hrs/day), and spent more time on passive leisure (5.04 hrs/ day) than active and social leisure (0.80 hrs/ day and 2.83 hrs/ day, respectively). Similarly, a UK-based study reports an average of 9.66 hours in sleep, 2.78 hours in passive leisure, and only 1.10 hours in labour force among 229 persons with schizophrenia (Shimitras et al., 2003). The literature demonstrates low participation in productive activities compared to the general population (on average, 7.7 hrs/ day of paid and unpaid work for Canadians aged 25-54 years) (Statistics Canada, 2015). In addition, difficulty in maintaining a daily rhythm and living in a reversed day-to-night pattern are other common issues for people with mental illness (Leufstadius et al., 2006). Research reports that many people with schizophrenia “did not have anything to do and did not have any idea what to do every day.” (Minato & Zemke, 2004, p.178). This lack of occupation may create another stressor in life.

The reason for such phenomena is complicated since various factors influence one’s time-use pattern. Barriers for people with serious mental illness to participate in activities can be personal and environmental. Personal barriers include: (1) psychotic symptoms, such as positive symptoms (e.g., delusions and hallucinations) and negative symptoms (e.g., avolition and anhedonia) (Guthrie, 2002); (2) limited cognitive functioning, such as attention, memory, and problem-solving (Tarrier & Bobes, 2000); and (3) the side effects of medications, such as sleepiness, slowness, and other unpleasant symptoms (Guthrie, 2002). Notably, these factors not only influence one’s performance in occupations directly but also impede emotional experience. For example, people with serious mental illness perceive less pleasure when performing pleasant events (Hayes & Halford, 1996); this may decrease the level of engagement, as experiencing pleasure and joy counterbalances the negative influences of stress (Moll et al., 2015).

Environmental barriers also limit one's level of activity engagement and sometimes have more significant impacts than personal barriers. People with serious mental illness often live in impoverished and disadvantaged environments, geographically and socially. The restricted access to living essentials, social connections, and employment opportunities leads to occupational deprivation (Boydell et al., 1999). However, current healthcare and supportive systems tend to focus on clinical treatment but rarely address people's occupational needs (Krupa, Eastabrook, et al., 2009). Furthermore, social stigma toward mental illness has a profound impact on their access to meaningful occupations (Corrigan & O'Shaughnessy, 2007). For example, individuals with mental illness often have difficulty getting a job due to workplace discrimination, which prevents them from participating fully in society (Eklund et al., 2009).

2.1.3 The self-perpetuating force of “inertia”

Initiating and maintaining behavioural changes is particularly difficult for people with serious mental illness, given the additional mental health-related barriers. The illness itself and its consequences often creates limitations in thoughts processes, decision-making, and cognitive function that interfere with the individual's ability to plan reasonable goals. Lack of motivation, will, spontaneity, and initiative (avolition and anergia) creates difficulties in envisioning or caring about making their lives better (DiClemente et al., 2008). It has been reported that the behavioural changes of people with serious mental illness are often driven by more external reinforcements and less internal motivation (Bellack & DiClemente, 1999); subsequently, the behaviours regulated by external pressures are less likely to be maintained (Silva et al., 2014).

In addition, the idea of making lifestyle changes is described as “overwhelming” by those who are already attempting to manage the substantial burden of mental illness (Yarborough et al., 2019). Knowing that they need to do something and yet are unable to do it produces additional stress and feelings of hopelessness and guilt, consequently making the individual withdraw further. The inability to make positive changes is like the force of inertia: the tendency to remain in the current status quo and lack of power to move beyond the force.

2.2 OVERCOMING THE INERTIA

2.2.1 Overview of the Action Over Inertia intervention approach

To address the profound disturbances that many people with serious mental illness experience in daily activity participation, a group of occupational therapists have developed the intervention approach, Action Over Inertia (AOI), which aims to enable engagement in activities that benefit health and well-being to people with serious mental illness. This step-by-step guide provides structural instructions and strategies, in addition to assessment and evaluation worksheets, for individual- and program-level implementation (Krupa et al., 2010). Five phases for promoting activity engagement were proposed in the workbook as follows:

- (1) Reflection: Identify the individual's need for change; evaluate their current time-use pattern; facilitate reflection on their health and well-being.
- (2) Quick changes: Break the force of "inertia" by promoting "action of doing"; provide the opportunity to experience the benefits of meaningful activities.
- (3) Education: Provide information about the connection between activity engagement and recovery; increase clients' knowledge and enable them to fully participate in the intervention.
- (4) Longer-term changes: Prepare individuals for planning longer-term change and facing upcoming challenges.
- (5) Sustain changes: Support individuals in actively doing and gaining momentum to engage in meaningful occupations.

Notably, the AOI emphasizes that after appraising the person's conditions of activity participation, it is crucial to support them in actually "doing". The second phase, quick changes, has a particularly powerful impact early in the process because the initiation of doing has the potential of breaking inertia and provides the opportunity to experience the health-fulfilling properties of meaningful activity.

AOI intervention was developed based on conceptual models or frameworks including ICF, Canadian Model of Occupational Performance and Engagement, Recovery, Do-Live-

Well, and Capabilities Frameworks. Current evidence has suggested the efficacy of the AOI intervention. For example, Edgelow and Krupa (2011) conducted a randomized controlled pilot trial in which people with serious mental illness received the AOI intervention along with assertive community treatment for over 12 weeks. The result shows that participants from the intervention group spent more time on activities and less on sleep, exhibiting an average difference of 47 min/day. In addition, qualitative data indicated positive responses from both clients and service providers. Another randomized controlled pilot study, conducted in Germany, demonstrates the positive outcome that participants' participation in self-care activities significantly increased with a large effect size of 0.72 (Pfeiffer & Höhl, 2017). Both pilot studies thus demonstrate good applicability and acceptance of AOI in people with serious mental illness.

2.2.2 The potentials of making simple changes

A qualitative study exploring the meaning of occupation in recovery from mental illness reports that all forms of occupational engagement can be meaningful in the recovery process. The transition from disengagement to engagement, called partial engagement, is an essential period of “grounding” the person and “reconnecting” them to their everyday world. The activity undertaken in the state of partial engagement may not be related explicitly to enjoyment, achievement, or satisfaction; however, these simple movements could gradually bring the person to their “here and now”, keep them occupied in the present, and allow them to become more open to other possibilities (Sutton et al., 2012).

A later scoping review conducted by Doroud et al. (2015) highlights the importance of “doing something” rather than “doing nothing”. Completing small, simple, and non-demanding tasks can potentially distract the person from struggles, allowing them to accept their illness as part of themselves. The simple tasks can be also seen as a process of “trial and error” in which the person may re-spark hope and re-appraise their capabilities and resources. Similarly, the AOI introduces the power of making small and quick changes, such as creating opportunities to experience the benefits of activity participation, signaling a belief in the possibilities for potential changes, preparing the person for the beginning steps, and anticipating challenges regarding the change. The goal is to create momentum to break the

force of “inertia” and gain experiences that enable learning and motivation for long-term changes.

2.2.3 Supporting behavioral changes

As described in the previous section, making even small changes can be challenging for those who are long-term disengaged. Krupa, Fossey, et al., (2009) suggest that the intervention should better address the multi-dimensional barriers that interfere with participation. At the personal level, the intervention may promote motivation to initiate change and enable the selection of activities by eliciting a wide range of choices. At the environmental level, the intervention may create a more supportive environment and increase the accessibility of opportunities and resources. A qualitative research interviewing people with mental illness about making lifestyle changes indicates the need for more tangible support in between healthcare visits which can be continually accessed over time (Yarborough et al., 2019).

Given the advance of technology, especially mobile technology and social media, offering healthcare through the Internet is a powerful method that can reach, engage, and retain a larger population (Huang et al., 2018). In the past ten years, a growing body of research has investigated the feasibility and effectiveness of integrating innovative tools, such as chatbots, into health-promoting intervention. The advantages of chatbots, such as conducting informative and encouraging conversations; leveraging and connecting users with relevant online resources; and being able to respond anytime and anywhere when necessary, can potentially accompany the delivery of therapeutic sessions to augment the therapeutic effects.

2.3 CHATBOT APPLICATION IN HEALTHCARE

2.3.1 Introducing chatbot system

A chatbot, often called “conversational virtual agent”, is a computer system that mimics person-to-person interaction by conducting conversations with the human user through natural language (either via text or text-to-speech) (Ivanovic & Semnic, 2018). The first computer system of this kind, ELIZA, was published in 1966 to simulate the responses of a

psychotherapist (Weizenbaum, 1966). Since then, various chatbots have been launched for purposes like commerce, marketing, customer support, education, entertainment, office management, and health promotion (Brandtzaeg & Følstad, 2017).

There are two types of chatbots: rule-based and AI-based. Rule-based chatbots offer linear, static, and simpler dimensions of response. The developers define the dialogue content, and the users interact with the chatbot using constrained inputs (e.g., multiple-choice options). AI-based chatbots are powered by Natural Language Processing (the computer learns to understand, analyze, manipulate, and generate human language), thereby facilitating more flexible and complex conversations. In general, building an AI-based chatbot requires a large amount of data to enable the computer to “learn”. Therefore, a rule-based chatbot is a common approach used in advance to collect user input and feedback when there is little data for a specific topic/purpose (Fadhil, 2018b).

The most significant advantage of a chatbot is its ability to automatically generate instant responses 24 hours per day. Applied in the healthcare field, chatbots can be used for assisting appointment booking; setting up personal health-related reminders; conducting health surveys; and collecting data to support clinicians making diagnoses and healthcare suggestions (Nadarzynski et al., 2019). Thus, chatbots can potentially increase access to healthcare services, promote intervention adherence, improve doctor-patient communication, and facilitate interventions in remote areas (Fadhil & Gabrielli, 2017). Fitzpatrick et al., (2017) used a chatbot to deliver a self-help program for college students who reported having depression and anxiety symptoms. The chatbot offered cognitive-behavioural-based intervention, encouraging users to monitor their mental health conditions. The participants were highly satisfied with the chatbot, and their symptoms of depression were significantly reduced ($F=6.47$; $P=0.01$) over the study period compared to the control group (who received information and resources via e-book), with a moderate between-group effect size ($d=0.44$; $p=0.04$). Tanaka et al., (2017) evaluated the effectiveness of delivering social skills training through a chatbot for individuals with social difficulties; the results indicate significant improvements in social skills after using the chatbot system ($p=0.003$; $d=1.17$). Additionally, Rhee et al., (2014) developed a chatbot to assist adolescents with asthma in self-managing their symptoms. Through daily text messaging, the participants had improved self-management; treatment adherence; and awareness of personal symptoms and triggers.

The positive outcomes from the literature indicate both the feasibility and efficacy of using chatbots in healthcare. Chatbots are seen overall as a convenient, time-saving, and effective tool for accessing instant health-related information, guidance, and advice. People are motivated to use the chatbot for minor health issues. However, some potential concerns underlying such application include: (1) potential miscommunications that influence the quality of intervention; (2) a lack of sympathy due to machine-based interaction without human presence; (3) cyber-security and confidentiality of information, especially related to personal health data (Nadarzynski et al., 2019). Therefore, the extent to which the target population accepts using a chatbot for a specific purpose should be investigated. Users' perspectives, experiences, and concerns should be addressed to optimize the uptake of the intervention.

2.3.2 Using chatbot to promote behavioural changes

A growing body of evidence suggests that using chatbot has the potential to promote behavioural changes. For example, Hudlicka (2013) developed and evaluated a virtual mindfulness coach ("Chris") which provided mindfulness training and coaching through text-based and natural language dialogue with a student. The pilot evaluation study indicates that "Chris" can help students establish a regular practice more successfully than those who only use self-administered written and audio materials with identical content. The participants in the chatbot group practised mindfulness more frequently (Mean = 4.5 days/week) compared to the control group (Mean = 3.2 days/week) and for longer periods of time (Mean = 19 vs. 16 minutes/session). The difference became more significant during the 3-week follow-up, in which the chatbot group participated for 4.3 days a week on average (2.7 days for control group) and meditated for 18.5 minutes per session (13.6 minutes for control group). In addition, compared to the control group, the participants who used "Chris" demonstrated more positive feedback and a lower dropout rate (3 vs. 6), and felt more confident in maintain their meditation practice.

Another research conducted by Perski et al. (2019) used chatbot to support smoking cessation. The researcher added a chatbot application into a smoking cessation app and tested the engagement and short-time quit success compared to another app version without the chatbot. The results show a significant increase in engagement (the number of logins

increased by 101% over the study period). The success rate of quitting smoking was also higher than the control group (15.8 % vs. 7.1 % if missing data counted as continue smoking; 79.5% vs. 73.3% if only counting those who followed up).

Hauser-Ulrich et al. (2020) demonstrate the feasibility of utilizing the chatbot (“SELMA”) to deliver cognitive behaviour therapy (CBT) for chronic pain self-management. The digital coach “SELMA” provided psychoeducation and various intervention modules and coping strategies for pain management. The results show that working alliance with the chatbot was comparable to that obtained with human coaches. Similarly, a study conducted in Japan delivered CBT-based intervention to problem gamblers through chatbot application (“GAMBOT”) since over 90% of this population were reluctant to seek or engage in face-to-face support. The evidence suggests that after using “GAMBOT” for 28 days, the severity of problem gambling was significantly decreased ($p= 0.01$). In addition, 77% of the participants continued to use GAMBOT throughout the 28-day period, which was promising in overcoming the high dropout rate of traditional face-to-face therapy sessions for problem gamblers (So et al., 2020).

2.4 SUMMARY OF LITERATURE REVIEW

In the context of mental illness, activity participation is a crucial facilitator of recovery. However, many people with serious mental illness have difficulties in re-engaging in meaningful activities in everyday life. The AOI intervention suggests that the action of making quick changes could be a critical step for individuals to move toward a healthy lifestyle. Additional supports are needed in order to enable activity changes. Given the advance of technology, using chatbots in healthcare is receiving increasing attention, and the feature of chatbot has the potential to promote behavioural changes. However, no research to date has investigated its feasibility of supporting people with serious mental illness in activity participation. To address this knowledge gap, this pilot study explored user experiences and perceptions of using a chatbot for promoting activity participation for people with serious mental illness.

3 METHODS OVERVIEW

The overall methods undertaken in this research were driven by the person-based approach (Yardley, Morrison, et al., 2015). The person-based approach is a method for optimizing the acceptability and feasibility of behavioural change interventions by emphasizing the perspectives of the people who use the intervention. It could be considered a particular form of user-centred design with greater attention to behavioural change outcomes. Integrating the person-based approach with the development of behavioural intervention enables the developers to consider the variations of how different people in different situations interact with the intervention, to focus on the most relevant and important components from the users' view and thus promote the attractiveness, adherence, effectiveness, and feasibility of the intervention (Morrison et al., 2018).

The person-based approach outlines the specific goals and research activity suggestions for intervention planning, development, and early evaluation (Yardley, Ainsworth, et al., 2015). At the planning stage, the person-based approach suggests conducting systematic investigations on the beliefs, attitudes, needs, and situation of the target population by conducting interviews, focus groups, observation, or questionnaire study. The goal of this stage is to identify the key intervention components that are likely to be important. Next, at the early stage of intervention development, it is useful to formulate design principles to ensure that the intervention features are consistent with and support the achievement of the primary intervention objectives. The intervention prototype should then be further explored for user reactions by using methods such as think-aloud techniques to elicit users' views and

behaviours when using the intervention. Finally, the prototype needs to be further modified based on users' feedback.

Based on the person-based approach, this thesis grounded the research methods over four phases with “a sensitive awareness of the perspective and lives of the people who will use them [the intervention]” (Yardley, Ainsworth, et al., 2015, p.1) to facilitate intended behavioural change (see Figure 3-1).

Phase One: Needs assessment. A needs assessment was conducted to (1) gain a preliminary understanding of activity participation for people with lived experience, and (2) collect activities that people would do in the local context. An activity bank, serving as the database of the chatbot, was created based on the results of the needs assessment.

Phase Two: Chatbot development. The design structure and principles were outlined to ensure that the chatbot features were consistent with the intervention goal. At the end of this phase, a chatbot prototype was developed.

Phase Three: Evaluation of usability and technology acceptance. To ensure that the chatbot's design and content is user-friendly, service providers (occupational therapists) and users (people with lived experience) were recruited to evaluate the chatbot's usability and technology acceptance. Usability issues and other suggestions were identified in the evaluation.

Phase Four: Chatbot refinement. The usability issues and suggestions for the chatbot were organized and prioritized, followed by further refinement of the chatbot accordingly. The modified chatbot features were presented at the end of the thesis.

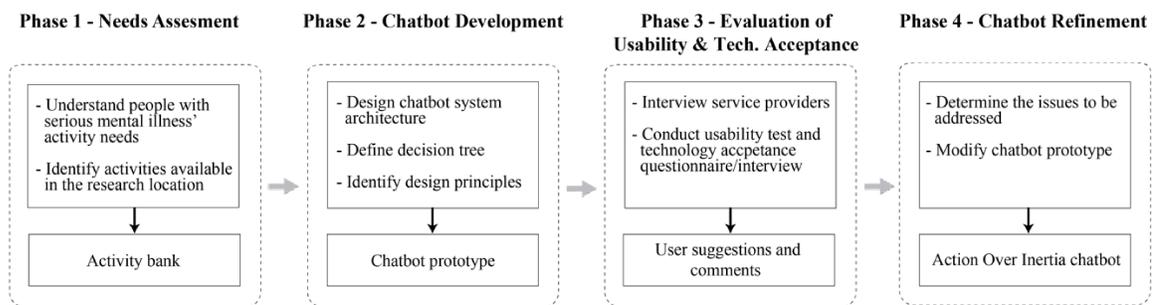


Figure 3-1. Methods overview.

4 PHASE ONE: NEEDS ASSESSMENT

Needs assessment is a process for determining goals, measuring needs, and prioritizing actions to be undertaken (Burton & Merrill, 1991). The steps of needs assessment include identifying needs, prioritizing needs, and selecting potential solutions. This can facilitate the planning and decision-making process; enable the intervention developers to prioritize areas of highest concern; provide valuable information for establishing priorities; and thus improve the quality of outcomes (Watkins et al., 2012).

The concept of need refers to the discrepancy between goals (what is ideal or desired to be) and the current status (what things are). It is critical to not only define the problem, but also specify resources that can support approaching the desired (Altschuld, 2004; Burton & Merrill, 1991; Kaufman et al., 1993). Considering the context of this research, the goal of the needs assessment was to understand the unmet activity needs of people with serious mental illness and explore the available assets that address those needs.

Through the lens of the person-environment-occupation (PEO) model, this research analyzed the problem by components of the person (an individual or a group of population with unique characteristics, experiences, and abilities), the environment (includes a broad domain of the physical, cultural, social, and institutional factors), and the occupation (the functional tasks or activities that the individual engaged in) (Strong et al., 1999; Wong, 2018). Two surveys were involved in this phase accordingly. Survey 1 concerned people with serious mental illness' activity participation (the personal component), aiming to answer the research question: what kinds of activities are important to people with serious mental illness,

and to what extent do they participate in these important activities? The exploratory nature of this survey provided an overview of the population's properties. Survey 2 aimed to identify the activity choices in the local environment (the occupation-environment components). The data collected informed the assets available for supporting a person's participation.

The findings of the two surveys were integrated into an activity bank consisting of activities that are deemed important by people with serious mental illness and fit the local context where the person engaged.

4.1 METHODS

4.1.1 Survey 1: Understand activity participation of people with lived experience

The World Health Organization's ICF highlights that participation should be in community-based, rather than agency-based, contexts (World Health Organization, 2001). Community participation provides opportunities for building relationships and finding one's values and is associated with greater levels of well-being and recovery for those living with mental health issues (Burns-Lynch et al., 2016; Krupa, 2007). Given the significance of community inclusion for people with serious mental illness, this research used the Temple University Community Participation (TUCP) measure (Salzer et al., 2014) to evaluate participation in community-based activities. The TUCP measure, which assesses both the actual doing per se (the number of participation days) and the subjective perceptions of participation, could provide holistic information about activity pattern and experience. The measuring of the perceived sufficiency (do you do this activity enough?) could indicate the gap between the desired and the current status. Also, although the meanings derived from activities are one of the major concerns of time-use interventions, the meanings often diverse- the same activity may have various meanings to different individuals. The TUCP measure asks the importance instead (is this activity important to you?), which can also inform what activities are valued by the respondent. The participant recruitment, the material used, and the research procedure of this survey were approved by the University of Alberta Ethics Board (#Pro00087965) (Appendix A).

Participant recruitment

A convenience sampling method was used to recruit participants. Recruitment posters with research purpose, context, and participant inclusion criteria were posted at three Edmonton community mental-health sites: Prosper Place clubhouse, Edmonton Community Mental Health Clinic, and Pathways Day Program (Appendix E). People who were (1) diagnosed with a serious mental illness, including schizophrenia, bipolar disorder, delusional disorder, and other psychiatric disorders that involve prevalent and persistent psychosis symptoms; (2) living in the community; (3) aged 18 to 70 years; (4) fluent in English; and (5) able and willing to provide written informed consent were included. People whose primary diagnoses are substance-related disorders or dementia were excluded. At each individual meeting, the researcher explained the study details, obtained informed consent, and assisted the participant in completing the survey. Each of the participants received a \$35 gift card as appreciation.

The survey questionnaire

The survey questionnaire consisted of demographic data, including age, gender, living status, housing, marital status, education, employment status, and sources of income, in addition to the TUCP measure (Appendix F).

The TUCP measure was used to assess participants' community participation. The measure was developed in the context of mental illness, aiming to help individuals to explore their self-directed participation in the community (Salzer et al., 2015). This measure can be used not only as an assessment but also as a goal-setting tool by highlighting areas for possible community activity. The 26 activity areas included in the TUCP were constructed based on the ICF life domains (domestic life; interpersonal life; major life areas such as education and work; and community, civic, and social life) in addition to feedback provided by a group of people with serious mental illness (see Table 4-1 TUCP measure activity areas). Participating in the activities listed in the TUCP measure was found to be associated with a higher level of recovery and quality of life. In addition to examining the objective aspect of participation (i.e., participation days in activities), the TUCP measure also concerns the subjective aspect of participation (i.e., the perceived importance and perceived sufficiency to activities), which could be insightful for identifying important activities for people with

serious mental illness. The measure has good evidence of internal consistency (Cronbach's alpha = .9). Preliminary results indicate that test-retest correlations over a 48-hour period are greater than $r = .7$ for total days of participation. Item-level correlations are above .6. The TUCP measure achieved consistent results with those obtained using the diary checklist approach to assessing community participation (Burns-Lynch et al., 2016; Salzer et al., 2014, 2015).

Table 4-1. Activity areas measured in the TUCP measure.

Item	Description	Item	Description
1	Go shopping at a grocery store, convenience store, shopping centre, mall, other retail store, flea market, or garage sale.	14	Go to a 12-step / self-help group for mental health issues.
2	Go to a restaurant or coffee shop.	15	Go to a 12-step / self-help group for substance use problems.
3	Go to a church, synagogue, or place of worship.	16	Go to another type of support group in the community (for example, overeaters anonymous, gamblers anonymous).
4	Go to a movie.	17	Go to a consumer-run organization or advocacy group/organization (This includes NAMI or any other organization that is completely run and operated by mental health consumers OR an organization or group that advocates for rights and services for mental health consumers).
5	Go to a park or recreation centre.	18	Go to a social group in the community (for example, a book club, hobby group, other group of people with similar interests).
6	Go to a theatre or cultural event (including local school or club events, concerts, exhibits and presentations in the community).	19	Work for pay.
7	Go to a zoo, botanical garden, or museum.	20	Go to school to earn a degree or certificate (for example: GED, adult education, college, vocational or technical school, job training).
8	Go to run errands (for example, go to a post office, bank, Laundromat, dry cleaner).	21	Take a class for leisure or life skills (for example, classes for cooking, art crafts, ceramics, photography).
9	Go to a library.	22	Participate in volunteer activities (in other words, spend time helping without being paid).
10	Go to watch a sports event (including bowling, tennis, basketball, etc.).	23	Get together in the community or attend an event or celebration with family or friends (for example, a wedding, bar mitzvah).
11	Go to a gym, health or exercise club, including pool, or <u>participate</u> in a sports event (including bowling, tennis, miniature golf, etc.).	24	Entertain family or friends in your home or visit family or friends in their homes.

12	Go to a barber shop, beauty salon, nail salon, spa.	25	Go to a community fair, block party, community clean-up day, or other community event or activity.
13	Use public transportation (for example, buses, Broad Street Line, subway) (This does NOT include mental health agency vans).	26	Go to or participate in civic or political activities or organizations.

The TUCP measure concerns a person’s participation across 26 activity areas. For each activity area, the TUCP measure asks:

- **Perceived importance.** Whether the activity is important to the person (Yes/ No).
- **Perceived sufficiency.** Whether the person thinks they perform the activity sufficiently (Enough/ Not enough/ Too much).
- **Number of days of participation.** The sum of participation days (0-30), during the past 30 days, that the person did the activity independently (or with family and friend) without program staff.

The outcomes of this measure can draw attention to those important activity areas and also indicate the needs and desires of the target population.

Data analysis

To answer the research question “what kinds of activities are important to people with serious mental illness, and to what extent do they participate in these important activities?” the following descriptive statistics were performed:

- (1) Analysis of personal participation. Several participation scales were calculated for the average of all participants:
 - a. Number of important areas. The sum of areas that were rated as important (possible score range: 0 to 26).
 - b. Number of important areas done enough. The sum of areas that were rated as important and were done enough (possible score range: 0 to 26).
 - c. Number of important areas participated in for at least one day. The sum of areas that were rated as important where the participant had at least 1 days of participation in the past 30 days (possible score range: 0 to 26).

- d. Sufficiency ratio (b/a). Dividing the number of areas considered important and done enough (b) by the number of important areas (a). The score of sufficiency ratio indicates the percentage of important activity areas where participation was done as much as the participant desired (possible score range: 0% to 100%).
 - e. Breadth ratio (c/a). Dividing the number of areas that were considered important and had at least one day of participation in the past 30 days (c) by the number of important areas (a). The score of breadth ratio indicates the percentage of important activity areas where participants had completed at least one day of participation in the past 30 days (possible score range: 0% to 100%).
- (2) Analysis of activity areas. For each activity areas, the followings were calculated:
- a. The average and medium of participation days.
 - b. The percentage of participants who perceived the activity area as important.
 - c. The percentage of participants who perceived the activity area as important and participated in the activity area as much as they desired.
- (3) Ranking activity areas. As age and gender often shape people's values, roles, and time-use pattern, the participants were grouped by age (30 years and under; between 31 and 50 years; 51 years and over) and gender (man, woman, unspecified). The reason for using the ages of 30 and 50 as the cut-off points is that they are the common ages when people's life goals change. Most people under 30 years are in school or just starting their career, while most people above 50 years might start planning a more relaxing lifestyle or enter retirement. In addition to man and woman, a general gender was also considered due to the diversity of modern gender identification. The activity areas were ranked for each of the nine subgroups (man aged 30 years and under; man between 31 and 50 years; man aged 51 years and over; woman aged 30 years and under; woman between 31 and 50 years; woman aged 51 years and over; people (gender not specified) aged 30 years and under; people (gender not specified) between 31 and 50 years; and people (gender not specified) aged 51 years and over) by conducting the following steps:

- a. The 26 activity areas were first ranked based on the percentage (%) of subgroup participants who considered the activity important. An activity area would be in a higher rank when more people considered it important.
- b. If more than one activity had the same rank by importance (i.e., the same percentage of participants considered the activities important), then these activities would be further ranked based on the percentage of participants who considered performing the activity less often than desired (perceived sufficiency).
- c. If more than one activity had the same rank by importance and perceived sufficiency (i.e., the same percentage of participants considered the activities important and insufficient), then these activities would be further ranked based on the percentage of participants who performed the activity on less than one day (participation days).

4.1.2 Survey 2 and an online website search: Explore Edmonton-based activities

To explore what people do and the local resources in the Edmonton area, this step involved two data collections: an online survey (Survey 2) and a website search.

Survey 2: Online Survey

Statistics Canada has published the Activity Group, listing Canadian activities for total work, personal care, and free time (Statistics Canada, 2019) (Appendix D). However, activities may vary across different locations given their culture, climate, and resources. Therefore, this research further refined the activity list by conducting a small-scale, location-based online survey, aiming to explore the activities undertaken recently by the general population in the area of Edmonton. The participant recruitment, the material used, and the research procedure of this survey were approved by the University of Alberta Ethics Board (#Pro00099631) (Appendix B).

Participant recruitment. A snowball sampling method was used to recruit online survey participants. Inclusion criteria include: (1) people who lived in Edmonton area during the survey time period; (2) people aged between 18 and 70 years. Recruitment messages were posted on social media (Facebook and Twitter) and spread by e-mail and word of mouth (Appendix G). Potential participants received a link to a Google Form survey where they

could read about research information, gain access to the online informed consent form, and participate in this anonymous online survey.

During the recruitment process, the researcher would review the submitted survey and monitor the diversity of respondents' characteristics (e.g., age, gender, employment status). For example, when the survey was completed mostly by students aged under 30 years, the researcher would continue to disseminate the survey with a statement of needing older or retired participants.

The survey questionnaire. The survey questionnaire was developed primarily based on the Statistics Canada Activity Group, with the exclusion of essential personal care activities, which have less emphasis on community participation.

The questionnaire consisted of three main sections. The first section collected demographic information, including age, gender, employment status, and whether living in Edmonton. The second section asked about people's participation in leisure activities. The participants were asked to check boxes from a list of activities that they had undertaken at least once during the past year prior to the COVID-19 outbreak, and enter other activities that they would do but were not listed in the survey questions. The third section focused on productive activities. Since the two main areas of productive activity – work and education – may not be achieved in a short period of time, the survey instead asked the common searching platform for jobs, classes, and volunteering opportunities. To collect more productive activity ideas, the survey also asked about household activities that the participants would perform (Appendix H).

Online website search

Activities and resources available in the Edmonton area were searched on the following webpages: (1) The City of Edmonton: Activity, Parks & Recreation (<https://www.edmonton.ca/activities-parks-recreation.aspx>), and Attractions & Events (<https://www.edmonton.ca/attractions-events.aspx>); (2) Explore Edmonton: Things to do (<https://exploreedmonton.com/things-to-do>). The webpages were reviewed for activities and resources that were available in Edmonton and were not mentioned in the online survey.

Data management for Survey 2 and website search

Survey 2: The activities from both the checklists and typed inputs were labelled and categorized based on their natures (e.g., social, physical, places to visit in the community). The number of counts and the percentage of the activities being done (as well as the platforms for jobs, classes, volunteer opportunity searching) were calculated.

Website search: The identified activities and resources were organized into a list.

4.1.3 An activity bank: Develop chatbot database

Based on the results of the two surveys and the website search, an activity bank was developed as the reference source of the chatbot database. The following steps were conducted (see Figure 4-1):

Step 1: Determining activity category. The 26 activity areas listed in the TUCP measure were reviewed and modified by (1) combining areas that shared common meanings into one category, to make the activity lists presented in the chatbot more concise; (2) modifying areas to a more inclusive category, to include more related ideas for activities; and (3) excluding routine activity areas (e.g., instrumental activities of daily living; activities that people would do when necessary in order to live independently).

Step 2: Activity matching. Each activity category developed in the first step was expanded with activities that share the same property and incorporated with the results of Survey 2 and the website search.

Step 3: Activity screening. The final activity categories and activities under each category were screened by the person, the environment, and the occupation constructs (e.g., the cognitive level, space, and equipment necessary for performing the activity) to ensure that the activity suggestions were applicable and realistic for people with serious mental illness.

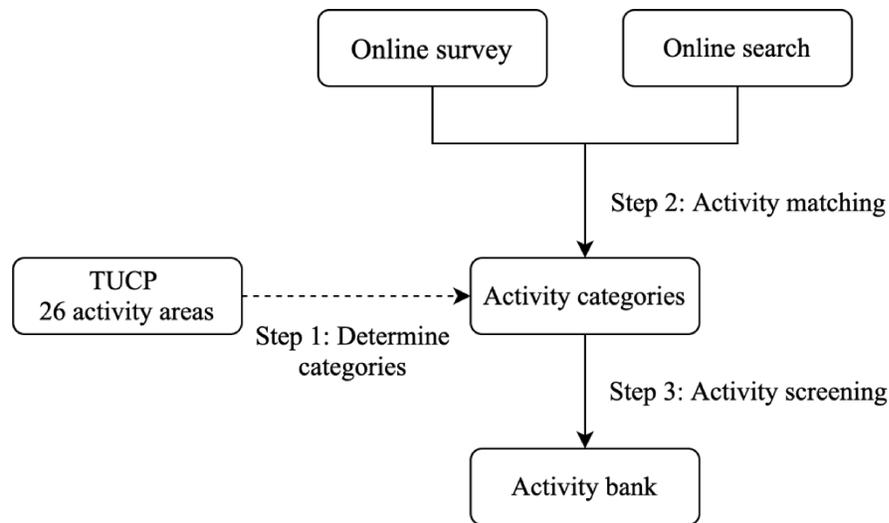


Figure 4-1. Development of the activity bank.

4.2 FINDINGS

4.2.1 Results of Survey 1

Sample characteristics

From April 2019 to February 2020, a total of 80 participants were recruited and completed the questionnaire. The 80 completed questionnaires were reviewed, among which ten were excluded for analysis: nine participants had too much missing data (range 14-78 missing out of 130 total data inputs), and one had invalid data (chose multiple answers for one item). A total of 70 participants were included in the data analysis. Of the 70 participants, the mean age was 46.5 years (range 21-70 years), and the gender was evenly distributed. Half of the participants were unemployed, and a majority of them relied on AISH (Assured Income for the Severely Handicapped, Alberta) or other benefits (71.4%).

Table 4-2 provides detailed information on the characteristics of the 70 participants.

Table 4-2. Characteristics of TUCP measure participants.

n=70		Percentage (N)
Gender	Man	48.6 % (34)
	Woman	50% (35)
	Other	1.4% (1)
Age	20-29	14.3% (10)
	30-39	15.7% (11)

n=70		Percentage (N)
	40-49	20.0% (14)
	50-59	32.9% (23)
	60-70	17.1% (12)
Education Level	Less than high school	8.6% (6)
	High school	32.8% (23)
	Some college, Associate degree, or Technical/vocational training	42.9% (30)
	Bachelor's degree	12.9% (9)
	Master's degree	1.4% (1)
	Missing data	1.4% (1)
Employment Status	Full-time	1.4% (1)
	Part-time	20% (14)
	Unemployed	50% (35)
	Retired	8.6% (6)
	Other*	20% (14)
Marital Status	Single	75.7% (53)
	Married or domestic partnership	5.7% (4)
	Divorced, Widowed, or Separated	18.6% (13)
Source of Income	Self	20% (14)
	Family	8.6% (6)
	AISH or other benefits	71.4% (50)
Living Status	Live alone	45.7% (32)
	With family	22.9% (16)
	With housemates/roommates	20% (14)
	Group home or assisted living	10% (7)
	Homeless	1.4% (1)

*Employment status (Other): 11 on AISH, 4 Long-term disability, 1 student, 2 Casual work, 1 semi-retired

Overall activity participation

On average, 18 areas were considered important among the 26 TUCP activity areas. About seven of the important areas were done as much as desired, and ten of the important areas were participated in at least one day. The sufficiency ratio and breadth ratio were about 0.45 and 0.62, respectively (see Table 4-3), indicating that only about half of those perceived important activity areas were participated in and were done as much as desired.

Table 4-3. TUCP activity participation.

N= 70	Mean (SD)	Median (IQ)
Number of important areas (a)	17.1 (5.3)	18 (2-26)*
Number of important areas done enough (b)	7.9 (5.6)	7 (0-26)*
Number of important areas participated at least one day (c)	10.3 (4.9)	10 (2-24)
Sufficiency ratio (b/a)	0.47 (0.28)	0.45 (0.27-0.81)*
Breadth ratio (c/a)	0.62 (0.23)	0.62 (0.47-0.81)

*The Shapiro-Wilk Test of normality: The data significantly deviate from a normal distribution.

Participation in TUCP activity areas

Among the 26 activity areas, the areas with the highest number of days of participation are #13 *use public transportation* (median= 20), #1 *shop for groceries* (median= 6), #8 *run errands* (medium= 4), and #2 *go to a restaurant or coffee shop* (medium= 4). Eighteen activity areas (69% out of 26) have a medium of 0 participation days, indicating limited participation across the ICF major life areas including education, work, community, civic, and social life. 12 areas have over half of the participants (who rated the area important) considered doing less than desired. Only routine activity areas such as #1 *grocery shopping*, #8 *do run errands*, and #13 *use public transportation* were sufficiently participated in. Among those that were participated in insufficiently (across productive, leisure, social, civic, physical, community activities), #19 *work for pay* had the lowest sufficiency (76.8% of those reported important considered not doing enough) (see Table 4-4). Overall, the participants had low participation in the activity areas that they perceived as important except routine activities, which include productive, social, and community activities.

Table 4-4. Participation in TUCP activity areas.

	a. Number of days Median (IQ range)	b. Perceived importance (% of 70)	c. Perceived sufficiency of those reported important (% of b.)		
			Enough	Not enough	Too much
1. Go shopping at a grocery store, convenience store, shopping centre, mall, other retail store, flea market, or garage sale.	6 (3-15)	92.9	67.7	23.1	9.2
8. Go to run errands (for example, go to a post office, bank, laundromat, dry cleaner).	4 (4-7)	84.3	64.4	28.8	6.8
24. Entertain family or friends in your home or visit family or friends in their homes.	2 (0-5)	84.3	33.9	62.7	3.4
5. Go to a park or recreation centre.	2 (0-5)	81.4	43.9	56.1	0.0
13. Use public transportation (for example, buses, Broad Street Line, subway) (This does NOT include mental health agency vans).	20 (5-30)	81.4	87.7	7.0	5.3
11. Go to a gym, health or exercise club, including pool, or participate in a sports event (including bowling, tennis, miniature golf, etc.).	0 (0-4)	80.0	35.7	60.7	3.6
19. Work for pay.	0 (0-4)	80.0	23.2	76.8	0.0
23. Get together in the community or attend an event or celebration with family or friends (for example, a wedding, bar mitzvah).	0 (0-3)	78.6	40.0	60.0	0.0
9. Go to a library.	1 (0-5)	75.7	47.2	49.1	3.8
22. Participate in volunteer activities (in other words, spend time helping without being paid).	0 (0-4)	74.3	36.5	59.6	3.8
2. Go to a restaurant or coffee shop.	4 (2-10)	72.9	64.7	27.5	7.8
12. Go to a barber shop, beauty salon, nail salon, spa.	1 (0-1)	72.9	56.9	41.2	2.0
6. Go to a theatre or cultural event (including local school or club events, concerts, exhibits and presentations in the community).	0 (0-2)	71.4	32.0	62.0	6.0
18. Go to a social group in the community (for example, a book	0 (0-4)	71.4	36.0	62.0	2.0

	a. Number of days Median (IQ range)	b. Perceived importance (% of 70)	c. Perceived sufficiency of those reported important (% of b.)		
			Enough	Not enough	Too much
club, hobby group, or other group of people with similar interests).					
21. Take a class for leisure or life skills (for example, classes for cooking, art crafts, ceramics, photography).	0 (0-1)	71.4	38.0	60.0	2.0
20. Go to school to earn a degree or certificate (for example: GED, adult education, college, vocational or technical school, job training).	0 (0-0)	64.3	31.1	64.4	4.4
4. Go to a movie.	0 (0-1)	60.0	38.1	57.1	4.8
7. Go to a zoo, botanical garden, or museum.	0 (0-0)	58.6	36.6	58.5	4.9
3. Go to a church, synagogue, or place of worship.	0 (0-4)	55.7	61.5	38.5	0.0
14. Go to a 12-step/self-help group for mental health issues.	0 (0-2)	54.3	39.5	57.9	2.6
25. Go to a community fair, block party, community clean-up day, or other community event or activity.	0 (0-1)	54.3	36.8	63.2	0.0
16. Go to another type of support group in the community (for example, overeaters anonymous, gamblers anonymous).	0 (0-1)	51.4	52.8	41.7	5.6
26. Go to or participate in civic or political activities or organizations.	0 (0-0)	44.3	35.5	61.3	3.2
10. Go to watch a sports event (including bowling, tennis, basketball, etc.).	0 (0-2)	42.9	56.7	43.3	0.0
17. Go to a consumer-run organization or advocacy group/organization.	0 (0-0)	37.1	38.5	57.7	3.8
15. Go to a 12-step/self-help group for substance use problems.	0 (0)	18.6	46.2	38.5	15.4

Activity rankings for different ages and gender

Among the nine age/gender subgroups, #1 *shop for groceries* (5 times), #13 *use public transportation* (4 times), and #23 *get together with family and friends* (4 times) are the most

frequent areas of participation (ranked in the first three orders); #15 *go to self-help group for substance use problem* (7 times), #17 *go to consumer-run or advocacy group* (6 times), #10 *watch a sport event* (5 times) are the less frequent areas of participation for all the subgroups (ranked in the last three orders). Despite these similarities, some certain activity areas were placed in different order of importance for the age/gender subgroups. For example, #20 *go to school* is ranked higher for the young population (below 30 years) compared to their older counterparts. #11 *participating in sports* is highly ranked by man aged 31 to 50 years but not other subgroups. For the older population, woman placed #5 *go to parks and recreational centres* and #22 *volunteer* in higher orders than man (see Table 4-5).

Table 4-5. Activity ranks for age/gender subgroups.

Gender	Age group (N)	Ranking order												
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Man	Under 30 (6)	13	23	20	26	22	24	9	8	1	5	19	18	21
	Between 31-50 (13)	11	1	23	24	5	2	19	22	9	12	8	21	6
	Above 51 (15)	8	13	1	19	9	12	10	11	4	6	23	24	18
Woman	Under 30 (6)	5	20	19	24	15	17	1	21	18	23	9	11	13
	Between 31-50 (13)	1	23	18	21	19	22	24	11	12	2	13	5	6
	Above 51 (16)	24	5	22	1	8	11	2	7	6	13	19	21	9
Not specified	Under 30 (12)	20	24	13	1	5	23	19	9	8	21	22	18	6
	Between 31-50 (26)	1	23	11	24	2	19	5	22	21	18	12	8	9
	Above 51 (31)	8	1	13	24	5	19	11	9	12	6	2	22	23

Gender	Age group (N)	Ranking order													
		#14	#15	#16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	
Man	Under 30 (6)	6	14	12	25	4	17	11	7	16	15	2	10	3	
	Between 31-50 (13)	4	7	18	20	13	25	14	16	3	26	10	17	15	
	Above 51 (15)	5	3	14	2	20	22	21	16	7	26	25	15	17	
Woman	Under 30 (6)	8	6	22	12	14	3	4	2	25	10	16	7	26	
	Between 31-50 (13)	25	8	3	9	4	20	7	16	14	26	17	10	15	
	Above 51 (16)	12	25	23	18	16	3	17	14	4	26	20	10	15	
Not specified	Under 30 (12)	11	14	12	4	26	2	25	3	10	7	16	17	15	
	Between 31-50 (26)	6	13	4	7	25	20	3	14	16	26	17	10	15	
	Above 51 (31)	18	7	3	21	16	4	14	20	10	25	26	17	15	

4.2.2 Results of Survey 2

Sample characteristics

From May to June 2020, a total of 37 local people (the general population, regardless of experiencing mental health issues) who lived in Edmonton, aged 18-70 years, completed the online survey. As shown in Table 4-6, among the 37 online survey respondents from different age groups, the largest proportion (43.2%) were 18-29 years old. The majority were woman (78.4%) and 18.9% were either unemployed or retired.

Table 4-6. Characteristics of online survey respondents.

n=37		Percentage (N)
Age Range	18-29	43.2% (16)
	30-39	24.3% (9)
	40-49	2.7% (1)
	50-59	21.6% (8)
	60-70	8.1% (3)
Gender	Man	21.6% (8)
	Woman	78.4% (29)
Employment Status	Full-time	37.8% (14)
	Part-time	18.9% (7)
	Unemployed	13.5% (5)
	Retired	5.4% (2)
	Student	24.3% (9)

Activities identified in the online survey

Activities that the participants do in Edmonton were labelled and categorized into socializing activity, physical activity, community places to visit, and household activities.

Quite a few activities were frequently mentioned or selected. For example, people like to spend time with others in home, exercise together, chat over the phone, and have meals together. As for physical activities, many people would walk, run, jog, play ball games, hike, and exercise. Shopping centres, stores, restaurants, coffee shops, parks, zoos, and botanic gardens are popular places to visit. In terms of household work, gardening is one of the most popular activities. A list of activities and their frequencies (numbers of people selected or reported) is presented in Table 4-7.

Table 4-7. Activities in Edmonton.

Category	Activity	Percentage (N)
Socializing activity	Inviting others in your home or visiting others in their homes	100 (37)
	Participating in sports events or exercising together	100 (37)
	Talking, having conversations over phone or video chat	97 (36)
	Going to restaurants/having meals together	95 (35)
	Watching movies/films at home or movie theatres	89 (33)
	Going shopping	86 (32)
	Listening to music/going to concerts/karaoke	76 (28)
	Cooking/baking together	73 (27)
	Barbecuing	65 (24)
	Socializing at bars or clubs	51 (19)
	Going for a picnic	43 (16)
	Socializing on social network apps or dating apps	43 (16)
	Socializing in community such as at block parties	35 (13)
Socializing at church/religious places	5 (2)	
Physical activity	Walking, jogging, running	100 (37)
	Ball sports (football, basketball, baseball, volleyball, hockey, soccer, field hockey, bowling, pool, ping-pong, pinball, golf, miniature golf, tennis, squash, racquetball, paddle ball)	76 (28)
	Hiking and birdwatching	73 (27)
	Exercising, weightlifting	73 (27)
	Bicycling	51 (19)
	Swimming	49 (18)
	Camping	49 (18)
	Yoga	41 (15)
	Skiing, ice skating, sledding, curling, snowboarding	41 (15)
	Fishing	27 (10)
	Boating	27 (10)
	Rowing, canoeing, kayaking	24 (9)
	Dancing	22 (8)
	Berry picking	8 (3)
	Hunting	5 (2)
Archery	3 (1)	
Community places to visit	Shopping centre/stores	86 (32)
	Restaurants/coffee shops	76 (28)
	Community, provincial, or national parks	73 (27)
	Libraries or community recreation centres	73 (27)
	City fairs, festivals, circuses, or parades	68 (25)
	Zoos or botanical gardens	65 (24)
	Museums or art galleries	51 (19)
	Opera, ballet, or theatre	43 (16)
	Heritage sites	38 (14)
	Casino, bingo, arcade	38 (14)
	Church/religious places	5 (2)
The lake/beach	3 (1)	

Category	Activity	Percentage (N)
Household work	Gardening/ taking care of plants	57 (21)
	Decorating	41 (15)
	Renovating	41 (15)
	Organizing	38 (14)
	Taking care of pets	11 (4)
	Taking care of senior/child	5 (2)

In addition to activities, the respondents suggested several common choices of jobs/classes searching platforms and volunteering places (see Table 4-8). For example, Indeed and LinkedIn were mentioned the most when asked about platforms for job hunting. Many people would go to the City of Edmonton website and universities' continuing education programs to find skill classes. As for volunteering, the respondents suggested several non-profit organizations, such as Mustard Seed, Hope Mission, or Salvation Army for volunteering opportunities.

Table 4-8. Popular platforms/places for job/class/volunteer position searching.

Category	Platform/ Places	Percentage (N)
Job hunting	Indeed	46 (17)
	LinkedIn	32 (12)
	Glassdoor	11 (4)
	Workopolis	5 (2)
	Kijiji	5 (2)
	City of Edmonton	5 (2)
	Government of Canada	5 (2)
	Government of Alberta	5 (2)
	Alberta Health Services	5 (2)
	Canada Post	3 (1)
	Jobtree	3 (1)
	Jobkin	3 (1)
	Eluta	3 (1)
	Careerconnect	3 (1)
Campusbridge	3 (1)	
Class for hobbies/skills learning	City of Edmonton	19 (7)
	University of Alberta, MacEwan, NAIT extension	16 (6)
	Udemi	11 (4)
	EDX	5 (2)
	Edmonton Public Library	5 (2)
	City Art Centre	3 (1)
	Groupon	3 (1)
	Metro Continuing Education	3 (1)
Community league	3 (1)	

Volunteering opportunity	Non-profit organizations	24 (9)
	Food banks	16 (6)
	Animal shelters/rescue teams	14 (5)
	Hospitals	8 (3)
	Senior homes	8 (3)
	Community leagues	8 (3)
	Churches	5 (2)
	School associations	5 (2)
	Public library	3 (1)

Activities/ resources identified in the website search

A total of 14 activities/resources were identified from the City of Edmonton and Explore Edmonton websites, including: (1) City of Edmonton: River Valley Parks/Trails Maps, Events Calendar, Picnic and BBQ sites, Leisure Access Program, Discover YEG Map, Commonwealth Walkway, and Community Leagues; and (2) Explore Edmonton: seasonal festivals, indigenous experiences/attractions, local restaurants/ coffee shops, local sports bars, local tours, snowshoeing, and Centre for Art.

4.2.3 An activity bank

Step 1. Determine activity categories

The activity categories of the activity bank were adapted from the 26 TUCP activity areas, with a particular focus on participants' needs (those activities that people perceived as important but participated in insufficiently). For example, social and community activity areas were both important but were participated in insufficiently; these areas were therefore adapted into more inclusive categories to cover more possible activity ideas. The following changes were made:

- Multiple activity areas were combined into a more inclusive category: (1) #4 *go to a movie*, #23 *get together in the community with family or friends*, #24 *entertain family or friends in homes* were combined as “social interaction”. The reason for including #4 *go to a movie* in this category was that going to movie theatres might be expensive for some and watching movies at home is considered passive leisure, whereas watching movies with others can add significant meaning to this activity. (2) #1 *shopping for groceries*, #2 *go to a restaurant or coffee shop*, and #25 *go to a*

community event were combined as “community”. (3) #14 *Go to a 12-step/ self-help group for mental health issues*, #15 *Go to a 12-step/ self-help group for substance use problems*, #16 *Go to another type of support group in the community*, #17 *Go to a consumer-run organization* were combined as “support groups”.

- Activity areas were modified to more general categories that may cover more possible activity ideas: #3 *go to place of worship* was changed to “spiritual”; #7 *go to a zoo, botanic garden, or museum* was modified to “city attractions”; #11 *participate in sports event* was renamed “physical activities”; #12 *go to a barber shop or beauty salon* was changed to “self pampering”.
- Routine activity areas were excluded: #8 *go to run errands* and #13 *use public transportation* were not included in the activity bank since they are instrumental to individuals’ personal needs; therefore, general suggestions might not fit into everyone’s unique context.

Consequently, 16 activity categories were created from Survey 1: learn new skills, city attractions, volunteer, social interaction, physical activities, spiritual, work, cultural, community, library, watch sports, education, support group, park/recreation centre, civic, pamper yourself.

Step 2. Activity matching

The 16 categories (adapted from Survey 1) were expanded with 56 activity ideas (identified from the results of Survey 2). Those that require minimum resources, such as free/low-cost activities, were prioritized for inclusion.

Step 3. Activity screening

The 56 activity ideas were further screened for their appropriateness as suggestions for people with serious mental illness. Some activities were modified or added to remove barriers for successful participation:

- Besides going to worship places, having spiritual moments with oneself is another activity idea that is feasible for everyone regardless of their religious beliefs.

- Employment is not easily begun within a short period of time, so was modified into various employment preparing activities.
- Compared to participating in civic or political organizations, reading newspapers is an easier way to be involved in the civic role.
- Going to a barber shop or beauty salon was modified to at-home beauty activities so it is more affordable, and people can do it more frequently.

The final activity bank, which was used as the database of the chatbot, includes 60 activity ideas across 16 categories. Table 4-9 lists the activity ideas included in the activity bank.

Table 4-9. Activity bank.

	Category	Activity ideas
1	Visit city attraction	Zoo, Botanic garden, City parks, Museums, Art galleries, City events, Local stores, Local coffee shop, International restaurants, Photo-taking spots, Architecture tour, Second-hand shop
2	Social interactions	BBQ, Picnic, Baking, Movie, Video-chat, Potluck, Family gathering, Watch sports, At-home karaoke
3	Physical	Hiking, Jogging/Running, Swimming, Home exercise, Yoga, Dance workout, House cleaning, Gardening, Closet reorganizing
4	Work	Prepare resume, Know your interest, Study job market, Connect with employment service
5	Education	Continuing education, Online learning
6	Volunteer	Community, Health organization, Animal shelter, Non-profit organization, Elder care, Environment care
7	Learn new skills	In-person, Online
8	Community	City festival, Community league, Volunteer, Neighbourhood walk
9	Cultural	City event, Architecture tour
10	Library	City library programs
11	Park/Recreation centre	City parks, Recreation centres
12	Support group	City support resources, Mental health group
13	Spiritual	Religious meeting, Spiritual activity
14	Civic	Read newspaper
15	Watch sports	Local sports bar
16	Pamper yourself	Home salon

4.3 SUMMARY OF PHASE ONE

The overarching goal of Phase One was to obtain an overview of people with lived experience' participation in community-based activities. The results of the TUCP measure indicate that the participants perceived most of the community activities as important yet had overall low participation in these activities. Interventions to support them in community participation are therefore needed. Another major outcome of this phase was the collection of activity ideas that are available in the research location. The final product – an activity bank – would serve as the database of the proposed chatbot prototype to ensure that the embedded content is relevant to the users' context.

5 PHASE TWO: CHATBOT DEVELOPMENT

This chapter presents the overall design and features of the chatbot prototype, including (1) chatbot system architecture, which was developed to guide the design of overall features and functions embedded in the chatbot; (2) a decision tree that provides the “flow” of the chatbot content; and (3) the design principles that guide the key intervention design objectives. A chatbot prototype was developed at the end of this phase.

5.1 CHATBOT SYSTEM ARCHITECTURE

The structure of the chatbot system consists of three parts: the chatbot database, the messaging platform, and the chatbot rule. First, the database contains data (i.e., the activity bank) that were collected from the needs assessment. The data were managed and categorized through a decision tree. Second, the messaging platform is where users interact with the chatbot system. Users see data in the form of human language instead of programming codes. Lastly, the chatbot rule bridges the database and the user. Working in the system background, the chatbot rule helps the computer system distinguish data requested by the user, thereby providing the user with access to tailored information.

Figure 5-1 illustrates the system architecture of the proposed chatbot. On the user platform, users send requests by clicking the predefined menu/buttons or texting keywords. All menu/buttons were set up to match a set of keywords in the decision tree to see whether the user is asking for activity ideas or another choice. The computer would then extract

matching data from the database following the users' choice of activity areas or lead them to the list for further searching. The users can also use text as an alternative method of interacting with the chatbot. In this case, the inputs must match one of the keywords to receive corresponding information. Otherwise, the users would receive a default reply (a fixed message that would be presented when there are no corresponding data) that directs the users to click buttons or wait for real human responses.

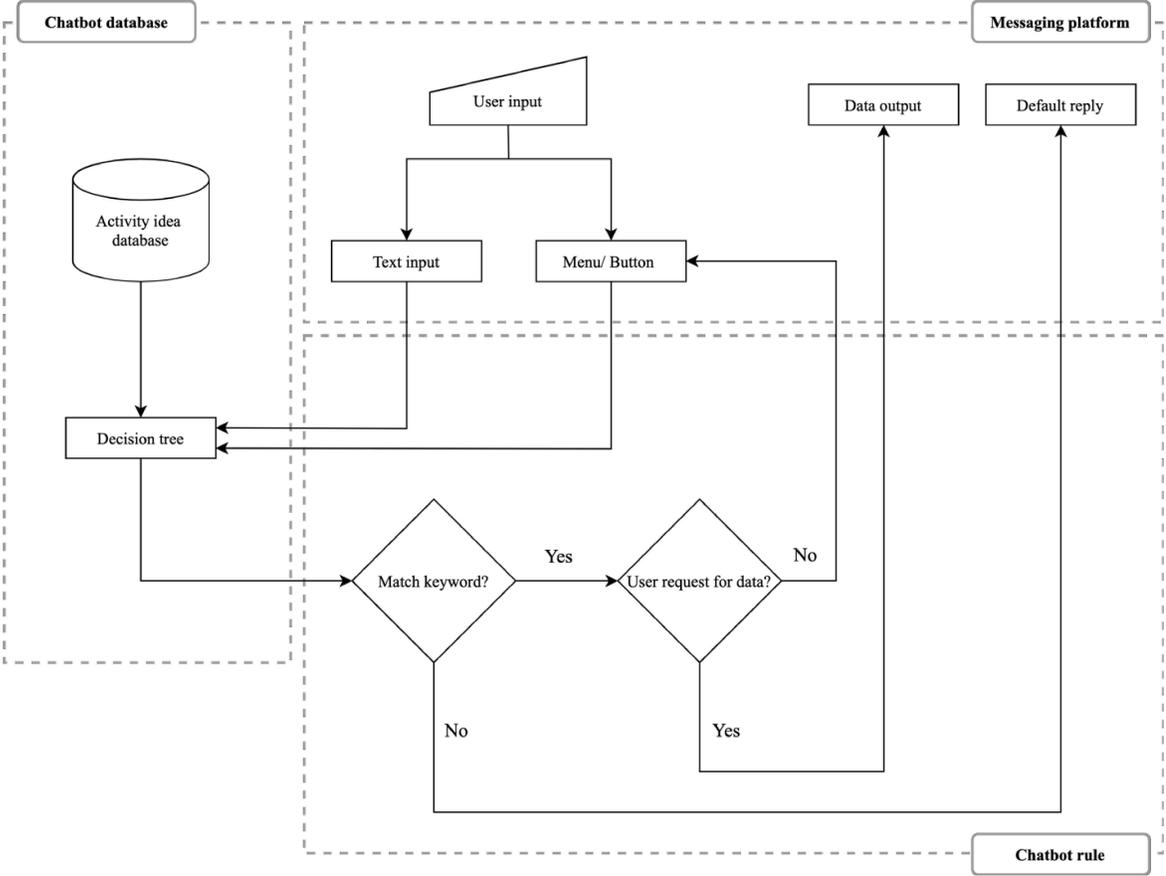


Figure 5-1 Chatbot system architecture.

5.2 DECISION TREE

As described in the chatbot system architecture, a decision tree was designed to categorize the data to enable users to obtain tailored responses. A decision tree is a tree-shaped flowchart which branches into multiple decision paths and ends with leaf nodes representing the solution.

Figure 5-2 illustrates the decision tree of the chatbot, which branches into three major paths:

- Path 1 - Purpose-oriented: Suggested by the AOI workbook, three dimensions of activity engagement – physical activity, social interaction, and access to community – were included in the purpose-oriented category. The activity ideas are selected into this path if users choose the purpose of activities.
- Path 2 - Age- and gender-based: The results of the Survey 1 suggest the variety of people of different ages and gender value activities. If users choose this category, the chatbot presents the activity ideas based on their age and gender in different orders. It should be noted that the ranking orders for the age/gender subgroups founded in Survey 1 were based on the TUCP 26 activity areas. However, the areas were further modified into 16 categories for the activity bank (and used as the chatbot database), and the ranking orders used in the chatbot were adapted accordingly. For example, for the subgroup of man aged 30 years and under, the first ranked area is *#13 use public transportation*, which was excluded for the activity bank; consequently, the second priority, *#23 get together in the community with family or friends*, is moved to the first priority.
- Path 3 - Randomly-selected: As the name suggests, the chatbot would offer activity ideas randomly without choosing a purpose, age, or gender.

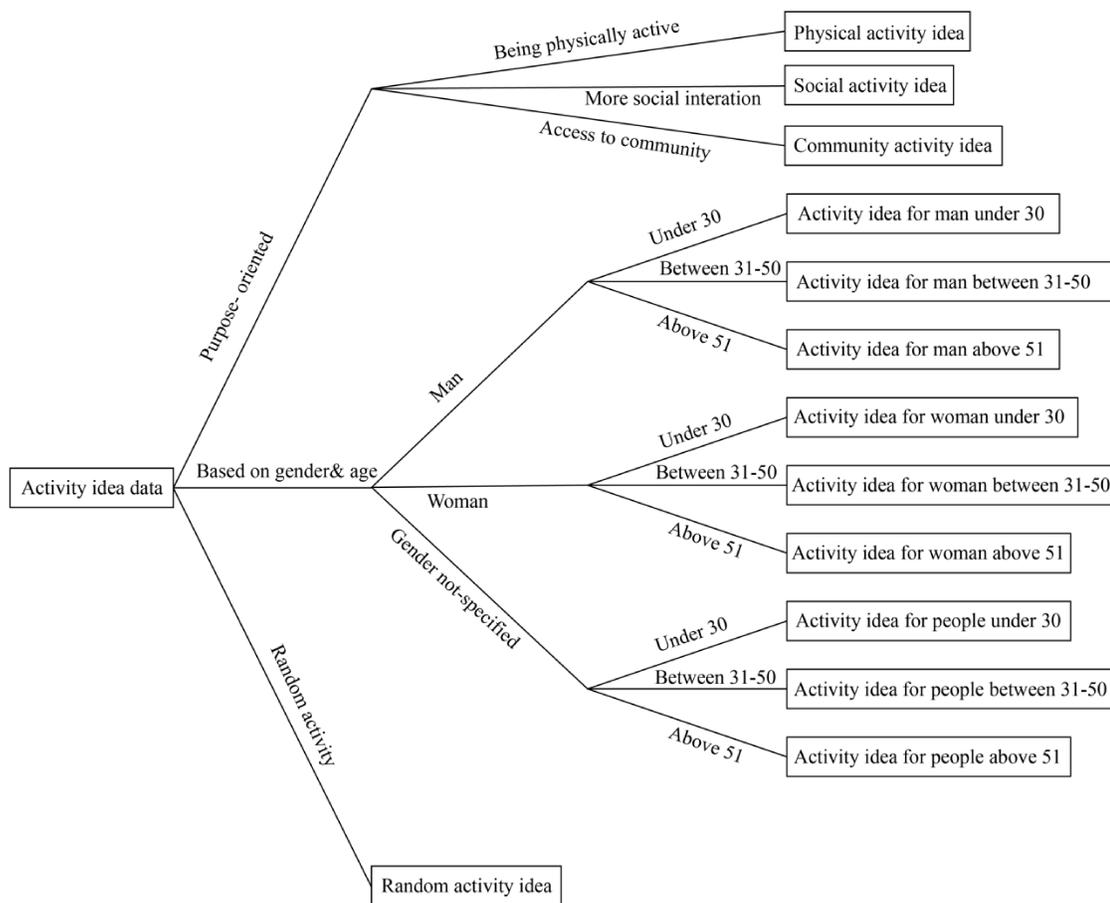


Figure 5-2. Chatbot data decision tree.

5.3 DESIGN PRINCIPLES

The Pipeline Design for Chatbot System identifies several major challenges when developing a health-promotion chatbot (Fadhil, 2018b). In an attempt to facilitate behavioural change, the guideline suggests considering the theoretical, behavioural, technical, design, logical, and linguistic components associated with the chatbot systems. The following five principles were developed based on the Pipeline Design for Chatbot System and were applied to the chatbot development.

Principle 1: Do-Live-Well framework and self-determination theory as theoretical foundation

In alignment with the AOI workbook, the chatbot was built upon the belief that occupational engagement benefits health, well-being, and recovery. This notion is prompted by the Canadian framework “Do-Live-Well”, which is rooted in the idea that “what you do everyday matters” (Moll et al., 2015). The framework identifies that health and well-being are influenced by the interactions among three constructs: dimensions of experience (a range of experiences); activity patterns (the nature of the experience); and personal and social forces (individual or environmental strengths and limitations). As a complementary tool of the AOI intervention, the chatbot was developed to facilitate changes in the three constructs: providing a wide range of activity ideas to support people to obtain various dimensions of experience; using encouraging language and emphasizing the activity benefits to initiate participation; and attaching online resources to increase access to information.

The self-determination theory (SDT) (Deci & Ryan, 1985) postulates that initiating and maintaining behavioural changes requires motivation internalization: the process of transforming controlled motivation (controlled and regulated by external pressure such as rewards or punishment or internal pressure such as guilt and pride) to autonomous motivation (driven by one’s own interest, meaning, and willingness). Autonomy (feeling in control of one’s own behaviour), competence (feeling effective and capable), and relatedness (feeling cared for and understood by others) are the three basic psychological needs that can facilitate the process of internalization (Gillison et al., 2018; Ryan et al., 2007). This research utilized several strategies proposed by Silva et al. (2014) to satisfy these three needs. Table 5-1 lists the behavioural change strategies used in the chatbot.

Table 5-1. Strategies to facilitate behavioural changes.

SDT component	Intervention strategy
Autonomy	<p><i>Respect.</i> Acknowledge the user’s ability for choice (e.g., “nice choice!”).</p> <p><i>Choice.</i> Provide a wide range of options and relevant information and encourage the user to choose activities based on their interests.</p> <p><i>Avoidance of control.</i> Not using forceful, authoritarian, or pressing language in the chatbot.</p>
Competence	<p><i>Instructional feedback.</i> Provide relevant information (e.g., online tutorial, map, links to websites) to support change.</p>
Relatedness	<p><i>Affection.</i> Provide encouraging social support. Use of positive and caring language (e.g., way to go!) and emojis with positive meanings (e.g., smiley face).</p> <p><i>Dedication of resources.</i> Provide resources in case of need.</p> <p><i>Dependability.</i> Being available in case of need.</p>

Principle 2: Appropriate user interface for individuals with serious mental illness

According to a brief report regarding how people with serious mental illness use smartphones and social media, about 71% of participants use social media platforms, among which Facebook is the most popular (94%) (Naslund et al., 2016). Therefore, this research built the chatbot on Facebook Messenger (a messaging platform launched by Facebook) with the expectation that more people would be familiar with the user interface. Nevertheless, the limitation of using an existing platform was the inability to make customized changes to the user interface.

Principle 3: User experience design

User experience design (UX) emphasizes user experience as the centre of the design. A positive user experience is characterized by satisfaction, utility, ease of use, and pleasure when using a product (UserTesting, 2019). When designing the chatbot prototype, the needs of the target users were the main focus throughout the design process. The content was presented concisely and consistently to avoid potential confusion. Users’ level of literacy was taken into particular consideration to ensure that they can receive the necessary information effortlessly.

Principle 4: Considering logical flow to reduce cognitive barriers

The design of chatbot-human conversations should be logical, easy to follow, and require minimal cognition to comprehend. A decision tree was used as the main structure steering conversations from beginning to end, to ensure that the chatbot presented information based on the user's requests.

Principle 5: Use of language to promote motivation

Besides the content itself (i.e., activity ideas), the language used in the messages influences users' motivation to make behavioural changes. In accordance with the SDT, the Persuasive System Design (PSD) suggested several computer-human dialogue principles for motivating users to achieve goals (Oinas-Kukkonen & Harjumaa, 2009). The principles applied in the chatbot are described in Table 5-2.

Table 5-2. Dialogue support principles.

Principle	
Praise	The system uses praise through words or symbols to provide users with encouraging feedback on their behaviours.
Suggestion	The system offers appropriate suggestions to enable users to achieve their goal.
Liking	The system presents its content in an appealing and visually attractive way.
Social role	The system acts like a social role, such as an assistant or specialist.

5.4 THE CHATBOT PROTOTYPE

This research built the chatbot prototype on Facebook Messenger using ManyChat (manychat.com), which is an online service that enables non-programmers to create chatbots on Facebook Messenger. It provides easy instructions for setting up chatbot functions such as the main menu, conversation flows, keywords, and default reply. Since many healthcare professionals do not have the skill of programming, using channels like ManyChat can allow more service providers to be involved in chatbot development. The main features of the chatbot prototype were presented as follows.

At the very first time of the interaction, the users are instructed to press the button “Get started” to start the conversation after entering the chat room (Figure 5-3a). The chatbot would then send greeting and introduction messages, orientating the users through the main functions (Figure 5-3b, c).

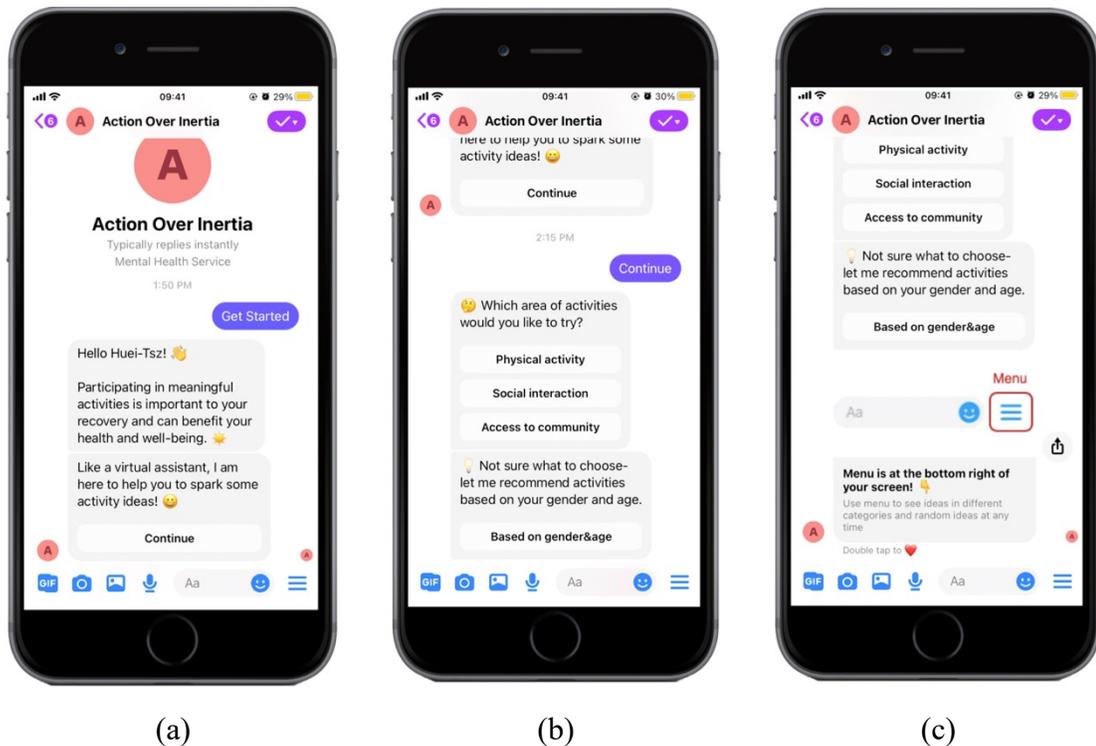


Figure 5-3. Greeting and orientating messages.

The users can browse through the information in different activity categories by using the menu (Figure 5-4a). For example, when the “Physical activity” button is tapped, the chatbot would generate a message flow focusing on physical activity (Figure 5-4b).

Following through the conversation, the users receive an activity list under this category and can choose activity ideas from the list (Figure 5-4c).

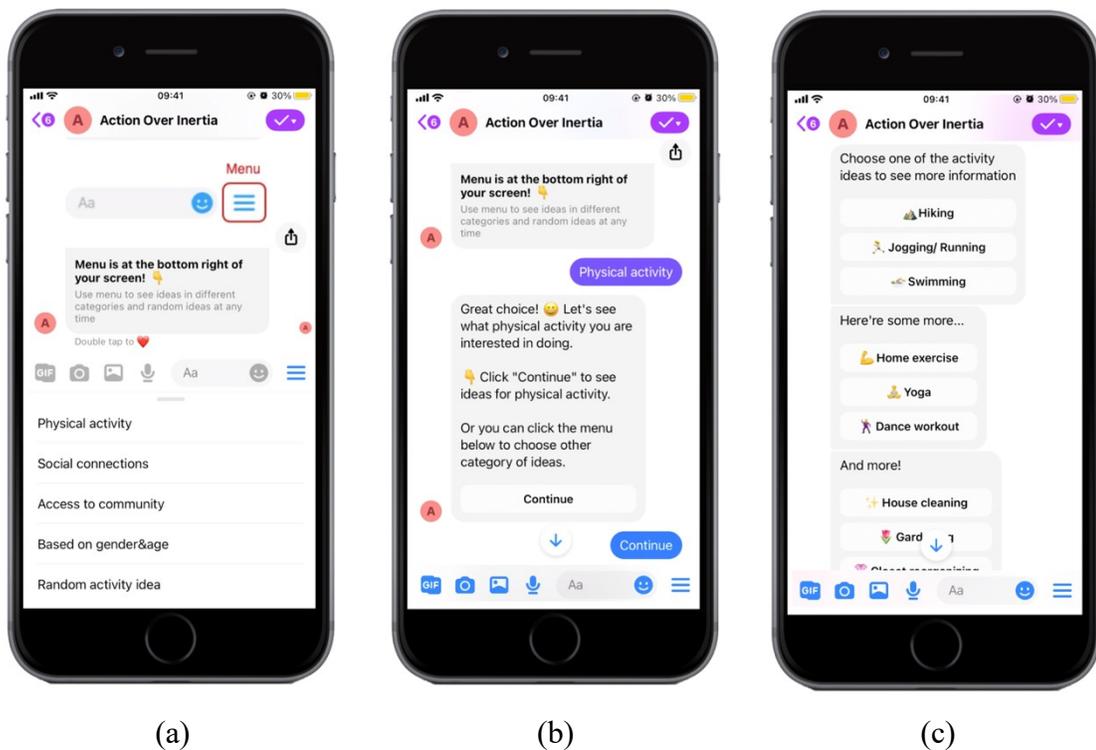


Figure 5-4. Use menu to browse information in categories.

After users choose one of the activity ideas, the chatbot first briefly introduces the chosen activity idea (Figure 5-5a). The users can choose either “see more information” or “back to idea list” based on whether they are interested in receiving more information about the chosen activity idea (Figure 5-5b). At the end of the conversation, the chatbot sends an encouraging message if users tap the “yes, I’ll do it” button (Figure 5-5c).

Besides purpose-oriented categories (i.e., physical activity, social interaction, access to community), users can also browse ranked activity ideas based on their gender and age, which was informed by the results of Survey 1 (Figure 5-6).

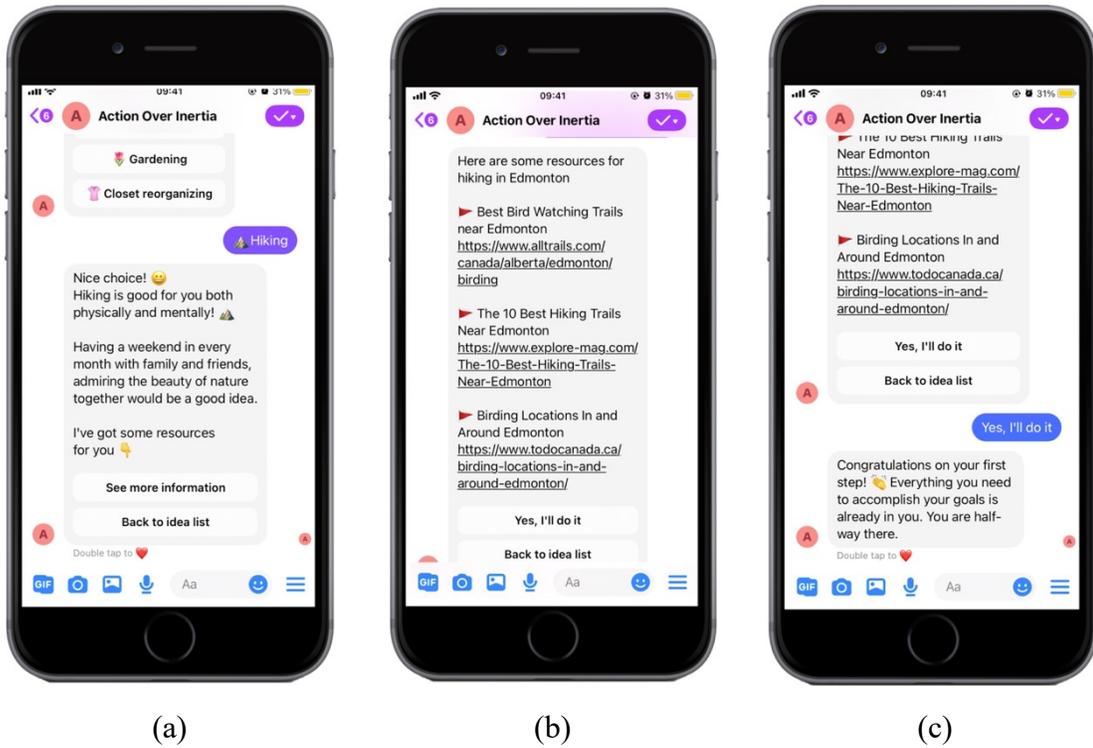


Figure 5-5. Activity idea along with online resources and encouraging message.

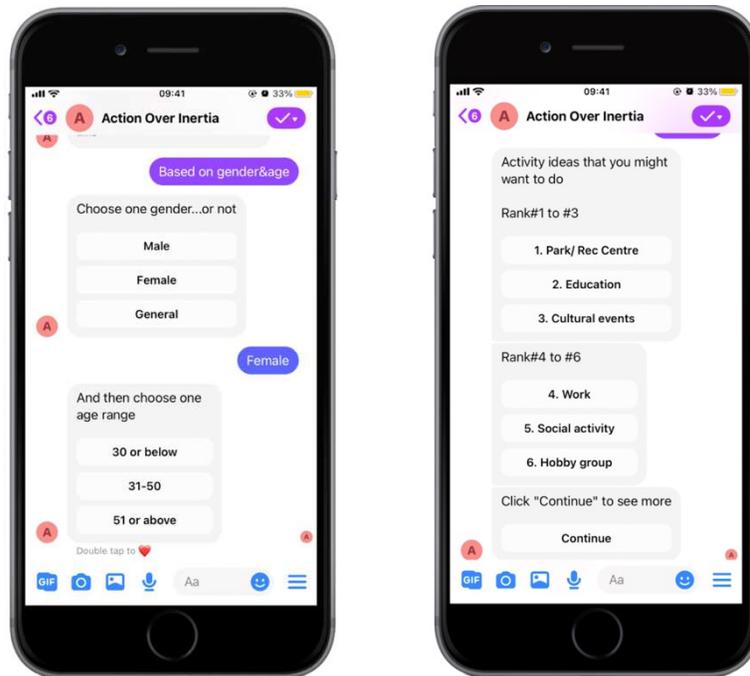


Figure 5-6. Suggest activity ideas based on gender and age.

Another function in the menu, “random activity idea”, allows the user to browse random activity ideas from the menu without selecting a purpose, age, or gender (Figure 5-7). Lastly, if the user texts something that does not match any of the pre-set keywords, the chatbot sends a default reply, instructing the users to either click other buttons on the chatbot or “talk to human” to report any unexpected issues such as invalid links (Figure 5-8).

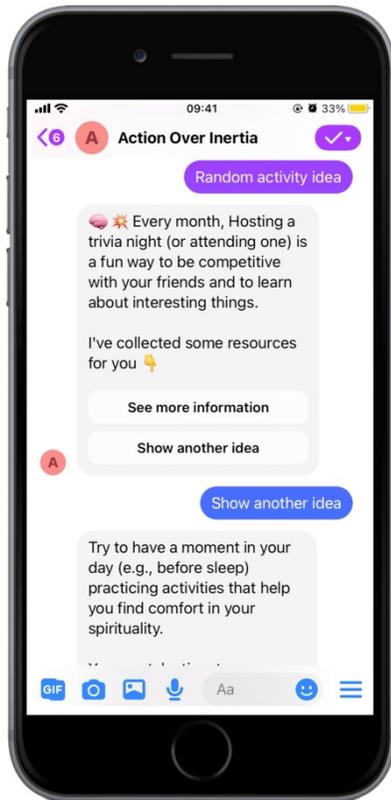


Figure 5-7. Random activity idea.

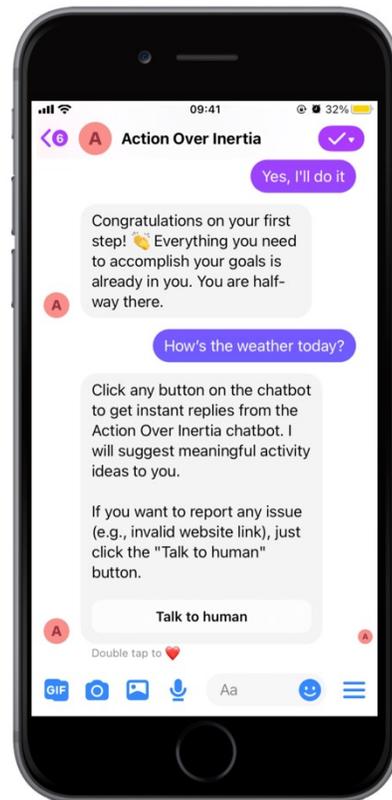


Figure 5-8. Default reply.

5.5 SUMMARY OF PHASE TWO

At this phase, the researcher defined the three fundamental components that guided the chatbot development, including the system architecture that helped to visualize the main structure and map the scope of the chatbot system; the decision tree that ensured that the data were distributed in a logical manner; and the design principles that guided the chatbot features to facilitate behavioural changes. A chatbot prototype was built on Facebook Messenger at the end of this phase and was evaluated in the following phase.

6 PHASE THREE: EVALUATION OF USABILITY AND TECHNOLOGY ACCEPTANCE

Following the development of the chatbot prototype, the objective of this phase was to evaluate user experience and to identify usability issues and suggestions from the user perspective. The chatbot prototype was evaluated for its (1) usability, defined as the extent to which the product (chatbot prototype) can be used by specified users (people with serious mental illness) to achieve specified goals (find activity ideas) (International Organization for Standardization, 2018), and (2) technology acceptance, emphasizing the attitudinal aspects of user's reactions toward using the chatbot (Liu et al., 2020).

Usability test is particularly valuable for the development of new interventions in which no best framework or practice to follow nor appropriate literature is available for a specified research population (Geisen & Bergstrom, 2017). Given the lack of literature on people with serious mental illness using a chatbot as an intervention tool, conducting usability tests can provide insights into whether the chatbot application works well in the context of serious mental illness.

This phase evaluated the chatbot prototype by conducting two research activities:

- Interviews with service providers: individual interviews with occupational therapists were conducted after they used the chatbot for at least a week to gain an

understanding of their perspectives toward using it to complement the AOI intervention.

- Usability tests and interviews with people with lived experience: people with serious mental illness were recruited to use the chatbot prototype and complete a set of usability tasks to measure usability, followed by a questionnaire and interview for evaluating technology acceptance.

The recruitment, research materials, and procedure were approved by the University of Alberta Ethics Board (#Pro00101961) (Appendix C).

6.1 CONCEPTUAL MODEL

The Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003) was used to guide the design of the questionnaire and the interview questions. According to the UTAUT model, people's use of technology can be predicted by behavioural intention and facilitating conditions (See Figure 6-1 for the conceptual model). Behavioural intention is attributed by three constructs:

- (1) Performance expectancy is the strongest predictor of behavioural intention to use the technology. If people perceive that using the technology can help them to reach the goal, they would have higher intention to use the technology. Since whether the chatbot can help activity participation may not be suggested by first-time users, and that the idea of activity participation may be too abstract for people with serious mental illness, the questionnaire and interview asked the participants to evaluate the quality of the content, such as whether the activity ideas are what they value, are important to them, or meet their needs.
- (2) Effort expectancy refers to the degree to which people believe that the technology is easy to operate, navigate, and understand. Based on this construct, a series of questions related to the efforts taken when using the chatbot were asked.
- (3) Social influence is defined as the degree to which people consider those important others think they should use the technology. In this case, since the

chatbot prototype was introduced to the participants for the first time, it might be confusing to ask the participants whether they think that staff/peers/important others would support their use of the chatbot. Therefore, this research did not measure the construct of social influence. Instead, the questionnaire and interview asked whether the participants would recommend their peers to use the chatbot, as an alternative way to evaluate whether the participants believe that using the chatbot complies or aligns with social norms.

Facilitating conditions, referring to one's belief of having the resources, knowledge, and supports necessary to use the technology, is another factor that influences use behaviour. Using the chatbot requires having an appropriate device (e.g., mobile phone, tablet, computer); access to the Internet; and knowledge and skills of using the messaging platform (Facebook Messenger). In the evaluation, the participants were asked whether they have sufficient resources (i.e., those mentioned above) to use the chatbot.

Finally, the question and interview also asked the participants to anticipate whether they would use the chatbot in the future to measure the construct of behavioural intention. The user's gender, age, experience with the technology, and voluntariness of use (mandatory or voluntary context) are four moderators of the relationship between the main constructs. In this research, however, the impacts of these moderators were not analyzed.

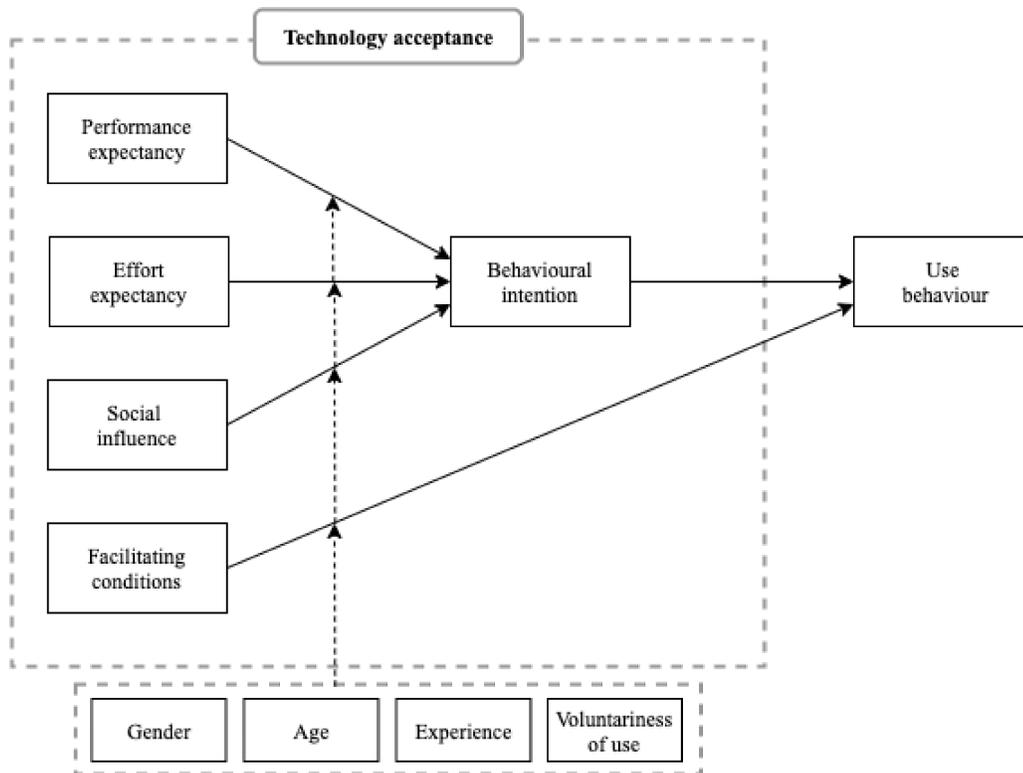


Figure 6-1. UTAUT conceptual model.
(adapted from Venkatesh et al. (2003), p.447)

6.2 METHODS

6.2.1 Interviews with service providers

Participant recruitment

Participants were recruited using convenience sampling. Three occupational therapists who were familiar with the Action Over Inertia intervention were recruited via e-mail.

Procedure

The participants received an initial contact e-mail which contained an introduction to the research, the link to the chatbot prototype, and basic instructions for using the chatbot (Appendix I). The participants were asked to use the chatbot prototype freely for at least a week, after which individual online interviews were scheduled. The interviews were audio-recorded after verbal consent was obtained.

Interview questions

The interview questions were developed based on the UTAUT constructs, focusing primarily on the participants' perception of having their clients (people with serious mental illness) using the chatbot. Other suggestions and comments were also made during the interview to gain a more in-depth understanding of participants' perceptions of the chatbot (Appendix J). Example questions include: Is this chatbot helpful for people with serious mental illnesses to make activity changes or increase participation (performance expectancy)? Do you find this chatbot easy to navigate and the layout easy to understand (effort expectancy)? Do you think people with serious mental illness would have sufficient resources to use the chatbot (facilitating conditions)? How likely are people with serious mental illness who have activity-health needs to use this chatbot (behavioural intention)?

During the interviews, the participants were asked about their perceptions of whether the design of the chatbot is appropriate for people with serious mental illness. If any major issue (e.g., the content or technical aspects of the chatbot may lead to psychological or emotional discomforts) was mentioned, the chatbot would be modified before usability tests were conducted.

6.2.2 Usability test

Participant recruitment

The recruitment letter, which stated the research purpose, context, and inclusion criteria, were posted at two Edmonton mental health community sites (Prosper Place Clubhouse and Pathways Day Program) (Appendix K). The site managers helped with recruiting potential participants and coordinating the tests.

People meeting the following inclusion criteria were recruited: (1) had been diagnosed with a serious mental illness; (2) lived in the community; (3) aged between 18 and 70 years; (4) were fluent in English; (5) had a Facebook account and a mobile device (e.g., smartphones, laptops, tablets) that could access Facebook Messenger; and (6) were able to understand the research details and provide written informed consent. Those who were under the influence of acute psychiatric symptoms were excluded from the study.

Procedure

The participants were asked to attend an in-person meeting individually, where the research context and usability test procedure were explained. After signing the informed consent form, the participants were asked to conduct the following procedure. Each participant received a \$35 gift card as compensation for their time.

1. Usability test: Think-aloud method

The think-aloud method is commonly used in technology usability tests to gain an understanding of what issues occur when the users operate the chatbot (Aitken & Mardegan, 2000; Vedanthan et al., 2014; Yardley, Morrison, et al., 2015). At the beginning of the usability test, a brief video was presented to demonstrate the think-aloud method (video link: https://www.youtube.com/watch?v=-q__eqNevb4). Participants were then asked to use their own mobile devices to complete a predefined set of tasks using the chatbot prototype and think-aloud during the process (see Appendix L for usability test tasks). Example usability tasks include: find Action Over Inertia on Facebook and start a conversation with the chatbot; use the menu and choose one of the activity ideas under the “physical activity” category; go back to the idea list and choose another activity idea under the same category; use the menu to find other activity ideas under other categories. Participants were asked to verbalize their thoughts regarding their actions and perceptions as they carried out the tasks. During the process, a minimum level of assistance was given only when the participants asked for clarifications. Verbal encouragement (e.g., “great! Keep talking.”) and prompts (e.g., “remember to keep talking.”) were also used when participants verbalized their thoughts clearly or did not respond for more than 10 seconds, respectively. After the participant completed the tasks, the researcher recorded the degree of assistance required for the participant to complete the tasks (without assistance, with minimal assistance, with full assistance). The process was audio-recorded.

2. Technology acceptance questionnaire

After the participants completed the usability test, they were then asked to fill out a questionnaire that was developed for this research (Appendix M). The questionnaire contained two parts. The first part asked about participants’ demographic data such as age, gender, and their experience of using technology to understand the characteristics of the

participants. The second part included questions developed based on the UTAUT constructs, asking their perceptions related to performance expectancy, effort expectancy, facilitating conditions, behavioural intention, and their intention of recommending others to use the chatbot. Example questions are: Are the activity ideas suggested by this chatbot important to you (performance expectancy)? Did you find the chatbot easy to use and to understand (effort expectancy)? Do you have the necessary resources, such as mobile phones or access to the Internet, to use the chatbot (Facilitating conditions)? Would you use this chatbot in the future (behavioural intention)? Would you recommend your peers to use this chatbot? The moderators (gender, age, experience, voluntariness of use) are beyond the scope of this thesis and therefore were not included for analysis. The participants rated the level of agreement on a total of 15 questions using a seven-point Likert scale.

3. Debriefing interview

To ensure the completeness of the data collected, debriefing interviews were conducted immediately after participants finished the questionnaire. The interview questions were the same as the questionnaire but asked for more in-depth thoughts on each item. The participants were encouraged to share other perceptions and suggestions about the chatbot.

Data analysis

Thematic analysis was used to analyze the transcriptions for interviews and think-aloud. Six phases were conducted as suggested by Braun and Clarke (2006): (1) Familiarize with data: read and re-read through the transcribing data; (2) Generate initial codes: identify important features of the data and allocate the “thought units” into codes; (3) Search for themes: review identified codes and conceptualize potential themes. Collect all data relevant to each potential theme; (4) Review themes: review and understand themes in relation to each other; (5) Define themes: refine themes and generate clear names of each theme; (6) Produce the report: select appropriate extract examples and relate the analysis results back to the research objectives. The themes extracted can inform the overall user perception toward the chatbot. In addition, usability issues and other suggestions mentioned by the users were identified from the transcriptions.

The results of the questionnaire were analyzed using descriptive statistics. Each level of agreement was assigned by one to seven points (strongly disagree = 1, quite disagree = 2,

slightly disagree = 3, neither agree nor disagree = 4, slightly agree = 5, quite agree = 6, strongly agree = 7). The average points of each question were calculated and served as an indicator of the overall perception of the participants.

6.3 RESULTS

6.3.1 Feedback from the service providers

Three service providers participated in the evaluation. All of them had a background in occupational therapy in the mental health clinical/academic field for 25, over 30, and over 40 years, respectively. None of the participants were involved in the development of the proposed chatbot and they were all familiar with the Action Over Inertia intervention. Three themes were identified in relation to the strengths of the chatbot: (1) “It can be a useful adjunct or supplement to occupational therapy”; (2) “You don’t have to be tech-savvy to use it”; and (3) “There is a place for it – the clients would like it.”

Strength 1: It can be a useful adjunct or supplement to occupational therapy.

Two service providers considered the chatbot to be a supportive supplement to the AOI intervention. Participant #P1 pointed out that the tool “is a great start” and can “at least help with that conversation” as idea generation can be challenging for both the clients and the therapists. She stated:

...it’s particularly useful in the beginning stages of the [Action Over Inertia] manual where you’re trying to stimulate the engagement to change. The idea generation would be a challenge. It gives you more opportunity for you to explore thing that might be there. I do think it’s a wonderful complement to the manual. (Participant #P1)

Participant #P1 also mentioned that the chatbot can help with the therapist-client relationship by offering a non-threatening way to initiate idea generation, rather than the therapist directing the intervention.

It’s a non-threatening activity to do. It’s less of the therapists interviewing and trying to approach the client to about what they’re interested in. If [the clients are] unready and un-motivational, that’s hard for them to generate ideas. So this way, it’s a very non-threatening way to say “let’s just try this!” ...it does give that positive reinforcement about trying things. So maybe something that clients

can do on their own and come back to say “actually I’ve decided to try this” or “you know what, I just did this yoga session online this week”. (Participant #P1)

Participant #P2 echoed this idea, opining that the chatbot is more “self-directive” from the client’s perspective and may therefore make them feel more comfortable to try new activities.

People can kind of go on and explore different ideas, and if they don’t like it, and then another idea might pop up. It might help them to get to a place where they feel a little bit more encouraged to try something, as opposed to the limitation of clinical intervention sometimes. (Participant #P2)

Furthermore, Participant #P3 acknowledged that the chatbot can be helpful for those with social anxiety. She explained:

Often people with activity limitations are really socially anxious. Even talking to the therapist about it can increase anxiety. So I can see a chatbot, for instance, giving it a little bit of room. ...I’m talking to myself through this thing, not my therapist. (Participant #P3)

Strength 2: You don’t have to be tech-savvy to use it.

All service providers agreed that the chatbot is user-friendly. It did not take long for them to learn to operate the system and they found the user interface easy to navigate. One mentioned, “it’s easy...there’s nothing difficult about it” (Participant #P3). Another noted, “it was pretty fast for me to figure it out...it was pretty easy to navigate and switch around” (Participant #P2). They also held positive attitudes toward people with serious mental illness using the technology, especially for the younger generation. For example, Participant #P1 shared:

As far as the chatbot itself, I think it’s easily navigated...some [people with serious mental illness] might need a little bit of training depending upon their use of technology, but I think it’s quite clear cause it pops up right away and you get continue. You don’t need to do multiple things, and you got the menu...it doesn’t require higher level of function. (Participant #P1)

Strength 3: There is a place for it - the clients would like it.

The service providers believed that their clients would enjoy using the chatbot. One stated, “I do think [people with serious mental illness] would really like [the chatbot]. I think

there is a good group of people who might actually do more and engage more because of that” (Participant #P2). In particular, Participants #P1 and #P3 both pointed out that the younger population might respond well toward using technology in intervention. One stated, “...it’s normalized particularly for young people...people seemed to respond to that. So I think there’s a place for it” (Participant #P3). Participant #P1 further noted the feasibility of using the chatbot in clinical practice:

I think I would try it based on the clients. I don’t know if it could work on all clients, based on how comfortable [the clients are] with technology. But more of the younger generation are coming up. They have a lot of [exposure] to technology. So I think they would be comfortable, they would be quite good [at using the chatbot]. Even some of the older population, it’s not hard to use. So I think they can be supported to use. I would definitely try it [in clinical practice] ... I think if [the clients] see it’s part of their therapeutic plan, and part of their support, then [that is] likely going to get more engagement. (Participant #P1)

Three themes were identified in relation to the limitations of the chatbot: (1) “People have to have the technology – it would not be available to everyone”; (2) “I could list a thousand activities; why are you selecting these?”; and (3) “It’s a big group of people; how we present it is a big challenge.”

Limitation 1: People have to have the technology – it would not be available to everyone.

All service providers mentioned the central limitation arising from the necessity for technology: it is not accessible to everyone. They noted that many of the clients live in poverty, with limited access to smartphones/computers and the Internet. However, Participant #P1 mentioned that many clients would use computers in public libraries or other facilities, and that the therapists might be able to help them to access one.

Limitation 2: I could list a thousand activities; why are you selecting these?

Participant #P3 pointed out that listing activities is not practical because there are too many activities exist. She explained, “...for activity participation there are thousands of activities that people can do, and they vary culturally and vary by time period”. She included an example: “hiking is a particular form of walking...hiking is something like I’m walking in nature...but it’s a variation on walking. I probably could come up with seven other words

for the walking concept”. The criteria and decision-making process for activity selection was questioned.

As all activities can be modified for various purposes, Participant #P3 noted:

If you say one of the things I’d like to change in my life is I want more social connections...all activities can be modified or constructed to increase your access to social connections...every activity can be modified to increase your physical activity. Every activity can be modified to access to community or make a community contribution.

Participant #P3 argued that the idea of identifying and suggesting activities is not useful in real practice due to the complexity of activities, stating, “...every activity that we list or identify has a context, like conditions, cultural things.” Instead, she believed it would be more consistent with the AOI intervention if the chatbot made recommendations to users for some “quick activity experiment”. She stated:

The idea here was you could do them [quick activity experiment] like this and it might take 15 minutes...[such as] clean off a counter table surface...and I would feel like I got something done...I feel like I accomplished something. ... the idea of quickly moving people to doing something when they have been stuck in doing what looks like nothing visible...if you could take this, and develop into a chatbot, I can see that they would really like it...none of these things require any prior learning; none of these things take much time; none of these things take many sources...like breaking the inertia, just getting something done, get some sort of movement. (Participant #P3)

Limitation 3: It’s a big group of people; how we present it is a big challenge.

Participant #P3 found it challenging to have the design of the chatbot “fit” everyone. She shared her experience of developing AOI workbooks: “...there are some very simple worksheets, but there are some people who can’t fill them out. But if we put it too [simply], those who have a graduate degree might think it’s insulting them. Even though it’s the same content, but how we present it to people, that’s a big challenge”. She noted:

Here’s a dilemma, it has to be accessible to the majority of people, there are people with serious mental illness [who] might think this chatbot might be too simple, too rudimentary, they would consider it almost insult their intelligence. There are people with serious mental illness who have low literacy level [or have]

cognitive impairment, and if you wanna reach them, it has to be simple...it's a big group of people. (Participant #P3)

Besides sharing their thoughts on the potential benefits and limitations of the chatbot, the participants also offered several suggestions that might better meet their clients' needs.

1. Suggestions for activity ideas

First, Participant #P1 expressed concern that some of the activity suggestions might remind people of their losses. For example, she noticed that several activity ideas would suggest that users participate in activities with their family or friends, whereas many have little or no connections with others due to their illness. She said, "...for some clients who [are sensitive about] the losses that they have suffered as the result of the illness...so we are not offering them something that either they definitely cannot do or [would be] challenging for them...I am just conscious about suggesting things that just highlight individuals' losses that's the result of the illness, like the things they can't really do anything [about]".

Participant #P2 suggested working with community organizations to include more mental health programs that people with mental health issues can participate in. Also, as mentioned in the earlier section, Participant #P3 thought the suggested activities would be more practical if they were simpler and easily achieved, i.e., "quick activity experiments".

2. Suggestions for language used

In terms of the use of language, Participant #P2 suggested that word choice should be made carefully, as some terms are culturally specific. She also mentioned that in Canada, a great portion of population use French, and therefore accessibility might be limited if the chatbot only uses English. Notably, Participant #P2 thought some of the messages, such as "that's great!" and "that's awesome!", were too contrived. She mentioned: "...some of the responses might be perceived as too cheesy or too enthusiastic...do they seem genuine? Or do they seem too contrived?" She suggested asking users for feedback specifically around their perceptions regarding these messages.

3. Suggestions for functionality

The participants also suggested several features that could be developed in the chatbot. For example, Participant #P1 believed that it would be useful to enable the users to track which activities they are interested in doing and, additionally, the ones that they try.

Also, considering that some people with serious mental illness have limited skills for manoeuvring technology, Participant #P2 proposed to place the buttons (e.g., button *back to idea list*) in a fixed page. This would enable the users to operate the chatbot more easily.

Participants #P1 and #P2 both mentioned that the chatbot's functionality could be improved by enabling the users (including healthcare providers) to suggest activity ideas in the chatbot. That is, adding a place where the users can input suggestions so that the developer can update the chatbot accordingly.

6.3.2 Results of usability and technology acceptance

Participants' characteristics

A total of nine people with lived experience completed the usability test, of which eight were recruited from the Prosper Place Clubhouse and one was referred by the co-investigator of this research. Participants were aged from 22 to 58 years, consisted of four man and five woman, and had experience of using messaging platforms. Table 6-1 provides more detailed information about the participants.

Table 6-1. Characteristics of usability test participants.

Participant	Age	Gender	Education level	Employment status	Messaging app use frequency
#1	51	Man	High school	Part-time employed	Daily
#2	36	Woman	High school	Part-time employed	Daily
#3	41	Man	Bachelor	Student	Daily
#4	22	Woman	High school	Unemployed	Daily
#5	34	Man	High school	Unemployed	Less than once per week
#6	29	Woman	Technical/vocational training	Part-time employed	Weekly
#7	56	Woman	Some college credits	Unemployed	Less than once per week
#8	52	Woman	Some college credits	Unemployed	Daily
#9	58	Woman	Associate degree	Unemployed	Weekly

Usability test performances and identified issues

All participants completed the predefined tasks within 30 minutes. As listed in Table 6-2, some minor assistances were provided during the usability test. There were two main types of assistance: task clarification and technical assistance. Task clarification assistance was provided when participants asked questions about a task, misunderstood a task, or skipped a task. Technical assistance was provided when participants encountered issues proceeding with the tasks. For example, Facebook Messenger did not auto-scroll down to the latest message when Participant #1 operated the chatbot; Participant #6 did not understand the function of the button *Woman under 30*; Participant #7 could not find the menu button at the beginning of the test; Participant #8 clicked one button multiple times since the size of the buttons were too small. As for Participants #2, #3, #5, and #9, they completed the tasks without any assistance.

Table 6-2. Summary of assistance provided.

Participant	Assistance type	# of assistance	Description
#1	Task clarification	4	Participant did not understand the task.
	Technical assistance	1	Participant could not find the latest message.
#4	Task clarification	2	Participant thought the task was finished.
#6	Task clarification	1	Participant did not understand the task.
	Technical assistance	1	Participant felt confused about the “Woman below 30” button.
#7	Technical assistance	1	Participant could not find menu.
#8	Technical assistance	1	Participant pressed one button multiple times.

The usability issues were identified through the think-aloud process and the debriefing interview. First, two participants received the responses longer than expected. Typically, the chatbot would generate instant responses. However, there were three delayed responses (15 seconds, 18 seconds, 30 seconds) during the usability test. Next, while a participant was completing the task *see five random activity ideas*, she received the same activity idea twice out of five attempts, whereas she expected to see five different ideas. Finally, a participant noticed a spelling error in a message. Table 6-3 summarizes the usability issues found by the participants.

Table 6-3. Summary of usability issues.

Usability issue
<ul style="list-style-type: none"> • Participant needed to manual scroll down the page to see the latest message. (P#1) • Chatbot generated the response longer than expected. (P#1, P#4) • Participant noted a spelling error. (P#2) • When conducting the task <i>see 5 random activity ideas</i>, the chatbot generated two identical activity ideas. (P#4) • The function of “Woman under 30” button was not clear. (P#6) • Buttons were too small for the participant to press precisely. (P#8)

Technology acceptance

1. Questionnaire results

The results of the questionnaire provide an indicator of participants' attitudes toward the chatbot (see Table 6-4). First, most participants agreed that the activity ideas were important, achievable, appropriate, and that they would like to do them more often (items #1-7). However, two participants rated *neither agree nor disagree* and *slightly disagree* for some of the items: one felt that some of the activities were not applicable for her physical condition, and the other stated that she expected the activity suggestions to be more personalized. When asked about whether the messages were encouraging, all participants rated *quite agree* or *strongly agree*. Also, the results of items #8-11 demonstrate that the participants generally believed that the chatbot was user-friendly, except for one, who rated *slightly disagree* on item #11 as she expected the chatbot to be able to respond to more open-ended questions. As for items #12 and #13, all participants agreed that they have sufficient resources to use the chatbot and feel safe using it. Finally, all of them would use the chatbot in the future, and eight out of nine participants would recommend their peers to use the chatbot. Overall, the results show high technology acceptance across the UTAUT constructs with an average score of 6.34 (SD= 0.328), ranging from 5.8 (#3 The activity ideas suggested by this chatbot are achievable) to 6.9 (#12 I have the resources necessary to use this chatbot; #13 I feel safe using this chatbot).

Table 6-4. Number of counts of questionnaire items (n=9)

		Strongly disagree (1)	Quite disagree (2)	Slightly disagree (3)	Neither agree nor disagree (4)	Slightly agree (5)	Quite agree (6)	Strongly agree (7)	Average (Mean; SD)
1	The activity ideas suggested by this chatbot are activities that I would like to do more.	0	0	0	1	1	3	4	(6.1; 0.99)
2	The activity ideas suggested by this chatbot are important activities to me.	0	0	1	0	1	3	4	(6.1; 1.25)
3	The activity ideas suggested by this chatbot are achievable.	0	0	0	1	3	2	3	(5.8; 1.03)
4	This chatbot gives appropriate suggestions for increasing physical activity.	0	0	0	0	2	2	5	(6.3; 0.82)
5	This chatbot gives appropriate suggestions for increasing social interactions with others.	0	0	0	0	2	2	5	(6.3; 0.82)
6	This chatbot gives appropriate suggestions for increasing access to various places in the community.	0	0	1	0	0	2	6	(6.3; 1.25)
7	The messages sent by this chatbot were encouraging.	0	0	0	0	0	2	7	(6.8; 0.42)
8	Learning to use this chatbot was easy for me.	0	0	0	0	0	4	5	(6.6; 0.50)
9	I found the chatbot easy to use and understand.	0	0	0	0	2	2	5	(6.3; 0.82)
10	Learning to use this chatbot does not take too long.	0	0	0	0	0	4	5	(6.6; 0.50)
11	It was easy to get the chatbot to show the information that I want to see.	0	0	1	0	0	5	3	(6.0; 1.15)
12	I have the resources necessary to use this chatbot (device and access to the Internet).	0	0	0	0	0	1	8	(6.9; 0.31)
13	I feel safe using this chatbot.	0	0	0	0	0	1	8	(6.9; 0.31)
14	I would use this chatbot in the future.	0	0	0	0	3	2	4	(6.1; 0.87)
15	I would recommend my peers to use this chatbot.	0	0	0	1	2	1	5	(6.1; 1.10)

2. Debriefing interview findings

Five themes emerged when asking participants about their perceptions of the chatbot prototype: (1) chatbot functionality; (2) ease of use: in a short time, I can find different activities to do; (3) the relevance, variety, and applicability of ideas suggested; (4) empowerment: it gives you the right to decide; (5) intention to use: I would use it when I run out of ideas.

Theme 1: Chatbot functionality

Several participants felt that the chatbot could be helpful for them to find things to do. For instance, Participant #1 stated, "...it's really good and really helpful, giving the activities...and it's good when you click the activities, it gives suggestions plus gives a website or different places to do that activity". Another participant mentioned, "I have a feeling that it can help you along very well, I like that it provides links and resources and ideas" (Participant #2). Participant #9 concluded, "...when you want something to do but not sure what to do, need some ideas, and that's when you would turn to it. I think it's a great idea". In particular, one participant emphasized the strength of using technology: it is accessible anywhere and anytime. He described: "It cannot replace real human interaction, but it definitely helps when you're in a lockdown, in the middle of the night, and there's no one you can reach." (Participant #3)

However, Participant #8 disagreed that the chatbot was helpful because she expected the chatbot to be able to "chat" and that she would be able to interact more with it. She stated:

It doesn't follow the same thing that you expect it to do, because you expect it's on messaging [platform] you are able to type the message and it would help you to find [information], or you would chat with the bot. You don't really...you have to choose the items in the box. (Participant #8)

Theme 2: Ease of use: In a short time, I can find different activities to do

Participants acknowledged that the chatbot was easy to use. Participant #5 stated, "...the strengths [of the chatbot] are how quick and easy it is to find what you are looking for". Another participant said, "It's great to understand...pretty easy to use. And easy to learn how to use it...in a short time, I can find activities and different things to do" (Participant #1). One participant highlighted the importance of having someone demonstrate

first, noting that: “I have no problem understanding it or getting around once I actually saw how to get around on it, then I have no problem manoeuvring it. After you [showed] me how to actually work it, it was excellent.” (Participant #7)

Theme 3: The relevance, variety, and applicability of ideas suggested.

When asked about their perceptions of the suggested activity ideas, some participants felt that the suggestions tailored their needs. For example, during the usability test, Participant #4 said “...this one is what I need!” when reading the information about education. Participant #6 also shared, “...I think that the chatbot is a way to figure out more like, tips for social connection, because I think that’s something I need more.” Some participants stated that the chatbot inspired them with some other ideas in addition to activities that they do already. For instance, when Participant #6 used the chatbot, she stated, “I have never thought about that. Cool!”, “...that’s interesting cause I didn’t know that there are things in the community to see”, and “I have to do that one of these days”. She further shared, “...some things were very important to me, sometimes I do a lot of physical stuff. So, just knowing that there’s different physical activities out there for me, that is very interesting”. Another participant also noted:

The activities are relevant [to me]. A lot of activity I do already. And it also suggests some other things I want to do as well... the things it suggests are things I would like doing. It’s very referring. I believe there’re things that I would like to do it tomorrow. I can look at the chatbot and look at one activity and go find something to do. (Participant #1)

Some participants mentioned the variety of activity ideas provided. For example, one said, “there are a lot of options that I like” (Participant #4), while another mentioned, “I like that there’s a lot of variety” (Participant #5). Some also acknowledged that the online resources can help them do activities more easily. Participant #3 shared,

I think they’re easy to do. They are not like hard activities, and there are some links [to tutorial videos] that you can watch. I think it’s good because it gives you enough information that you can explore more. And you can get a different recommendation; I like that part. (Participant #3)

However, although most of the participants held positive attitudes toward the activity ideas, Participant #7 considered the physical activity ideas to be unachievable due to her

physical challenges. She said, “I can’t physically do [some activities] because of my knee, so you have to give me more ideas... if it could show us some stuff that we could do physically that takes into account of our limitations, [it] would be great”. Also, Participant #9 shared her concerns regarding transportation, noting: “I think they are quite achievable, it’s the matter of transportation. Not every people with mental illness has access to transportation, to say, go to the botanic garden”. Participant #8 considered the activity ideas too “general”, stating that the chatbot should have asked questions like “where do you live in? Do you need accessible places [for physical disability]? What’s your income group?”, to “get to know you first at the beginning”.

Theme 4: Empowerment: It gives you the right to decide

Two participants noted that the chatbot enabled them to make their own decisions. As one stated, “it was encouraging...it wasn’t just saying that ‘oh, this is what you can do’. It’s like ‘you can do it!’” (Participant #5). Another also shared: “I also like having like, options. Like, yes, I’ll do this, continue. I like that part...I guess it gives you the right to free speech, or like, to get you the decision instead of telling you to do this.” (Participant #4)

Theme 5: Intention to use: I would use it when I ran out of ideas.

After using the chatbot prototype, some participants showed their interest in using the chatbot in their life after the test. Participants #1 and #4 both asked about whether the prototype would be “launched” and available as a product, as they would like to use it in the future. Another participant shared, “I found it pretty interesting and I think it is really easy to use. So, I think I would use it...like, down the road and ran out of ideas I’ll just [use it]” (Participant #6).

Other comments and suggestions

- **Include more mental health support.** The participants proposed several categories that they felt should be prioritized, among which activities for improving mental health were the most mentioned. For instance, Participant #6 stated, “I definitely would like to see mental health supports. Put mental health in it. Just because we are people living with mental illness, and sometimes people need that extra resources”. Likewise, some other participants suggested activities that would benefit their mental

health, such as spiritual activities (Participant #4); creative activities such as writing (“that really helps [for my mental health]” (Participant #9)); and having the chatbot recommend activity ideas based on feelings or mood (Participant #3). Other suggestions regarding the categories includes cost (“so people would know how much they need for that activity” (Participant #1)) and location (“...lead you to what is near you” (Participant #5)).

- **Visual design.** Participant #8 felt that the chatbot was “cluttered”, “[blended]”, and “[lacking] colours” due to “the fact that [it was built on] Facebook messenger and you are limited by the way it [is] set up”.
- **The use of emoji.** Several participants liked having emojis in the messages. Participant #4 stated, “...I like the emojis. It makes [messages look] better. Seeing the pictures instead of reading a lot of [words]”. Likewise, Participant # 3 mentioned, “I think the graphic, the emoji thing. That’s always interesting, to show some emotion. More human-like”. Another participant stated, “...people are very visual, I like the idea that you do use the icons” (Participant #8).
- **Make it more like a human.** Two participants suggested that the chatbot could be more humanized. Participant #3 gave an example, “...[the chatbot is] missing that initial talk, the small talk like a human being. [When interacting with human beings] we sit down and we start having a small talk...how’s the weather, how’s your life, how’s your day going...you don’t get that kind of interaction with the chatbot. It does not feel like [a] human as it [is] supposed to be, especially the small talk...before [jumping] into the big talk”. In terms of the language used, Participant #8 thought the messages were encouraging but “boring” because “it seemed to be repetitive”. She further suggested giving the chatbot a name, making it more like a human. She proposed the name Anita, as an acronym of Action Over Inertia.

6.4 SUMMARY OF PHASE THREE

Overall, the three service providers held positive attitudes toward the chatbot intervention. This easy-to-use technology was considered to potentially supplement the

delivery of the AOI intervention. However, the activity ideas suggested by the chatbot should be further refined for appropriateness.

Among the nine participants with lived experience, four of them required technical assistance during the usability tests, but no major technical issues (issues that would prevent the participant from continuing with the tasks) were encountered. The results of the questionnaire show high technology acceptance (average 6.34 out of 7 points), and the debriefing interview also indicates that the chatbot was perceived overall as useful, user-friendly, and meeting the users’ activity needs.

A total of 18 usability issues or suggestions for improvement were identified from the interviews and usability tests. Table 6-5 provides a complete list.

Table 6-5. Issues/ suggestions identified.

Issues/ suggestions identified	
1	The activity ideas should be simple and quick to achieve.
2	Avoid suggesting ideas that might remind the users of their losses or limitations.
3	Have the content also written in French.
4	Enable the users to track the activity ideas that they are interested in and those that they have actually done.
5	Include information outside Edmonton and have the chatbot suggest activities based on users’ geographic location.
6	Place all the buttons on one fixed page.
7	Enable users to report issues or provide suggestions in the chatbot.
8	Facebook Messenger did not scroll down automatically.
9	The function of a button (i.e., <i>Woman under 30</i>) was unclear.
10	Buttons were too small. User interface looks cluttered and blended.
11	Responses were delayed.
12	Chatbot showed repeated random activity ideas.
13	A spelling error was found.
14	Physical activity ideas were not suitable for users with physical challenges.
15	Chatbot should be able to have open conversations and have “small talks”.
16	Boring, contrived language was used.
17	Activities for mental health support should be prioritized.
18	The chatbot should be given a name.

7 PHASE FOUR: CHATBOT REFINEMENT

In the last phase of this research, the chatbot prototype was modified based on users' suggestions derived from both interviews (with both service providers and service users) and usability tests. The chatbot prototype was refined and relaunched as the final result of this research.

7.1 DETERMINE ISSUE PRIORITY

Given the budget, schedule, and resources of this research, it was challenging to address all concerns. The identified issues were therefore prioritized based on two indicators suggested by Geisen and Romano Bergstrom (2017): (1) the issue's impact on quality. Issues that have great impact are those that might lead to difficulties in manoeuvring the chatbot. (2) The effort required to modify the feature. Issues that related to the nature of the software/device and those that required custom programming are the hardest to be addressed. In Figure 7-1, the 18 identified issues/suggestions are distributed in the four quadrants.

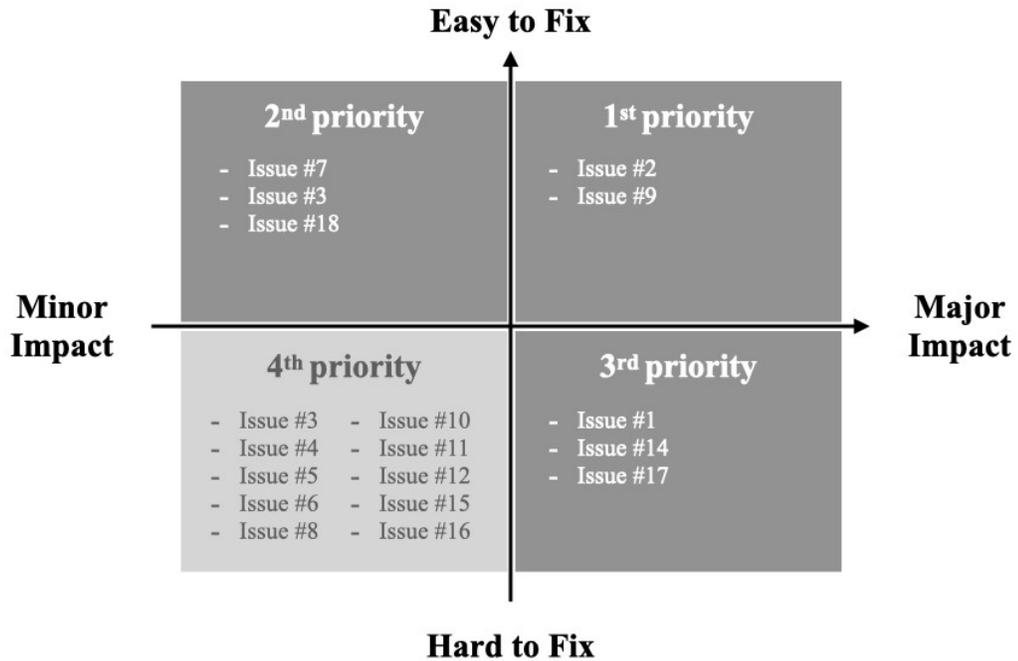


Figure 7-1. Prioritize issues/suggestions by two indicators: (1) impact on quality and (2) effort required to modify.

The first quadrant represents the highest-prioritized issues, which are the showstoppers that might discourage the users from continued use. For example, buttons with confusing names might lead to difficulty in navigating the system. The second priority is easily fixed issues, such as spelling errors, which only require wording-level changes rather than system- or structure-level changes. The third quadrant are those requiring more effort to address but have considerable impact on quality. For instance, adding another activity category would change the system structure but can provide more options for the users. Finally, issues in the fourth quadrant are those that are difficult to fix and whose impact on quality is relatively low. For example, the user interface could not be changed at this current stage since the chatbot was built on an existing platform. Table 7-1 presents the details of the issues/suggestions and the strategies to address them. This research addressed the issues/suggestions of the first to third priorities. The modified features are presented in Appendix N.

Table 7-1. Priority of identified issues/suggestions.

Priority	#	Issue/suggestion	How to address
1 st	2	Avoid suggesting ideas that might remind the users of their losses or limitations.	Review the suggested ideas and modify descriptions such as “grab your camera” or “go with your family or friends” where appropriate.
	9	The function of the button (i.e., <i>Woman under 30</i>) is unclear to users.	Change the names of the buttons (including Woman under 30, Woman between 31 to 50, Woman above 51, Man under 30, Man between 31 to 50, Man above 51, People under 30, People between 31 to 50, People above 51) to Back to idea list.
2 ^{ed}	7	Enable users to report issues or provide suggestions in the chatbot.	Specify that the users can report issues in default reply and change the name of the button <i>Talk to human</i> to <i>Report issue</i> .
	13	A spelling error was found.	Correct the spelling error.
	18	Name the chatbot.	Chatbot can introduce itself as Anita.
3 rd	1	The activity ideas should be simple and quick to achieve.	Add a category for quick activity experiments.
	14	Physical activity ideas are not suitable for people who are physically challenged.	Add physical activity ideas that require lower mobility.
	17	Activities for mental health support should be prioritized.	Add a category for mental health boosts.
4 ^{th*}	3	Have the content also written in French.	Have French speakers assist in developing the content in French.
	4	Enable the users to track their interested activity ideas and also those they have actually done.	Integrate the chatbot system with Google Sheets to save user data.
	5	Include information outside Edmonton and have the chatbot suggest activities based on users’ geographic location.	Form a larger team to further develop the chatbot content and include activity information for different locations.
	6	Place all the buttons on one fixed page.	Have software developers build an independent app and customize the user interface.
	8	Facebook Messenger did not scroll down automatically.	Test the system with a variety of devices and brands before launching.
	10	Buttons are too small. User interface looks cluttered and blend.	Have software developers build an independent app and customize the user interface.
	11	Responses were delayed.	Test the system with a variety of devices and brands before launching.
	12	Chatbot showed repeated random activity ideas.	Expand the number of activity ideas to lower the probability of showing the same message.
	15	Chatbot should be able to have open conversations and engage in “small talk”.	Collect a sufficient amount of data to enable machine learning and develop an AI-based chatbot.
	16	Boring, contrived language was used.	Form a larger team to further refine the messages.

* Issues/ suggestions in the fourth priority were not addressed in this research.

7.2 THE REFINED AND FINALIZED DELIVERABLE CHATBOT: ANITA

Anita is a rule-based chatbot designed to complement the AOI intervention. This chatbot can interact with the user by using constrained natural languages. The goal of the dialogues in Anita is to support people with serious mental illness to participate in activities by eliciting various activity ideas and relevant resources based on user inquiry. While providing activity ideas can be accomplished by other forms of medium (e.g., resource sheets), the idea behind using the chatbot is to achieve this in a more natural way via friendly dialogue and increase the accessibility of information by leveraging the power of technology. In addition, the chatbot adopted a social role (a virtual assistant) to make the user feel that they are being supported and cared for by others.

The content embedded in Anita was developed based on the findings of a needs assessment that specifically focused on the activity needs of people with serious mental illness. Therefore, the suggested activities are those that are likely to be important and desired in the context of serious mental illness. The chatbot also utilizes strategies to satisfy the person's autonomy, competence, and relatedness, aiming to facilitate behavioural change.

The users can access Anita (<https://m.me/100386948148554>) on Facebook Messenger by using either mobile devices or a desktop and connecting to the Internet. The technology allows users to search for activity ideas in either urban or rural areas, on days or nights, with or without their therapist's company. The dialogues in Anita are pre-defined: users can interact with Anita via (1) selecting dialogues from a list of reply options and then receiving instant response from the chatbot, or (2) commenting or reporting issues by free text and waiting for the response from the system administrator (human response). In general, the user can follow the questions raised by Anita and receive tailored content based on their previous inputs.

There are seven paths for exploring activity ideas: (1) Physical activity: suggesting activities that require physical effort; (2) Social connections: suggesting activities that can be done with others; (3) Access to community: suggesting places in the city for visiting; (4) Mental health boost: providing activities or resources that may benefit mental health; (5) Quick activity ideas: suggesting simple and easy activity ideas that can be done in a short time; (6) Based on gender and age: suggesting activity ideas in the order that might be valued

the most given the user's gender and age; and (7) Random activity idea: suggesting activity ideas randomly.

For most of the activity ideas, Anita provides relevant information or links to online resources to further support people's participation. In addition, the use of language was designed to be friendly, encouraging, and motivating, thereby attempting to promote activity participation for people with serious mental illness.

8 DISCUSSION AND CONCLUSION

The aim of this thesis was to understand the activity needs of people with serious mental illness living in Edmonton, and to develop and evaluate a chatbot accordingly as a supplement to the AOI intervention. To our knowledge, this is the first research presenting the development of a chatbot system designed to address the activity needs of people with serious mental illness, and which explores the user experience of the chatbot system. In the first phase, the results of Survey 1 show that participants overall considered productive, social, community, and physical activities to be important but that they insufficiently participated in them. The analysis also demonstrates how nine groups of people of different ages and gender prioritized their valued activities. Survey 2 identified 56 activities that people commonly participate in within the local context. By integrating both survey findings, an activity bank consisting of 60 activity ideas was developed. In the second phase of the research, a chatbot prototype was built on Facebook Messenger to suggest activity ideas by categories of physical activity; social interaction; access to the community; based on age and gender; and random activity ideas. In the third phase, three service providers and nine people with lived experience evaluated the chatbot. Overall, the results of the usability tests indicate the feasibility of offering activity ideas to people with serious mental illness via chatbot application, as no major usability issues were found. The nine participants were able to operate the chatbot and complete the usability tasks with or without a minor level of assistance. Also, an average of 6.34 out of 7 points of agreement on technology acceptance questions indicates the overall high technology acceptance. The qualitative data further revealed that they perceived using the chatbot to be helpful; they felt that it enabled them to

find activity ideas efficiently, that the content was relevant to their needs, and that they intended to use the chatbot in the future. In the fourth and final phase, 18 issues were prioritized based on their impacts on intervention quality and the effort required to address them. Eight issues were finally addressed and amended in the refined chatbot.

In summary, the results identify a gap between the desired and the status quo in terms of people with serious mental illness' activity participation. Additionally, both the occupational therapists and people with serious mental illness gave overall positive feedback about Anita, a chatbot that offers activity ideas, indicating the potential of integrating this technology into time-use interventions. The following sections discuss the activity needs of people with serious mental illness; the advantages and concerns of the chatbot application; the limitations of this present research; and implications for future works.

8.1 ACTIVITY NEEDS OF PEOPLE WITH SERIOUS MENTAL ILLNESS

The findings of Survey 1 indicate that the participants overall had low participation in the TCUP activity areas. According to Eklund and Leufstadius (2007), subjective perceptions of occupational engagement are in higher association with self-rated health and well-being than the performance of the activity itself. Accordingly, the sufficiency ratio, which represents the percentage of perceived important activity areas that were done as much as desired, is an important indicator of participants' activity needs. In the present research, the 45% of sufficiency ratio indicates that less than half of the perceived important activity areas had participated sufficiently for all the participants. Townley et al. (2018) reported 41% sufficiency of important activity areas among 294 participants with serious mental illness. Likewise, the number of perceived important areas that were participated in at least once in 30 days (10.3 ± 4.9) accords with the literature, reporting an average of 9.34 ± 4.56 among 119 participants (Salzer et al., 2014). The findings support the general understanding that people with serious mental illness have low participation in community activities from both subjective (perceive sufficiency) and objective (actual participation) perspectives.

Survey 1 answered the first research question: what activities are valued by people with serious mental illness? Among the 26 TUCP activity areas, the ten most important activity areas consist of routine activities (grocery shopping, errands running, using public

transportation), social activities (socializing at homes and community), productive activities (working and volunteering), community activities (going to parks, recreation centres, and libraries), and physical activities. Of these most important activity areas, only routine activities were rated as sufficiently done by at least 50% of all participants. The results echo Salzer et al.'s (2014) findings, which show low sufficiency of those most important activity areas except routine activity areas. This may be explained by the nature of routine activities; they are more “necessary” activities that people would do for independent living. Salzer et al.'s research also indicates that although social, physical, community, and productive activities were highly valued by around 70-80% of people with serious mental illness, 60-80% had done those activities less than desired. This finding should be worth further attention, since participating in these major life areas is associated with greater levels of recovery and quality of life (Burns-Lynch et al., 2016).

In addition, the analysis demonstrates that people of various ages and gender value a wide range of activity areas. Some activity areas are highly prioritized by a particular age/gender subgroup, such as civic activities for men aged 30 years and under; physical activities for men aged 31 to 50 years; going to support groups for woman aged 30 years and under; and education for people aged 30 years and under regardless of gender. These can be partly supported by previous research conducted by Thomas et al. (2017), which found that a significantly larger proportion of people aged 18 to 30 years rated education as important ($p=0.01$), while more people aged 31 to 55 years rated physical activities as important. Furthermore, the present research and literature both reveal that most of the older population rated routine activities such as using public transportation, run errands, and shopping for groceries as important. These findings suggest that gender and age may influence people's activity choices, as one's sociodemographic traits may affect their roles and current life goals. However, according to Erikson's stages of life development and Vaillant's adaptation of life, young adults need to form intimate relationships; middle-aged adults typically care for building their career; and older adults seek the meaning of life and place more emphasis on spirituality (Agronin, 2014). This research did not identify results that match the theoretical postulations such as that the younger population values social activities, middle-aged people value work, and the older population values spiritual activities. Particularly, men aged 51 years and over placed work in higher order than their younger counterparts, which is

unexpected and contradictory to the theories. This may be explained by the high unemployment rates among people with serious mental illness, by which their career-building needs have not been satisfied, even in later adulthood. In addition, 50.0% of participants in Survey 1 were unemployed, 45.7% lived alone, and 94.3 % were not in a relationship; this could reflect their lack of participation in work and social activities. It is reasonable to infer that mental health-related factors interrupt or at least delay their development milestones. For instance, the onset of serious mental illness typically starts by the mid-teens to 20s, which is a critical time for obtaining education and accumulating important skills (Dudley et al., 2014). Prolonged or incomplete educational attainment restricts the opportunities for entering competitive employment and developing a supportive social network, and influences the possibilities for accessing various activities that enrich life (Krupa et al., 2010). Therefore, rather than suggesting activities that meet social expectations and social norms, the suggested activities should instead match the person's current values, expectations, capacities, and available resources.

In terms of the influence of gender, Vari et al. (2016) state that people's learned and adopted behaviours are strongly influenced by their social context, wherein different socio-cultural expectations lead to different gender identity and gender roles. How people perceive their roles might ultimately influence their choice of activities. The role that age and gender play in a person's activity choices, however, is beyond the scope of this research. It should also be noted that the results of this present research may be influenced by the small sample size (no more than 32 participants for each subgroup); thereby, the rankings are significantly influenced by individual variations.

Interestingly, in Survey 1, going to support groups for mental health issues was perceived as less important for all subgroups compared to other activity areas; yet many usability test participants mentioned that the chatbot should place more emphasis on activities related to mental health support. This contradiction may be explained by the fact that participants who completed Survey 1 and the participants for the usability tests were a different group of people who were recruited from different sites. Most of the Survey 1 participants were recruited from the mental health clinic, where they may receive more individual interventions. On the other hand, the usability test participants were recruited from the community-based clubhouse which offers opportunities to participate in mental health

groups. The Survey 1 participants may not have as many opportunities for participation in mental health support groups as those attending the clubhouse, thus placing this activity area in lower priority.

8.2 CHATBOT AS A COMPANION FOR TIME USE INTERVENTION

The second research question, namely the degree to which people with serious mental illness perceived the chatbot as useful in promoting activity participation, was also explored. Given the growing number of chatbot applications in mental health, there is relatively little research investigating the use of chatbots in serious mental illness. A recent systematic review identified seven chatbot applications in mental illness, four of which targeted major depressive disorder and three of which examined anxiety disorder (Vaidyam et al., 2020). This research, therefore, contributes knowledge regarding the feasibility of applying chatbots in serious mental illness, of which the population is distinctive by the serious functional impairments that substantially interfere performance.

The person-based approach, which informed the overall process from planning, design, development, to evaluation of the chatbot, was a feasible approach in terms of developing a chatbot that suggests activity ideas. By emphasizing the users' perspectives throughout the design, the chatbot was generally considered usable and acceptable by the target users. In terms of usability, no participant required full assistance but only assistance related to technical or task clarification. Chatbots are usually reported as easy for users to learn and familiarize themselves with; this may be due to the fact that they are often built on messaging platforms, and the users are able to operate them with their own devices, thereby allowing them to manoeuvre the new technology without much effort (Abd-Alrazaq et al., 2019). Similar to the present findings, most of the usability issues identified in other mental health chatbots were more related to technical glitches such as screen freezing (Abd-Alrazaq et al., 2021).

The results of the questionnaire (ranging from 5.8 to 6.9 out of 7 points) reflect the overall high technology acceptance of the chatbot. In particular, the constructs of performance expectancy and effort expectancy were assessed by multiple questions (questionnaire items #1 to #7 related to performance expectancy; items #8 to #11 related to

effort expectancy) and were supported by the qualitative data. Conversely, the constructs of facilitating conditions, and behavioural intention were assessed by only one or two questions; social influence was not measured; and they were discussed relatively less in the interviews. The high scores may therefore indicate bias in the design of the questionnaire and require further validation by a more complete set of qualitative and quantitative data. Nevertheless, the chatbot was rated with high technology acceptance overall, as far as the collected data suggest. The positive finding aligns with the finding reported in a previous study investigating the acceptability of healthcare chatbot, namely that most people would show a high willingness to use chatbot applications for health concerns that are relatively minor, non-urgent, and do not require a physical examination (Nadarzynski et al., 2019). Another study regarding the use of eHealth interventions among people with serious mental illness has also suggested that this group are more likely to use the Internet for accessing health information than the general population (Naslund et al., 2015).

Despite the diversity of purpose, population, and research design, previous research on mental health chatbots indicates that users usually consider providing in-time feedback and immediate access to relevant information to be a handy feature of chatbot applications. This advantage enables clients to receive support and resources externally to their therapy sessions and can also benefit those who have difficulty seeking in-person support due to cost, location, and those who are not comfortable with sharing thoughts with other people (Abd-Alrazaq et al., 2021; Nadarzynski et al., 2019; Vaidyam et al., 2019). One of the service providers also mentioned the potential to benefit those who are socially withdrawn and have social anxiety.

In addition to its functionalities, evidence also supports the argument made by an occupational therapist that utilizing the medium may favour the therapist-client relationship. It has been reported that people are more likely to disclose to the text-based chatbot than a human counsellor (Vaidyam et al., 2019). Although Anita, the chatbot proposed in this research, does not ask the user to share their personal information, it provides a buffer between the clients and therapists where the clients are able to explore choices in the way they are comfortable with.

The results of the qualitative data indicate that the chatbot, Anita, can potentially promote users' motivation based on the self-determination theory assumptions that satisfying autonomy, competence, and relatedness can increase one's motivation for behavioural changes. Firstly, two participants mentioned that the chatbot enabled them to make their own decisions, which may indicate that the chatbot has the potential to promote the empowerment and autonomy of its users. As a matter of fact, many chatbot applications have been designed to support individuals with health conditions to self-manage, self-monitor, and self-train; the user is free to decide whether to use the technology and follow the recommendations made (Abd-Alrazaq et al., 2019). The role of the chatbot is primarily to provide information that enables the user to make informed choices. Second, the chatbot can increase competence by allowing the users to feel more effective and capable of finding things to do. The participants generally believed that using the chatbot helped them to find activities to participate in, and the online resources also helped them to participate more easily in those activities. Finally, the satisfaction of relatedness can be indicated by participants' perception of messages as encouraging (6.8 out of 7 points) and their feedback about feeling supported and able to receive resources whenever needed.

Despite the potential benefits that the chatbot brings, as mentioned above, the user feedback also indicates that the chatbot cannot replace human interaction. The most distinctive limitation of chatbot-human interactions is the inability to provide personalized interaction, especially for rule-based chatbots. As long as the chatbot relies on the predefined rule (e.g., decision tree), it is unable to respond and adapt to every individual's specific needs (Abd-Alrazaq et al., 2021). The database and decision tree can be constructed in response to various user needs; however, it will be time-consuming and will always be incomplete. Several studies have reported that mental health chatbot applications are often criticized for their repetitive responses (Abd-Alrazaq et al., 2021), a point that was also raised by one of the participants in the present research. The repetitive responses make the chatbot feel less humanoid and thus may affect the therapeutic alliance and engagement. The chatbot Anita, however, is assumed to be accompanied by the delivery of the AOI intervention. The therapeutic alliance and engagement can be facilitated during the therapy sessions, and the therapists are assumed to respond to the client's individual needs in addition to the general support provided by the chatbot. In other words, the strengths of real human intervention

(the ability to provide personalized, humanized feedback) and chatbot application intervention (the ability to provide instant responses and connect the user with online resources) can complement each other, thereby increasing the scope and extent of the support provided.

Other limitations associated with mental health chatbot applications discussed in the literature include lack of sympathy, inability to respond to an emergency, and data breach (Abd-Alrazaq et al., 2021; Nadarzynski et al., 2019; Vaidyam et al., 2019). These concerns were not identified in the present research, which may be due to Anita's instrumental, rather than counselling, nature. The primary purpose of Anita is to offer activity ideas; therefore, the users might not expect the chatbot to show empathy or respond to mental health problems such as suicide ideation, compared to a counselling chatbot. Furthermore, as Anita does not require users to input their personal information, its content does not contain any sensitive personal data. The result of the questionnaire demonstrates that the participants feel safe using the chatbot (6.9 out of 7 points).

As mentioned earlier, there are only few chatbots designed for people with serious mental illness. However, serious mental illness often results in functional limitations, which may substantially interfere with users' reactions to the chatbot system. Therefore, special considerations of designing chatbots for this population should be discussed in depth. Firstly, it is suggested to minimize the extent to which the cognitive effort required to manoeuvre and navigate the chatbot system (Baldauf et al., 2018). Many people with serious mental illness have cognitive limitations or difficulty in processing complex information. The design of the chatbot system should be simple, clear, and organized to avoid confusion and disorientation (Naslund et al., 2015). For example, Anita provides explicit instructions, guiding the user to select an option that best fits their intentions (e.g., "click 'continue' to see more information or 'back to the idea list' to see other ideas"). The use of rule-based predefined choices allows users to send requests easily; sidesteps the effort of typing and spelling; and ensures that interactions are relevant to the intended topic. Users of mental health chatbots do not favour long messages, as they can be overwhelming (Abd-Alrazaq et al., 2021). In Anita, the messages often use emojis to represent the corresponding activity ideas (e.g., emoji of a man running for the running/jogging activity idea), which one of the

participants particularly appreciated. Emojis are also used in another mental health chatbot to deliver engaging and positive information (Fitzpatrick et al., 2017).

Previous research has raised a concern that is particularly relevant to those who are unable to recognize reality interacting with virtual assistants (Bickmore et al., 2010). For example, a user in acute psychotic distress may become paranoid, thinking that the chatbot or the human who controls the chatbot is monitoring them or intends to harm them; alternately, they may develop a parasocial relationship with the chatbot. Bickmore et al. suggest strategies such as stating the chatbot's role and purpose clearly; using concrete language; and focusing on real events to reinforce reality. However, how to prevent the chatbot from triggering symptoms has rarely been discussed in the literature. Nevertheless, such concerns are not specific to the chatbot intervention, as clients are equally likely to develop paranoid thinking when interacting with real human therapists. The general principles for maintaining optimal therapeutic relationships may therefore apply to the chatbot intervention. For example, when first introducing the chatbot to the clients, the service providers should provide a clear explanation of the chatbot's role in the intervention process as a supportive computer system. The chatbot content should be user-directed and avoid showing the intention of asking the user to do things. Also, providing more structured content and enabling the chatbot user to manage tasks may divert attention from their symptoms. During the interview, none of the participants confused the chatbot with real humans; they all referred to the chatbot as "it" rather than "he" or "she". Nevertheless, more evidence is needed to support whether people with acute psychotic symptoms can use the chatbot system safely, and what design principles can be embedded to address the risk of triggering psychotic symptoms.

Likewise, to avoid triggering negative emotions, the suggestion content should be sensitive to the conditions and contexts of serious mental illness; one occupational therapist also suggested that the activity ideas should avoid reminding the user of their losses. According to the strength-based approach, highlighting the capacity and possibilities; providing links to resources; expanding and explaining choices to facilitate meaningful and informed decision making; and using goal-oriented practice can all increase the hopefulness of the client (Pattoni, 2012; Rapp et al., 2005). Rather than disregarding any challenges or limitations, it is better focus on the strengths of the person and their environments, to enable

people with serious mental illness to look beyond their limitations and envision a more positive future. For example, excessively suggesting ideas that need to be done with family or a group of friends, and those that require money, materials, and spaces that many people with serious mental illness do not possess (or have lost due to their illness), should be avoided; rather, the activity suggestions can place more emphasis on benefits, possibilities, and available assets. In addition, the service providers can discuss with clients and prepare them for the anticipated challenges associated with activity changes based on their individual context.

Socioeconomic disadvantage is a significant barrier to using technology interventions. People with serious mental illness have limited Internet use and limited access to mobile devices due to poverty and disadvantageous living conditions. However, evidence also suggests increasing use and availability of mobile devices and online services among this population (Naslund et al., 2015). According to the literature on mobile use among people with serious mental illness, over 70% of participants owned a cellphone (Bonet et al., 2017); about 40% of those who owned a cellphone used them to access the Internet, while about 79% of them used social media daily (Naslund et al., 2016). One of the occupational therapists in this study also suggested that many clients can use computers in public libraries or their daycare/therapy programs even if they cannot afford one. Indeed, one of the participants in this research used the public computer, and many used free Wi-Fi provided by the clubhouse when conducting usability tests.

In summary, this pilot research provides preliminary evidence of the feasibility of applying chatbot technology in time-use intervention for people with serious mental illness. In the context of time-use intervention, the chatbot system has the strengths of offering in-time feedback, facilitating immediate access to online resources, and supporting the user to make activity changes externally to therapy sessions. It also has the potential to promote motivation for making behavioural changes and serve as a buffer between therapist and client. Although some limitations and concerns still require more attention to be addressed, the increasing use of technology and the high technology acceptance of this chatbot indicate the feasibility of using a chatbot system such as Anita to accompany the AOI intervention.

8.3 LIMITATIONS ASSOCIATED WITH THE RESEARCH

A number of limitations associated with methodological weaknesses need to be highlighted. First, eight out of nine usability test participants were recruited from the Prosper Place clubhouse. This research was unable to recruit participants from more sites due to the impacts of the COVID-19 pandemic. The clients of the clubhouse have opportunities to participate in a variety of activities offered by the organization. Therefore, the usability test participants were more likely to have a higher level of activity participation than those who do not attend equivalent community programs. In addition, this research only recruited participants who have their own device (or the ability to access one) and Facebook account; these participants were assumed to have an adequate level of technological literacy. Consequently, the outcomes of the usability tests may not be generalized to those who have little or no experience in using the Facebook Messenger platform or any other social media user interface. One of the questionnaire items, which asked whether participants had the resources necessary to use the chatbot, is therefore biased, since the research only recruited participants who already had access to those resources. At the very least, the findings suggest that people with serious mental illness who have an adequate level of technological literacy are able to operate the chatbot system without encountering major usability issues. It is reasonable to believe that if sufficient supports are provided (e.g., recommending public computer locations and offering in-person training for manoeuvring the chatbot interface), those who have lower technological literacy or limited resources could also benefit from this emerging technology-based approach.

Second, the researcher who developed Anita is not a native English speaker; therefore, the use of language in the chatbot, especially the encouraging, motivating, and relatedness components, might be affected. To mitigate this limitation, the content of the chatbot prototype was reviewed by a native speaker for wording and grammatical issues before evaluation. However, the overall quality of deliverability may be compromised, which could lead to the issue raised by the participants (both by occupational therapists and people with serious mental illness) that the language used was contrived and repetitive. It should be noted that the use of language is an important issue, as facial expression, linguistic intonation, and other nonverbal communications are absent from chatbot-human interactions.

Third, given the pilot nature of this research, little attention was paid to the selection of the online resources. There were no rigorous selection criteria used for the online resources provided in Anita. Future research might consider using a more rigorous selection strategy to ensure the quality of information and hence increase the trustworthiness of the chatbot application.

Fourth, the questionnaire used for the technology acceptance evaluation may require further modifications given the cognitive and literacy level of the population. Some of the items may be too abstract to conceptualize. For example, item #1, *The activity ideas suggested by this chatbot are activities that I would like to do more*, could be changed to a more direct statement, such as *I would like to do the activities suggested by this chatbot*. In addition, a seven-point Likert scale might be difficult to respond to, compared to a three- or five-point Likert scale (Liu et al., 2019). Although no participants in this research showed difficulties in answering the questionnaire, it is still possible that the reliability of the results were influenced by the complexity of the questionnaire. Despite such concerns, the interviews that were conducted immediately after the questionnaire helped to collect more data regarding the questionnaire items, thereby ensuring that the participants understood what the questions were asking.

Finally, there are several usability issues or suggestions that were not addressed in this research due to its scope and time limitations. Some suggestions for the chatbot features were raised, however, to inform future works. For example, the chatbot could track the user's interested activity ideas and whether they have attempted them; integration with positioning systems (e.g., Google Maps) could be achieved, to have the chatbot suggest activities near the user; and the chatbot system could be developed as a stand-alone software to facilitate more flexibility in the user interface design.

8.4 POTENTIAL BIAS ASSOCIATED WITH THE RESEARCHER

Since the research was planned, implemented, and reported by a sole researcher, the researcher's background, attitude, belief, and decision-making may have led to bias. For example, when designing the technology acceptance questionnaire, the content was outlined to fit the context of the target population. However, potential bias regarding the population's

cognitive and literacy level may influence the selection of evaluation methods. Potential biases may exist when the researcher chose the level of Likert items for evaluation. The decision may reflect how the researcher perceived the target population's cognitive level, which might be influenced by potential stereotypes (e.g., having fewer scale points tends to be a suitable choice for people with mental illness and limited cognitive function). To eliminate the potential bias, it would have been better if inviting people with lived experience to pre-assess the questionnaire before the evaluation.

The researcher's prompting technique might also introduce bias into the think-aloud process. For instance, feedback with a positive or negative tone (e.g., saying "you are doing great!" or nodding) might have potentially influenced the participants' performance. It is better to avoid such concern by using only neutral language (e.g., "keep talking") when prompting and having the participants do a retrospective summary of the think-aloud process.

Finally, when reporting the results, the researcher might have unconsciously interpreted the data based on personal beliefs and reported the findings that support pre-existing assumptions. Involving participants in data analysis, followed by conducting a member checking exercise to validate the findings, would be the strategies to mitigate this bias.

8.5 IMPLICATIONS FOR FUTURE RESEARCH

There are several implications derived from this research. First, the results of Survey 1 indicate that people with serious mental illness have low participation overall, especially in productive, social, physical, and community activities; there is a need for future research and clinical practice to support this population with not only housing and employment, which are the two most common intervention focuses, but also in the important leisure and social activities that comprise the fabric of life (Burns-Lynch et al., 2016). Also, gender and age might potentially affect how people value activities, as these factors shape people's preferences and priorities in life; thus, it is important to understand clients' sociocultural contexts when offering activity suggestions. The activity suggestions must be personally meaningful, manageable with one's available resources, and sensitive to one's unique context. It is suggested to collect more qualitative data, such as by conducting an interview about the client's activity history, interest, assets, and barriers, to gain a more in-depth

understanding of the person's specific needs and thus enable the service provider to offer more tailored interventions and support.

Overall, the participants of this research gave positive feedback about the chatbot application. It may be feasible for service providers (e.g., occupational therapists) to use chatbots as a supplementary tool of time-use intervention (e.g., AOI) for people with serious mental illness. Developing an AI-based chatbot that allows for small talk and tailored interactions, or expanding the chatbot's functionality, may increase usage of the chatbot. It is advisable to include software engineers, programmers, or software developers in the future chatbot-development team to maximize the potential benefits that can be brought by the technology. For instance, future works may develop chatbot systems with those suggested chatbot features that were not addressed in this thesis, as mentioned above, to increase the satisfaction and perceived usefulness of the chatbot intervention.

Furthermore, future research can address the weaknesses of this pilot research. Regarding the needs assessment, this research used the TUCP measure to assess activity participation in people with mental illness. Using a questionnaire facilitates the collection of data from more participants within a given time; however, this might result in the failure to consider other activities not included in the list provided. Future research might consider using a more exploratory approach to identify activity needs other than the 26 TUCP activity areas. In addition, the snowball sampling method used in Survey 2 restricted the diversity of participant characteristics. Only 37 people participated in the online survey, a large proportion of whom were young students (43.2% were aged 18 to 29 years and 24.3% were students) while few were aged 40 to 49 years (2.7%), unemployed (13.5%), and/or retired (5.4%). The lack of representativeness and the limited number of activities collected may affect the quality of the chatbot. A more rigorous sampling method and a larger-scaled survey is necessary for future local activity surveys to ensure the comprehensiveness of the data collected.

In terms of activity ideas, the Action Over Inertia specifies that the "activity experiment" should be simple, easy, and possible to be done rapidly. Although the activities suggested by Anita required few resources, and a category of simple "activity experiment" was added in the later version of Anita, some of the ideas themselves were not simple and could not be

done quickly. For example, the idea of “home workout” can be done by watching free YouTube videos; however, it can still be challenging for people to initiate the action of playing the video, finding a workout space at home, and following the workout tutorials. The activity can be further simplified to ideas that can be done rapidly, such as stretching after waking up.

Finally, given the scope of this research, it is still unclear whether the chatbot can actually increase the user’s activity participation. Future research should investigate the effectiveness of chatbots for promoting behavioural changes. It is recommended that further research assess the change in activity participation over time, compared with a control group with a traditional medium (e.g., AOI’s resource sheets), and analyze how the chatbot system can be integrated into real practice in a cost-effective manner.

8.6 KNOWLEDGE TRANSLATION

The knowledge gained in this research can further benefit people with serious mental illness by collaborating with stakeholders. For instance, the findings of this pilot research can be synthesized by summaries, reports, and academic articles, aiming to disseminate the message about the potential of chatbot application in time-use intervention for people with serious mental illness. The partnership of researchers, service providers, and clients can then be facilitated. Local community organizations can help to define available resources, thereby expanding and completing the content of the chatbot. Occupational therapists and the clients themselves can clarify the needs and barriers and suggest strategies used in the chatbot to promote usability and usefulness. The co-development of the chatbot can eliminate the gap of knowledge-to-action and enables the technology to be implemented seamlessly in accordance with feedback from both service providers and receivers. The ongoing partnership can also help to monitor, evaluate, and optimize the effectiveness of the intervention. Altogether, the supports for activity participation for people with serious mental illness can be strengthened by knowledge exchange between the researcher and other stakeholders.

8.7 CONCLUSION

This pilot research adds to the body of knowledge regarding the activity needs of people with serious mental illness. In general, this population lacks participation in social, productive, community, and physical activities. Age and gender may additionally influence how people prioritize different activities. Furthermore, although there are some limitations related to the chatbot content and functionality, the participants overall held a positive attitude toward using a chatbot for promoting activity participation, since the chatbot could achieve its intended purpose of suggesting activity ideas for participation in the context of serious mental illness and could be operated by the target users without encountering major usability issues. It was considered useful for inspiring activity ideas, easy to use, and empowering for people with serious mental illness in making their own activity choices. The occupational therapists also suggested the potential of utilizing a chatbot in time-use intervention for people with serious mental illness. A more rigorously designed study is needed to validate the effectiveness and feasibility of this innovative intervention approach, and partnership with local stakeholders can also facilitate the knowledge-to-action process.

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Appendix A – University of Alberta Research Ethics Office Ethics Approval for Survey 1

Health Research Ethics Board

308 Campus Tower
 University of Alberta, Edmonton, AB T6G 1K8
 p. 780.492.9724 (Biomedical Panel)
 p. 780.492.0302 (Health Panel)
 p. 780.492.0459

Approval Form

Date: March 13, 2019
 Study ID: Pro00087965
 Principal Investigator: [Shu-Ping Chen](#)
 Study Title: Validating Activity Engagement Measure (AEM) for people with serious mental illnesses?
 Approval Expiry Date: Thursday, March 12, 2020

Approved Consent Form: Approval Date: 3/13/2019 Approved Document: [Informed Consent 5.pdf](#)

Sponsor/Funding Agency: Faculty of Rehabilitation Medicine start-up funds

	Project ID	Project Title	Speed Code	Other Information
RSO-Managed Funding:	View RES0027720	Validating Activity Engagement Measure (AEM) for people with serious mental illnesses	ZD667	

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel. Your application, including the following, has been reviewed and approved on behalf of the committee;

- AEM-Ad 4 (3/7/2019)
- AEM Questionnaire (1/23/2019)
- Proposal 2 (1/18/2019)

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Health Research Ethics Board does not encompass authorization to access the patients, staff or resources of Alberta Health Services or other local health care institutions for the purposes of the research. Enquiries regarding Alberta Health Services approvals should be directed to (780) 407-6041. Enquiries regarding Covenant Health should be directed to (780) 735-2274.

Sincerely,

Anthony S. Joyce, PhD.
 Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix B – University of Alberta Research Ethics Office Ethics Approval for Survey 2

Notification of Approval

Date: May 1, 2020
Study ID: Pro00099631
Principal Investigator: [Huei-Tsz Liu](#)
Study Supervisor: [Shu-Ping Chen](#)
Study Title: **Developing a chatbot for promoting activity engagement for individuals with serious mental illness: A pilot study**
Approval Expiry Date: April 30, 2021

Approved Consent Form: Approval Date 5/1/2020 Approved Document [Activity survey_Informed Consent_v.2clean.docx](#)

Thank you for submitting the above study to the Research Ethics Board 2. Your application has been reviewed and approved on behalf of the committee.

Any proposed changes to the study must be submitted to the REB for approval prior to implementation. A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Dr. Ubaka Ogbogu, LLB, BL, LLM, SJD
Chair, Research Ethics Board 2

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix C – University of Alberta Research Ethics Office Ethics Approval for Interviews and Usability Tests

Health Research Ethics Board

308 Campus Tower
University of Alberta, Edmonton, AB T6G 1K8
p. 780.492.9734 (Biomedical Panel)
p. 780.492.0302 (Health Panel)
p. 780.492.0459

Approval Form

Date: July 8, 2020
Study ID: Pro00101961
Principal Investigator: Shu-Ping Chen
Study Title: Developing a chatbot for promoting activity engagement for individuals with serious mental illness
Approval Expiry Date: July 7, 2021
Approval Date Approved Document
Approved Consent Form: 2020-07-08 [chatbot interview_Informed Consent_OT_V3 clean.docx](#)
2020-07-08 [chatbot interview_Informed Consent_PMI_V3 clean.docx](#)

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel. Your application, including the following, has been reviewed and approved on behalf of the committee:

- Chatbot Evaluation Cover Letter_PMI_Clean, Version 2, June 23, 2020;
- Chatbot Evaluation Cover Letter_OT_Clean, Version 2, June 23, 2020;
- Chatbot Evaluation Cover Letter_Site Managers, Version 2, July 7, 2020;
- Usability Test+ Interview Protocol_PMI, Version 2, June 23, 2020;
- Interview Protocol_OT, Version 1, June 15, 2020;
- Activity Engagement Proposal, Version 2, June 15, 2020.

Any proposed changes to the study must be submitted to the REB for approval prior to implementation. A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Health Research Ethics Board does not encompass authorization to access the patients, staff or resources of Alberta Health Services or other local health care institutions for the purposes of the research. Enquiries regarding Alberta Health Services approvals should be directed to (780) 407-6041. Enquiries regarding Covenant Health should be directed to (780) 735-2274.

Approval by the Research Ethics Board does not encompass authorization to recruit and/or interact with human participants at this time. Researchers still require operational approval (e.g., Alberta Health Services) and must meet the requirements imposed by the public health emergency ([link to Alberta COVID page](#)).

Sincerely,

Anthony S. Joyce, PhD.
Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix D – Statistics Canada Activity Group 2019

1. TOTAL WORK

1.1. Paid work and education

1.1.1. Paid work and other related activities (Paid work activities include paid work, other income-generating activities, paid training, selling of goods or services)

1.1.1.1. Paid work

1.1.1.2. Activities related to paid work

1.1.1.3. Communing

1.1.2. Education and other related activities (include schooling full time/part time - on site, schooling full time/part time - online, homework or studying, self development or leisure and special interest classes)

1.2. Unpaid work

1.2.1. Household work and related activities (include meal, lunch or snack preparation, preserving foods, baking, freezing, sealing, packing foods, indoor house cleaning, dish washing, tidying, taking out garbage, recycling, compost, unpacking goods, laundry, ironing, folding, sewing, shoe care, repair, painting or renovation, organizing, planning, paying bills, unpacking groceries, packing and unpacking luggage for travel and/or boxes for a move, outdoor maintenance such as car repair, ground maintenance, snow removal, cutting grass, planting (picking), maintaining, cleaning garden; caring for house plants, pet care such as feeding, walking, grooming, playing.)

1.2.1.1. Cooking and washing up

1.2.1.2. Housekeeping

1.2.1.3. Maintenance and repair

1.2.1.4. Other household work

1.2.1.5. Shopping for goods and services (Shopping for goods or services such as gasoline, groceries, clothing, car, legal services, financial services, vehicle maintenance, health professional visit, consultation, researching for goods or services.)

1.2.1.6. Child care

1.2.2. Civic and voluntary work

2. **PERSONAL CARE** (including personal hygiene, praying, spiritual activities, meditating, sexual activities, self-administered medical care such as taking blood pressure, sugar level, medication, treatment)
 - 2.1. Night sleep
 - 2.2. Meals (excluding restaurant meals)
 - 2.3. Other personal activities
3. **FREE TIME**
 - 3.1. Socializing including restaurant meals (Socializing means communicating - in person or using any type of technology (phone, email, social media, skype...))
 - 3.1.1. Restaurant meals
 - 3.1.2. Socializing in homes
 - 3.1.3. Other socializing
 - 3.2. Television, reading and other passive leisure
 - 3.2.1. Watching television
 - 3.2.2. Reading books, magazines, newspapers
 - 3.2.3. Other passive leisure
 - 3.3. Sports, movies, and other entertainment events
 - 3.4. Active leisure (Active leisure includes drawing, painting, crafting, playing an instrument, dancing, collecting, knitting, photography, board and card games, gambling, walking, pleasure driving, birdwatching, writing such as letters, cards, books, poems, general computer use, video games, Internet, art or music production)
 - 3.4.1. Active sports (Active sports includes exercising, organized recreational sports, competitive sports (indoor or outdoor), outdoor sports (non-competitive) such as skiing, skating, swimming, tennis, football, baseball, outdoor activities such as fishing, hunting)
 - 3.4.2. Other active leisure

Source: Statistic Canada's 2019 Activity group

<https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=1230353>

Appendix E – Phase One: Survey 1 Recruitment Poster

PARTICIPANTS NEEDED - RESEARCH STUDY

Validation of Activity Engagement Measure

Research study: Validating Activity Engagement Measure (AEM) for people with serious mental illnesses. (U of A Ethics ID: Pro00087965)

Researchers from Department of Occupational Therapy, University of Alberta are investigating a measure of people's daily activity engagement.

We would like to invite you to help us understand the overall picture of your activity engagement and time-use pattern. This will involve a self-report questionnaire that takes about 10-15 minutes.

As an appreciation of your participation, an honorarium of \$35 gift card will be provided.

You are eligible to participate in this study if you meet the following criteria:

- being diagnosed as serious mental illness (including schizophrenia, bipolar disorders, delusional disorder, or any kind of psychotic disorders)
- Living in the community
- Between 18-70 years of age
- Fluent in English

If you are interested in participation, please contact:
Haley Liu 780-492-0894; hueitsz@ualberta.ca

Haley Liu
(780) 492-0894
hueitsz@ualberta.ca

Appendix F – Phase One: Survey 1 Questionnaire

Dear participants,

You are invited to complete this questionnaire to help us understand your activity engagement.

Principal investigator: Dr. Shu-Ping Chen, Assistant Professor, Department of Occupational Therapy, Faculty of Rehabilitation Medicine, University of Alberta, Edmonton, AB.

Phone number: (780) 492-3905. Email: shuping2@ualberta.ca

Thank you in advance for your time. I am Huei-Tsz (Haley) Liu, the research assistant, will be here to assist you if you have any questions about the questionnaire.

First, we would like to know a bit about you.

1. What is your age as of today? _____
2. How do you identify your gender?
 Man Woman Other
3. Highest level of education attained?
 Less than high school High school, no diploma High school graduated, diploma or the equivalent Some college credits, no degree Technical/ Vocational training Associate degree Bachelor's degree Master's degree Doctorate degree
4. Your marital status?
 Single, never married Married or domestic partnership Divorced
 Widowed Separated Other, please specify: _____
5. Your current employment status?
 Full-time employed Part-time employed Unemployed Retired
 Other, please specify: _____
6. Your primary source of income?
 Myself Family Other, please specify: _____
7. Where do you live currently?
 With family In my own apartment by myself In an apartment or house with housemates/roommates
 Other, please specify: _____

Second, we would like to ask a bit about your participation in each activity during the past 30 days.

A. How many days during the past 30 days did you do the following activities without a program staff person going with you:	B. Number of Days (without a staff person)	C. Do you do this activity?			D. Is this activity important to you?	
		Enough	Not Enough	Too Much	Yes	No
1. Go shopping at a grocery store, convenience store, shopping center, mall, other retail store, flea market, or garage sale.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Go to a restaurant or coffee shop.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Go to a church, synagogue, or place of worship.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Go to a movie.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Go to a park or recreation center.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Go to a theater or cultural event (including local school or club events, concerts, exhibits and presentations in the community).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Go to a zoo, botanical garden, or museum.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Go to run errands (for example, go to a post office, bank, Laundromat, dry cleaner).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Go to a library.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Go to <u>watch</u> a sports event (including bowling, tennis, basketball, etc.).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Go to a gym, health or exercise club, including pool, or <u>participate</u> in a sports event (including bowling, tennis, miniature golf, etc.).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Go to a barber shop, beauty salon, nail salon, spa.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Use public transportation (for example, buses, Broad Street Line, subway) (This does NOT include mental health agency vans).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

A. How many days during the past 30 days did you do the following activities without a program staff person going with you:	B. Number of Days (without a staff person)	C. Do you do this activity?			D. Is this activity important to you?	
		Enough	Not Enough	Too Much	Yes	No
14. Go to a 12-step / self-help group for mental health issues.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Go to a 12-step / self-help group for substance use problems.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Go to another type of support group in the community (for example, overeaters anonymous, gamblers anonymous) (Specify name of group: _____)	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Go to a consumer-run organization or advocacy group/organization (This includes NAMI or any other organization that is completely run and operated by mental health consumers OR an organization or group that advocates for rights and services for mental health consumers).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Go to a social group in the community (for example, a book club, hobby group, other group of people with similar interests) (Specify name of group: _____)	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Work for pay.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Go to school to earn a degree or certificate (for example: GED, adult education, college, vocational or technical school, job training).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Take a class for leisure or life skills (for example, classes for cooking, art crafts, ceramics, photography).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Participate in volunteer activities (in other words, spend time helping without being paid).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

A. How many days during the past 30 days did you do the following activities without a program staff person going with you:	B. Number of Days (without a staff person)	C. Do you do this activity?			D. Is this activity important to you?	
		Enough	Not Enough	Too Much	Yes	No
23. Get together in the community or attend an event or celebration with family or friends (for example, a wedding, bar mitzvah).	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Entertain family or friends in your home or visit family or friends in their homes.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Go to a community fair, block party, community clean-up day, or other community event or activity.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Go to or participate in civic or political activities or organizations.	_____ (# of Days)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

THANK YOU!!!

Thank you for participating in this research project.

Appendix G – Phase One: Survey 2 Cover Letter

Dear participants,

You are invited to participate in a study to help us understand what activities composing people's daily lives.

You are eligible to participate if you live in Edmonton, between 18-70 years old.

Title of Study: Developing a chatbot for promoting activity engagement for individuals with serious mental illness

In this study, we are going to build a chatbot that supports individuals with serious mental illness to participate in meaningful activities. A chatbot is a conversational system that allows the users to interact with the computer through natural language. It is like a virtual conversational agent that simulate human interactions via text or text-to-speech. Before developing the chatbot, we would like to first understand what the activities people would do in their daily lives.

To participate in this study, you will be asked to complete an online survey. This online survey will take up to 15-20 minutes. You will be asked to select activities that you would do in your typical days (before the COVID-19 outbreak) from a list of activities. You are also encouraged to add any activities that are not on the list. What we learn from the survey will contribute to our understanding of people's participation in activities.

If you are interested in taking part in this study, please contact hueitsz@ualberta.ca for details.

Project Investigator

Huei-Tsz Liu, Master's student, Faculty of Rehabilitation Medicine, University of Alberta.

Email: hueitsz@ualberta.ca

Supervisor

Shu-Ping Chen, Assistant Professor, Department of Occupational Therapy, Faculty of

Rehabilitation Medicine, University of Alberta. Email: shuping2@ualberta.ca

Appendix H – Phase One: Survey 2 Online Survey Questions

Activity participation survey

Dear participant,

Thank you for participating in this study.

Study title: Developing a chatbot for promoting activity engagement for individuals with serious mental illness

The purpose of this study is to develop a chatbot (a conversational system that allows the users to interact with the computer through natural language) that supports individuals with serious mental illness to participate in meaningful activities.

Your valuable information will help us gain knowledge about what activities comprising people's lives, and help us to ensure the information provided by the chatbot is appropriate.

It is your decision to take part in this study. You can stop the survey by closing the browser at any time.

Please read the informed consent form before you start.

<https://drive.google.com/file/d/1CP5Z-YbJGQoofcS4go5bMnmCjyvdZVd/view?usp=sharing>

By clicking submit you agree to participate in this study.

Thank you in advance for your time.

Project Investigator

Huei-Tsz Liu, MSc student, Faculty of Rehabilitation Medicine, University of Alberta. Email:

hueitsz@ualberta.ca

Supervisor

Shu-Ping Chen, Assistant Professor, Department of Occupational Therapy, Faculty of

Rehabilitation Medicine, University of Alberta. Email: shuping2@ualberta.ca

University of Alberta Ethics ID: Pro00099631

* Required

Personal information

We would like to know a bit about you.

1. What is your age as of today? *

Mark only one oval.

- 18-29
- 30-39
- 40-49
- 50-59
- 60-70

2. How do you identify your gender? *

Mark only one oval.

- Woman
- Man
- Other
- Prefer not to say

3. Your current employment status? (check all that apply) *

Check all that apply.

- Student
- Full-time employed
- Part-time employed
- Unemployed
- Retired
- Other: _____

Leisure

We would like to ask you about your participation and suggestions about leisure activities.

We understand that things have been changed rapidly during the past months due to the COVID-19 crisis. Please try to answer the question based on your "typical" life experiences (prior to the COVID-19 outbreak).

4. Here is a list of socializing activities. Please check ALL activities that you did with someone else (e.g., friends, family members, colleagues, classmates) at least once during the past year prior to the COVID-19 outbreak.

Check all that apply.

- Invite others in your home or visit others in their homes
- Go to restaurants/ have meals together
- Watch/ participate in sports/exercise
- Listen to music/ concerts/ karaoke
- Watch movies/ films at home or movie theatres
- Go for a picnic
- Go to shopping malls
- Hangout online, online games
- Talking, conversation, phone
- Socializing at bars or clubs
- Socializing on social network apps or dating apps
- Socializing in social groups, hobby groups, or book clubs
- Socializing in community fairs, block parties, or community clean-up days
- None

5. Besides the socializing activities listed above, what are the other activities that you did (or want to do) for socializing? List at least one activity.

6. Here is a list of active leisure activities. Please check ALL activities that you did at least once during the past year prior to the COVID-19 outbreak.

Check all that apply.

- Football, basketball, baseball, volleyball, hockey, soccer, field hockey
- Tennis, squash, racquetball, paddle ball
- Golf, miniature golf
- Swimming, waterskiing
- Skiing, ice skating, sledding, curling, snowboarding
- Bowling, pool, ping-pong, pinball
- Exercises, yoga, weightlifting
- Judo, boxing, wrestling, fencing
- Rowing, canoeing, kayaking, windsurfing, sailing
- Walking, hiking, jogging, running
- Bicycling
- Gardening
- Barbecuing
- Hunting
- Fishing
- Boating
- Camping
- Horseback riding, rodeo, jumping, dressage
- Baking, preserving food, home brewing
- Playing musical instrument
- Dancing
- Painting, drawing
- Card games, puzzles, board games
- Video games (by using Nintendo Switch, Nintendo wii, Sony Playstation, etc.)
- Caring of house plants
- Meditating
- At-home workouts, yoga, weightlifting
- Home decorating
- None

7. Besides the active leisure listed above, what are the other leisure activities that you did (or want to do)? List at least one activity.

Community

We would like to ask you about your participation in the community.

We understand that things have been changed rapidly during the past months due to the COVID-19 crisis. Please try to answer the question based on your "typical" life experiences (prior to the COVID-19 outbreak).

8. Here is a list of places to visit in the community. Please check ALL places that you went at least once during the past year prior to the COVID-19 outbreak.

Check all that apply.

- Go to restaurants/ coffee shops
- Watch/ participate in sports events
- Go to fairs, festivals, circuses, or parades
- Go to community, provincial, national parks
- Go to libraries or community recreation centres
- Go to zoos or botanical gardens
- Go to shopping malls
- Go to opera, ballet, or theatre
- Go to museums or art galleries
- Go to heritage sites
- Go to casino, bingo, arcade
- None

9. Besides the community places listed above, what are the other places that you went (or want to go)? List at least one.

Productivity

In this section, we would like to ask you about your participation in productive activities and suggestions about productive activities.

We understand that things have been changed rapidly during the past months due to the COVID-19 crisis. Please try to answer the question based on your "typical" life experiences (prior to the COVID-19 outbreak).

10. If you were looking for a job (either full-time or part-time), what are the websites/ headhunting agencies/ job banks you would possibly use to search for openings? List at least one.

11. If you wanted to take classes for leisure or life skills (e.g., cooking, art craft, photography, self-development), what are the websites/ organizations/ platforms you would possibly use to search for classes or tutors? List at least one.

12. What other household works you or your family would do (either daily or occasionally) except cooking, cleaning, and laundry? List at list one activity.

13. If you wanted to participate in voluntary activities (e.g., unpaid help or care, civic activities, political activities, religious activities), what are the organizations/ groups/ unions that you would most possibly contact? List at least one.

Thank you

Thank you for your participation. We appreciate your contribution to our study. Please click 'submit' before you leave the page.

Appendix I – Phase Three: Service Provider Interview Cover Letter

Dear participants,

You are invited to participate in a study to help us evaluate a chatbot that supports individuals with serious mental illness to participate in meaningful activities.

In this study, we have developed a chatbot that aims to support individuals with serious mental illness to participate in meaningful activities. A chatbot is a conversational system that allows the users to interact with the computer through natural language on the messaging platform (e.g., Facebook Messenger). It is like a virtual conversational agent that simulates human interactions via text. Our proposed chatbot will suggest users for meaningful activity ideas along with online resources.

If you are interested in taking part in this study, please contact hueitsz@ualberta.ca

You will receive a link to our proposed chatbot, and you can explore the system freely with your own Facebook account. After using the chatbot, please notify us and we will set up an online meeting on Zoom. We will talk about your experience and opinions on using the chatbot. This online meeting will take approximately 30-40 minutes. Your valuable feedback can help us improve time-use intervention for individuals with serious mental illness.

Action Over Inertia Chatbot link: <https://m.me/100386948148554>

Some introductions on the chatbot functions:

You can choose to see activity ideas from 3 categories (1) **Different purposes**: physical activity, social interaction, or access to community; (2) **Based on gender & age**: the chatbot will rank the activities based on gender and age you chose. (3) You can click the menu beside the dialogue bar and choose **Random activity idea** to see random ideas.

Once you click one of the activity ideas (e.g., Hiking), you will see a short description of the activity (e.g., Hiking is good for you physically and mentally! Having a weekend in every month with family and friends, admiring the beauty of nature together would be a good idea). For some activities, you can see the option **See more information-** then the chatbot will send you some links of online resources (e.g., a link to best bird-watching trails near Edmonton map).

You can see activity ideas from other categories by clicking the menu beside the dialogue bar at any time.

Appendix J – Phase Three: Service Provider Interview Protocol

Introduction: (10 minutes)

- Introduce the investigator.
- Thank participant for participating.
- Explain the purpose of the interview- to understand your perceived usefulness and usability of this chatbot.
- Briefly introduce the chatbot- the purpose is to provide ideas for activity changes and served as an Action Over Inertia supplement tool.
- The interview will take approximately 40 minutes, please inform if need breaks.
- The conversation will be audio-recorded.
- The information collected is confidential and the participation is voluntary. You can stop at any time.
- Have participant briefly introduce themselves.

Interview (30 minutes)

We would like to understand your comments on using this chatbot.

1. What's your overall feeling about the chatbot? What are the strengths and limitations of this chatbot?
2. Performance expectancy
 - Is this chatbot helpful for people with serious mental illnesses to make activity changes or increase participation? why?
 - Is this chatbot useful as a supplement to the Action Over Inertia intervention? Why?
 - Do you think using this chatbot can increase the effectiveness of the Action Over Inertia intervention?
 - Please comment on the “content” of the chatbot – Are the activities listed broad enough to capture various life experiences?
3. Effort expectancy
 - How much time did you take to learn this chatbot?
 - Do you find this chatbot easy to navigate and to understand the layout?
 - Please comment on the appropriateness of the chatbot design for people with serious mental illnesses.
4. Social influence
 - Do you think the hospitals/clinics/mental health facilities would support the clients to use the chatbot?

- 5. Facilitating conditions
 - Do you think people with serious mental illness would have sufficient resources (device, access to internet, software, knowledge and skills) to use the chatbot?
 - 6. Behaviour intention
 - If you were an OT clinician, how likely are you to use this chatbot in practice? Why?
 - How likely are you to recommend other therapists to use this chatbot? Why?
 - How likely are people with serious mental illness who have activity-health needs to use this chatbot? Why?
- How to improve the chatbot to better meet the needs of people with serious mental illnesses?
 - Do you have any other suggestions or comments on the chatbot?

Closing (5 minutes)

Is there anything else that we should have ask you? Is there anything you would like to ask us?

Thank you for your time and your valuable feedback. These information can help us improve the system.

Appendix K – Phase Three: Usability Test Cover Letter

Dear site manager,

We are a research team from the Faculty of Rehabilitation Medicine at the University of Alberta. We are now working on a research project- to develop a chatbot that aims to support individuals with serious mental illness to participate in meaningful activities. A chatbot is a conversational system that allows the users to interact with the computer through natural language on the messaging platform (e.g., Facebook Messenger). It is like a virtual conversational agent that simulates human interactions via text.

We would like to recruit research participants from your site. Inclusion criteria include: (1) Has been diagnosed as one of the serious mental illness, including schizophrenia spectrum disorder, schizoaffective disorder, delusional disorder, psychotic disorder not otherwise specified, bipolar disorder I, II, and not otherwise specified; (2) living in the community; (3) between 18 to 70 of age; (4) fluent in English; (5) have a Facebook account, being able and willing to use Facebook Messenger, and have a mobile device that can access Facebook Messenger, and (6) being able and willing to give written informed consent. We will exclude people who have acute psychiatric symptoms (showing significant and unstable symptoms)

The participants will be asked to use the chatbot and complete some tasks with their own device (smartphone, tablet, or laptop). During the process, they will be asked to say-aloud every thought that comes to their mind so that we can understand user perceptions toward using the chatbot. After using the chatbot, we will conduct a brief follow-up interview to further understand their opinions.

This evaluation will take up to an hour and will be conducted in an in-person individual meeting. In amid of the COVID-19 pandemic, we will follow the public health orders from the Government of Alberta and requirements of the Chief Medical Officer of Health. We will maintain at least two meters of social distancing and provide surgical masks and hand sanitizer at the meeting.

Each participant will receive a **\$35** gift card as an appreciation for their participation, even if they withdraw from the study.

We would appreciate it if you can disseminate the following recruitment message to people who fit our inclusion criteria. Potential participants can contact hueitsz@ualberta.ca for details.

Dear participants,

We invite you to take part in a study and help us to test the function of a chatbot. A chatbot is a computer system. It can have conversations with its users on the messaging platform (e.g., Facebook Messenger) automatically. It is like a virtual conversational agent that simulates human interactions via text. We built this chatbot because we want to help individuals with serious mental illness do meaningful activities. This chatbot can give you suggestions for meaningful activities and can connect you with many resources.

You can take part in this study if you meet the following criteria.

- (1) Have been diagnosed as one of the serious mental illnesses;
- (2) Living in the community;
- (3) Between 18 to 70 of age;
- (4) Fluent in English;
- (5) Have a Facebook account, being able and willing to use Facebook Messenger, and have a mobile device that can access Facebook Messenger, and
- (6) Being able and willing to give written informed consent.

To take part in this study, you need to have your own Facebook account to operate the chatbot. We will ask you to use the chatbot and complete some tasks with your own device (smartphone, tablet, or laptop). During the process, you need to say-aloud every thought that comes to your mind, so that we can understand your thoughts on using the chatbot. After using the chatbot, we will have a brief follow-up interview to further understand your opinions.

You will need to meet in-person with one researcher. This includes 25 minutes of chatbot function test and a 25 minutes interview (approximately 1 hour in total). In consideration of the COVID-19 situation, we will follow the public health orders from the Government of Alberta and requirements of the Chief Medical Officer of Health. We will maintain at least two meters of social distancing and provide surgical masks and hand sanitizer at the meeting.

You will receive a **\$35** gift card as an appreciation for your participation, even if you withdraw from the study.

If you want to take part in this study or have any concerns or questions, please contact **hueitsz@ualberta.ca** for details.

Appendix L – Phase Three: Chatbot Prototype Usability Tasks

Task	Check <input type="checkbox"/> if complete
1 Find Action Over Inertia on Facebook and start conversation with the AOI chatbot.	<input type="checkbox"/>
2 When performing Task 3-11, click Yes, I'll do it when see activity ideas that you are interested in doing.	<input type="checkbox"/>
3 Select Physical activity, choose to see one of the activity ideas. (see more information and link to online resources if applicable)	<input type="checkbox"/>
4 Go back to the idea list and choose another Physical activity idea. (see more information and link to online resources if applicable)	<input type="checkbox"/>
5 Use menu, select Social Connections, choose to see one of the activity ideas. (see more information and link to online resources if applicable)	<input type="checkbox"/>
6 Go back to the idea list and choose another Social Connections idea. (see more information and link to online resources if applicable)	<input type="checkbox"/>
7 Use menu, select Access to community, choose to see one of the activity ideas. (see more information and link to online resources if applicable)	<input type="checkbox"/>
8 Go back to the idea list and choose another Access to community idea. (see more information and link to online resources if applicable)	<input type="checkbox"/>
9 Use menu, select Based on gender & age, choose to see one of the activity ideas. (see more information and link to online resources if applicable)	<input type="checkbox"/>
10 Go back to the idea list and choose another Based on gender & age idea. (see more information and link to online resources if applicable)	<input type="checkbox"/>
11 Use menu, select Random activity idea and see 5 activity ideas. (see more information and link to online resources if applicable)	<input type="checkbox"/>

Appendix M – Phase Three: Technology Acceptance Questionnaire

We would like to know a bit about you.

1. What is your age as of today? _____

2. How do you identify your gender?

Male Female Other

3. Highest level of education attained?

Less than high school High school, no diploma High school graduated, diploma or the equivalent Some college credits, no degree Technical/ Vocational training Associate degree Bachelor's degree Master's degree Doctorate degree

4. Your current employment status?

Full-time employed Part-time employed Unemployed Retired Other, please specify: _____

5. Frequency of using messaging app/platform (e.g., Facebook Messenger, WhatsApp, Telegram..., etc.)?

Daily Weekly Less than once per week Never

[CONTINUE ON THE NEXT PAGE]

The purpose of this questionnaire is to get a preliminary understanding of your experience and opinions on using the Action over Inertia chatbot. Please rate items 1 to 15 using the scale to indicate your level of agreement. Please mark only one box per item.

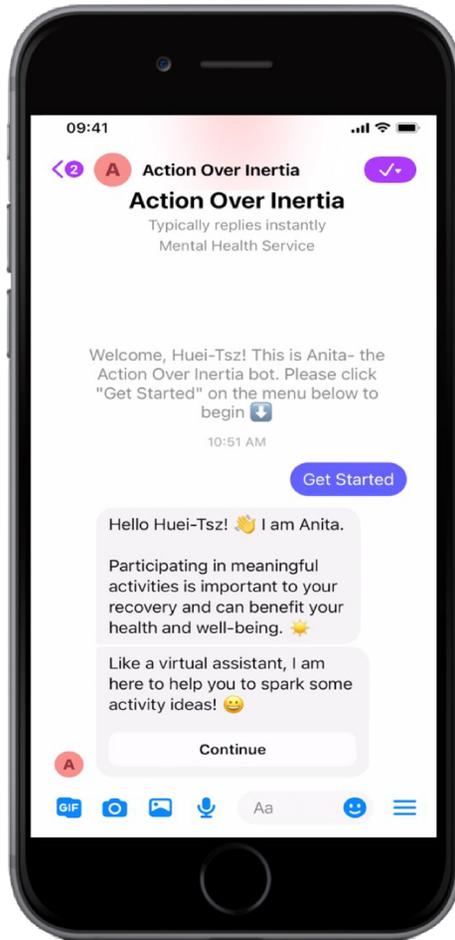
After finishing this survey, the researcher will ask you some questions based on the items and get more in-depth information.

		Strongly disagree	Quite disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Quite agree	Strongly agree
1	The activity ideas suggested by this chatbot are activities that I would like to do more.							
2	The activity ideas suggested by this chatbot are important activities to me.							
3	The activity ideas suggested by this chatbot are achievable.							
4	This chatbot gives appropriate suggestions for increasing physical activity.							
5	This chatbot gives appropriate suggestions for increasing social interactions with others.							
6	This chatbot gives appropriate suggestions for increasing access to various places in the community.							
7	The messages sent by this chatbot were encouraging.							
8	Learning to use this chatbot was easy for me.							
9	I found the chatbot easy to use and to understand.							
10	Learning to use this chatbot does not take too long.							
11	It was easy to get the chatbot to show the information that I want to see.							

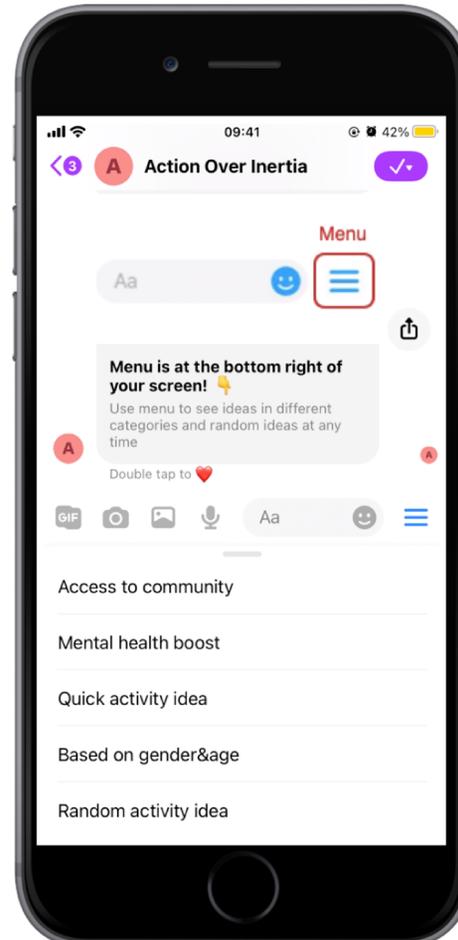
12	I have the resources necessary to use this chatbot. (Device and access to the internet)							
13	I feel safe using this chatbot.							
14	I would use this chatbot in the future.							
15	I would recommend my peers to use this chatbot.							

Appendix N – Modified Chatbot Features

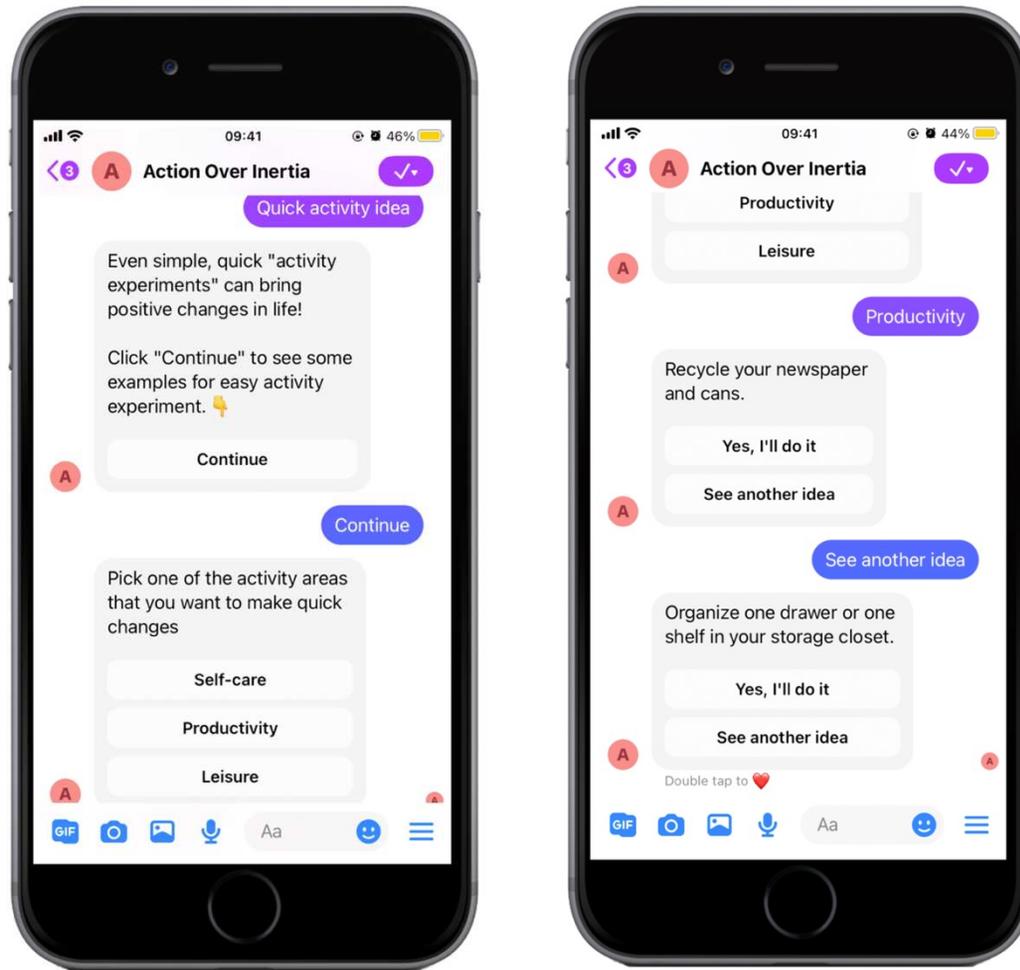
Modified message	Original message
Taking photos every Sunday and exploring a little deeper in Edmonton would be a great idea!	Grab your camera every Sunday and explore a little deeper in Edmonton would be a great idea!
Hiking is good for you both physically and mentally! Pick a weekend in every month, admiring the beauty of nature would be nice.	Hiking is good for you both physically and mentally! Pick a weekend in every month and ask family and friends to admire the beauty of nature together.
Pick one Saturday in every month and spend time in the River Vally Parks would be a great idea!	Pick a Saturday every month and spend time with your family and friends in the River Valley Parks would be a great idea.
Modified button name	Original button name
Back to idea list	Woman under 30; Woman between 31 to 50; Woman above 51; Man under 30; Man between 31 to 50; Man above 51, People under 30, People between 31 to 50, People above 51
Report issue	Talk to human



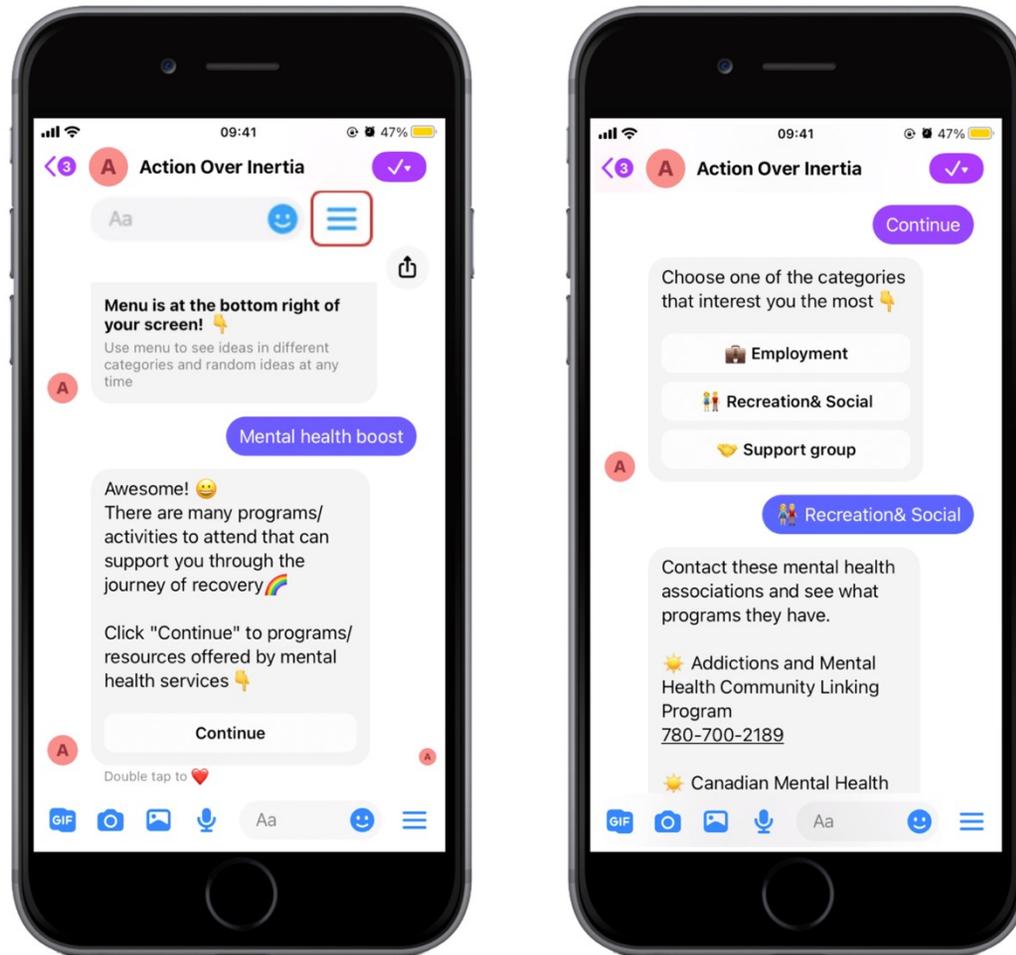
The chatbot introducing itself as Anita.



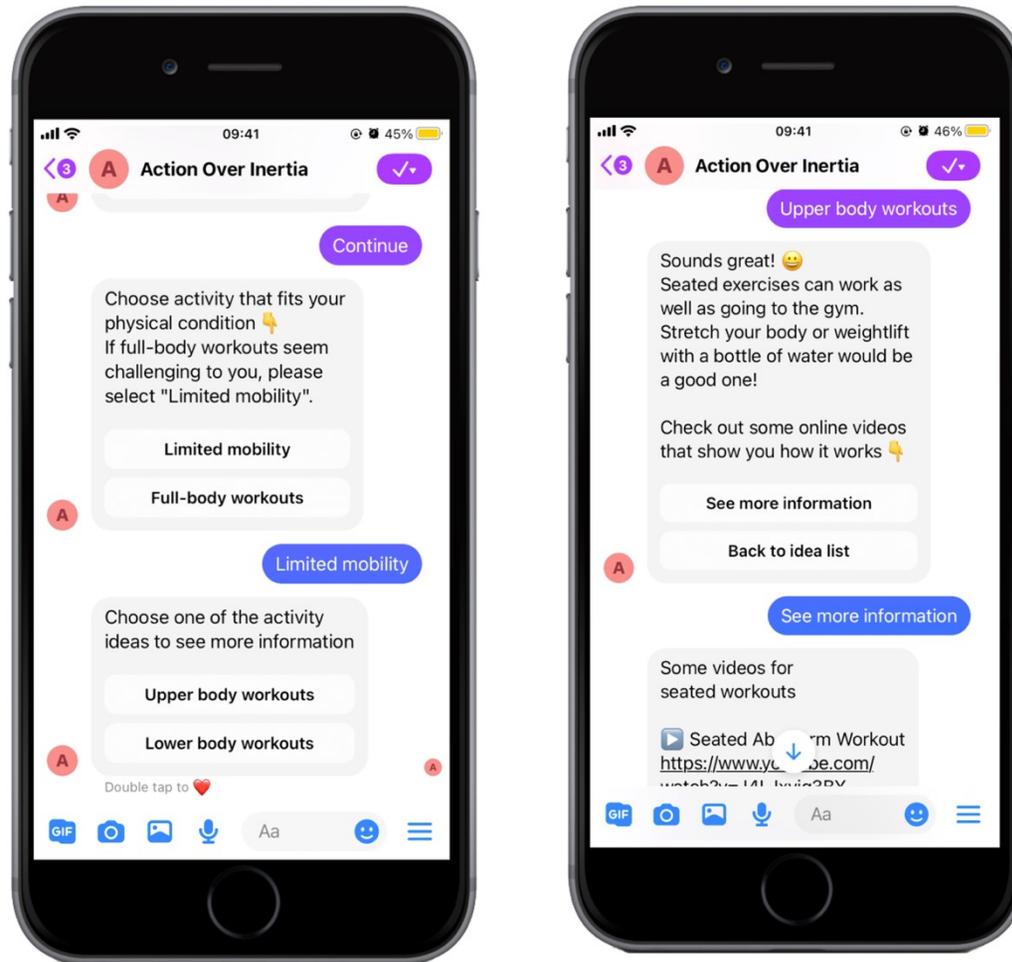
Two activity categories added in the menu: Quick activity idea and Mental Health Boost.



Quick activity idea: the chatbot provide activity ideas that can be done rapidly.



Mental Health Boost: the chatbot provide information that people with mental health issues might be most concerned about.



Physical activity: further include physical activity ideas that can be done by people with limited mobility.