Mental Health Engagement Network (MHEN)

Dr. Cheryl Forchuk, Professor and Associate Director
Nursing Research
Western University
cforchuk@uwo.ca
London, Canada

Dr. Abraham Rudnick, Associate Professor
Department of Psychiatry
abraham.rudnick@viha.ca
University of British Columbia
London, Ontario

Dr. Jeffrey Hoch, Health Economist and
Research Scientist,
St. Michael's Hospital
jeffrey.hoch@utoronto.ca
Toronto, Canada

Mike Godin, Team Leader
Housing Program
Canadian Mental Health Association
mike@london.cmha.ca
London, Canada

Dr. Lorie Donelle, Assistant Professor
Faculty of Health Sciences
Western University
ldonelle@uwo.ca
London, Canada

Dr. Diane Rasmussen, Assistant Professor
Faculty of Information & Media Studies
Western University
dneal2@uwo.ca
London, Canada

Dr. Robbie Campbell, Associate Professor
Department of Psychiatry and Physician Lead
Regional Mental Health Care
robbie.campbell@sjhc.london.on.ca
London, Canada

Walter Osoka, Peer Specialist
Can-Voice
woetime9@yahoo.ca
London, Canada

Betty Edwards, Community Reach Coordinator
Can-Voice
bae.canvoice@yahoo.ca
London, Canada

Dr. Elizabeth Osuch, Associate Professor
Department of Psychiatry
Western University
elizabeth.osuch@lhsc.on.ca
London, Canada

Dr. Ross Norman, Professor
Department of Psychiatry
Western University
rnorman@uwo.ca
London, Canada

Dr. Evelyn Vingillis, Professor
Schulich School of Medicine and Dentistry
Western University
evingili@uwo.ca
London, Canada

Dr. Beth Mitchell, Director
Mental Health Program
London Health Sciences Centre
beth.mitchell@lhsc.on.ca
London, Canada

Dr. Jeffrey Reiss, Professor & Vice Chair
Department of Psychiatry, Western University, Site Chief,
Mental Health Program, LHSC
jeffrey.reiss@lhsc.on.ca
London, Canada

Mike Petrenko, Executive Director
Canadian Mental Health Association
mpetrenko@london.cmha.ca
London, Canada

Dr. Deb Corring, Administrative Psychiatric Lead
Mental Health Transformation
Regional Mental Health Care
deb.corring@sjhc.london.on.ca
London, Canada

Meaghan McKillop, MA
Lawson Health Research Institute
meaghan.mckillop@lawsonresearch.com
London, Canada

Abstract— This research study introduces, delivers, and evaluates the benefits of using web and mobile technology to provide consistent supportive health care to individuals living within London, Ontario and the surrounding area who have been diagnosed with a mental illness. This longitudinal, mixed method study consists of 400 (245 men and 155 women) individuals who have been diagnosed with either a mood or a psychotic disorder who are currently working with mental health care professionals (54 mental health care providers across 4 agencies). The participants will have access to the Lawson SMART record, a web-based application that provides individuals with a personal health record, and tools to help them manage their health. Participants will access the Lawson SMART record using an iPhone 4S. Based on preliminary findings, client participants are generally comfortable with the use of technology. Most indicated that they were either extremely comfortable (26.3%) or slightly comfortable (20.3%) with technology generally, while only a minority said that they were either slightly uncomfortable (4.0%) or extremely uncomfortable (5.8%). It is hypothesized that the use of smart technologies in the treatment of mood and psychotic disorders will improve quality of life while reducing health care costs through a decrease in hospitalizations and hospital room visits. The Mental Health Engagement Network: Connecting Clients with their Health Team project was presented at IARIA-Smart 2012 Conference by Dr. Cheryl Forchuk in May 2012 [1]. As a result of the presentation, this paper was developed.

Keywords- SMART Technology; Mental Health Care; Personal Health Records; Quality of Life; Health Care Costs; Mood Monitor; Mobile Technology; Web-based Technology

I. INTRODUCTION

The economic cost of mental illness to Canada was recently estimated at $51 billion annually, and still the current "system" of care is fragmented and without sufficient resources (financial, human, and technological), per "The Healthcare Interview" Canadian Healthcare Network, December 2009 [2]. The 2009 cost estimates showed a dramatic increase from 2003, when it was estimated that the Canadian economic burden due to mental illness was ~ $34 billion ($1,056 per capita), which was a 3-fold increase from 1998 estimations of $12.3 billion. Twenty percent of Canadians will experience a mental illness in their lifetime and most others will experience mental illness indirectly through a family member, friend, or colleague. Mental illness affects people of all ages, regardless of education, income level, or culture [3]. With mental health services at a crisis point, even though billions of dollars are being invested to help, most people in need of care will not receive the care they require [4].

Commonly, mental health care is prioritized for individuals with the most severe symptoms, due to the lack of available services. This runs counter to the general health care system where prevention and intervention at less serious levels is the norm. The current way of treating psychiatric illness is unsustainable and only through developing new service models that provide support and early intervention, will the mental health care system be sustainable. A new and potentially more sustainable method of providing mental health care would be that of employing smart technologies to enhance the treatment of mental health clients.

The Mental Health Engagement Network (MHEN) is focused on putting technology in the hands of mental health clients and their mental health care providers to demonstrate a more effective and efficient mental health care service delivery model. In partnership with TELUS Health Solutions, this project will deploy TELUS health space™ consumer health platform along with a customized personal health record application, the Lawson SMART record, and interactive tools that support a novel way to provide clients with standardized health services, ongoing monitoring and regular communication with their mental health care providers. This innovative solution will help coordinate care across the continuum; ensuring that services are more accessible, patient-centered, and promote the empowerment of individuals so they can better manage their own health. From a population perspective, this proposed system re-design will have the capability to reduce or prevent acute episodes of mental illness and reduce the severe pressures on an already over burden health care system.

This document proceeds as follows. Section II provides an overview of existing literature and applications. Section III describes the methods employed by the MHEN project. The expected outcomes are outlined in Section IV and the conclusion is presented in Section V.

II. LITERATURE REVIEW

A. Existing Studies

In recent years there has been a growing body of research evaluating the benefits of using mobile and web based technology to help individuals better manage their health.

Studies evaluating the use of web-based interventions, including online learning programs, Personal Health Records (PHR), e-therapy, and online databases with access to mental health resources, have shown that these types of interventions have positive outcomes for mental health clients. For example, a study employing, Anxiety Online, an educational website which provides information about anxiety disorders, links to useful resources, psychological assessments and a referral system found e-mental health treatment increases accessibility to mental health care in a cost effective and efficient way. The authors also indicate that this type of technology may encourage individuals to access mental health treatment who would not otherwise access traditional forms of treatment due to stigma [5].

Another study, evaluated the use of an online cognitive behavioural therapy based treatment for depression, with a sample of 141 individuals diagnosed with major depressive disorder. The authors found that participants in the intervention group experienced a reduction in symptoms of depression and better clinical outcomes than the control group [6].

Other studies evaluating the use of mobile-based interventions, including text-messaging and mobile applications, have also shown that this type of intervention has positive outcomes for individuals with mental health

issues. For example, one study in which 55 clients with schizophrenia or schizoaffective disorder received a cell phone and a text messaging based intervention found that medication adherence and social interactions increased significantly [7].

Another study with a similar population, of 154 participants diagnosed with schizophrenia, employing a text messaging based intervention found improvement in medication adherence among participants after 3 months, and improvement among negative, cognitive and global symptoms [8].

The MHEN project will contribute to the existing literature by providing an analysis to the effectiveness of a combination of web and mobile-based technologies in mental health care.

B. Applications

Several applications, both mobile and web based, have been developed employing smart technology to support health care. Examples include: My Mood Monitor [9] and MedHelp's Mood Tracker [10], which are both applications designed to monitor a user's mood; medication adherence assistance applications such as RxReminder [11]; the Mobile Assessment and Treatment for Schizophrenia (MATS) [7] which is an interactive text-messaging intervention; and the use of Personal Health Records/Electronic Health Records [12].

The MHEN project will contribute to the existing applications in that this web-based solution will employ all of these applications in one complete platform. Participants will have access to an electronic Personal Health Record, and to tools that will assist in the management of their health. Additionally, the MHEN project will contribute to the existing literature in that the effectiveness of these applications has not been extensively researched, particularly in mental health care.

III. METHODS

The following subsections describe the methods employed in the MHEN project.

A. Study Design

This research study began in September, 2011 and will conclude in November, 2013. It includes 54 community mental health providers and 400 clients who have been diagnosed with a mood disorder or a psychotic disorder. Client participants were randomized into Group 1 (early intervention) or Group 2 (later intervention) by care provider caseload, so that participating mental health care providers would have roughly 4 participants in Group 1 and Group 2.

Group 1 (200 participants) received an iPhone 4S, a TELUS health space™ account, and version 1.0 of the Lawson SMART record during Phase I (August 2012). The remaining 200 clients, Group 2, will initially act as a control group, and at Phase II (6 months later) will receive an iPhone 4S, a TELUS health space™ account, and version 2.0 of the Lawson SMART record. The participating mental health care providers will receive a Lawson SMART record account and an iPad during Phase I.

In addition to the tools deployed through the MHEN project, 12 month voice and data plans will be provided to client participants. Similarly, 18 month data plans will be provided to the mental health care provider participants.

B. Sample

The 400 client participants and 54 community mental health care provider participants were recruited from January, 2012 to August, 2012. Participants were recruited through community programs at London Health Sciences Centre and St. Joseph's Health Care, as well as through the Canadian Mental Health Association (London-Middlesex Branch) and WOTCH Community Mental Health Services.

London Health Sciences Centre Adult Mental Health Care Program offers a wide range of programs, including Prevention and Early Intervention Program for Psychoses, the First Episode Mood and Anxiety Program, and Geriatric Mental Health Program to support adults living in the community with mental illness. St. Joseph's Health Care governs Regional Mental Health Care - London and St. Thomas and both of these sites are participating in the MHEN project. Services offered include, Mood and Anxiety Programs, Transition to Primary Care Program, Forensic Outreach, a Schizophrenia Program, and Assertive Community Treatment teams. WOTCH Community Mental Health Services provides adults over 16 years of age who are managing serious mental illness many services including: one-on-one counseling, housing support, employment support, family support, and access to health services. The Canadian Mental Health Association (London-Middlesex) provides individuals living in the community with many services including, Court Support and Diversion programs, Housing Advocacy programs, the Justice-Community Support Program, Crisis Services, and peer support groups.

Mental health care provider participants were recruited through presentations at regularly held staff meetings at the participating agencies. Mental health care providers were eligible to participate if they had at least 8 clients on their caseload with mood or psychotic disorders, and if they were willing to employ the health information technology in addition to the regular care they provide. Of the 54 mental health care providers, 28 were recruited from St. Joseph's Health Care (12 community mental health care teams), 12 from London Health Sciences Centre (2 community mental health care teams), 7 from the Canadian Mental Health Association (London-Middlesex), and 7 from WOTCH Community Mental Health Services. The participating mental health care workers consists of 12 Registered Nurses, 12 Registered Social Workers, 7 Occupational Therapists, 7 Mental Health Care Managers, 4 Social Service Workers, 3 Rehabilitation Counselors, 2 Recreational Therapists, 2 Registered Practical Nurses, 2 Psychiatrists and 3 other (See Tables I and II).

TABLE I. DESCRIPTION OF COMMUNITY MENTAL HEALTH CARE PROVIDERS – AGENCY

Variable	Description of Community Mental Health Care Providers (N = 54)		
	Sub Variable	*Frequency*	*Percentage*
Agency			
	St. Joseph's Health Care London	29	53.7
	London Health Sciences Centre	11	20.4
	Canadian Mental Health Association	7	12.9
	WOTCH Community Mental Health Services	7	12.9

TABLE II. DESCRIPTION OF COMMUNITY MENTAL HEALTH CARE PROVIDERS – OCCUPATION

Variable	Description of Community Mental health Care Providers (N = 54)		
	Sub Variable	*Frequency*	*Percentage*
Occupation			
	Social Service Worker	12	22.2
	Registered Nurse	12	22.2
	Mental Health Case Manager	7	13
	Occupational Therapist	7	13
	Registered Social Worker	3	5.6
	Rehabilition Counselor	3	5.6
	Recreational Therapist	2	3.7
	Registered Practical Nurse	2	3.7
	Psychiatrist	2	3.7
	Other	4	7.4

Client participants were recruited from the caseloads of participating care providers. Eligible client participants had either a mood or a psychotic disorder and were between the ages of 18 and 80. Of the 400 client participants, 192 were recruited from St. Joseph's Health Care, 96 from London Health Sciences Centre, 48 from the Canadian Mental Health Association (London-Middlesex), and 62 from WOTCH Community Mental Health Services (See Table III).

TABLE III. CLIENTS PARTICIPANTS BY AGNECY

Variable	Client Participants (N = 410)		
	Sub Variable	*Frequency*	*Percentage*
Agency			
	St. Joseph's Health Care London	192	48
	London Health Sciences Centre	96	24
	Canadian Mental Health Association	48	12
	WOTCH Community Mental Health Services	62	15.5

C. The Lawson SMART record

The Lawson SMART record was developed in partnership with TELUS Health Solutions and an advisory group with community, clinical, consumer and technical representation. The solution employs TELUS health space™, a consumer platform powered by Microsoft® Health Vault™. TELUS health space™ is an electronic health care system, that allows individuals to store and manage health information and to share this information with their care providers. The Lawson SMART record is an application provided through TELUS health space™ to participants of the MHEN project.

The Lawson SMART record is a web-based application that provides individuals with an electronic personal health record. Through this record, individuals can store, maintain, and manage their personal health information (i.e. list of medications, family history, immunization records, allergies, care provider contact information, care plans and crisis plans). The Lawson SMART record also provides individuals with tools to help them in the management of their health. For example, as part of the MHEN project, a mood monitor was developed. This tool allows individuals to determine their mood at any given time and track it electronically. Through the Lawson SMART record client participants also have the ability to set prompts and reminders for themselves, where they can be reminded about upcoming appointments, when to take medications or when to exercise. Individuals can also electronically track physiological measures such as weight, blood glucose, blood pressure and cholesterol.

Through the MHEN project, the participating mental health care providers have electronic access to their participating client's Lawson SMART record. This access will allow the mental health care providers to view the information within their client's record, and to communicate directly with their clients through the Lawson SMART record's messaging tool.

D. Training

As a requirement of the MHEN project, participating clients and mental health care providers must complete one half-day training session to learn about the Lawson SMART record and their handheld device. A training committee with representation from the consumer, clinical, community and technical perspectives was created to guide the development of training content and materials. Each training session was structured to include Lawson SMART record and TELUS health space™ account creation, a live demonstration of the Lawson SMART record, during which the participants followed along using their handheld devices, instruction on the basic features of their respective handheld devices, and delivery of the guidelines associated with the use of their handheld devices and the Lawson SMART record. Participants also received a training manual which described the features and functions of the Lawson SMART record, outlined the guidelines for use of the Lawson SMART record and their handheld devices, and described the project support model.

Mental health care provider training sessions were held in June, 2012. Participants were trained in groups of up to 15 individuals. Each training session was approximately 3 hours in length and was facilitated by a member of the research team. Additional training sessions were held in September, 2012 to provide ongoing support as the Lawson SMART record and iPhones were deployed to their clients. The research team also developed a support model to manage hardware, software and application inquiries from the participating mental health care providers. After client training began and mental health care providers began to use the application and iPad, the research team did receive inquiries ranging from simple password resets to in depth support on the Lawson SMART record.

Client participant training began in July, 2012 and was completed in September, 2012. Clients from Group 1 were trained in groups of up to 15 participants per session. Each training session was approximately 3 hours in length and was facilitated by a member of the research team. Drop in sessions were held twice a week throughout the month of August and September, 2012 to provide additional support to client participants. Initial inquiries to the research team ranged from basic iPhone support, email support, phone calling support, text messaging support, and downloading of applications and music to inquiries about the specific features and functions of the Lawson SMART record.

Client participant training for Group 2 is scheduled to begin in February 2013. Findings obtained through Group 1 client feedback on training evaluations will be applied to the structure and content of Group 2 training sessions, as well as to the mental health technology.

E. Data Collection

Individual interviews with client participants were held during the baseline period and then every 6 months for 18 months (See Fig. 1).

The quantitative data collected during interviews will involve the following eight questionnaires: Demographic Form; Quality of Life – Brief Version (QoL-BV); Health, Social, Justice Service Use; Medical Outcomes Study 36-item Short Form Health Survey (SF-36); EQ-5D; Community Integration Questionnaire; Adult Consumer Empowerment Scale; and a Perception of Smart Technology Form.
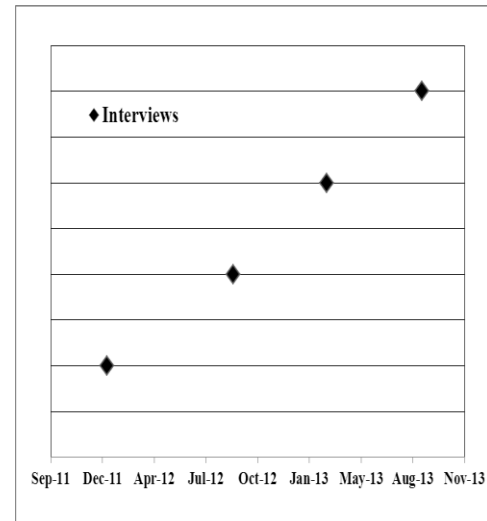

Figure 1. Interview Timeline

Focus group sessions will take place at multiple points during the study. Group 1 will have the option to participate in three focus group sessions: (1) approximately one month after receiving the handheld device and a TELUS health space™ account to discuss usability and adoption; (2) follow up focus group sessions will be held two months thereafter to discuss the benefits and pitfalls associated with the technology and to form base recommendations for the next phase of study (Group 2); and (3) 6 months later to discuss future recommendations. Group 2 will also have the opportunity to participate in 3 focus group sessions. They will meet in a similar timeframe: (1) approximately one month after receiving the handheld device and a TELUS health space™ account to discuss usability and adoption; (2) follow up focus group sessions will be held two months thereafter to discuss the benefits and pitfalls associated with the technology; and (3) 6 months later to discuss future recommendations. Focus group sessions with mental health care providers will also be held at similar time points so that issues can be identified and addressed quickly (See Fig. 2).

The knowledge learned through Group 1, over the initial 6 months will provide baseline and comparative data to understand the client's perceptions for designs and outcome purposes of the technology intervention. Improvements in the technology approaches made during the initial 6 month period will enhance the tools for Group 2. We are expecting different feedback from focus group sessions, one to guide development and one to improve what is developed.
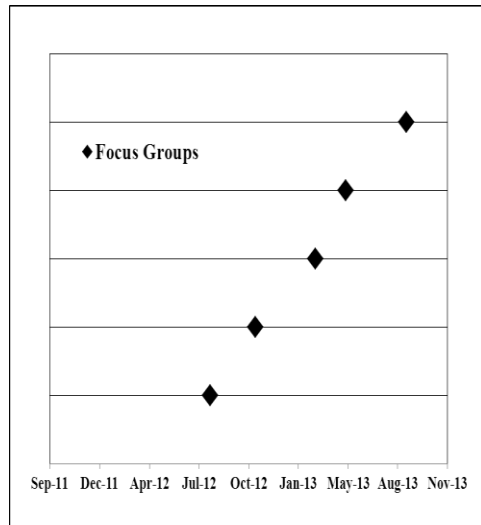
Figure 2. Focus Group Timeline

IV. BASELINE RESULTS

A. Baseline Interviews

Preliminary quantitative data analysis of 400 client participants (245 men and 155 women) indicates that the mean age of the population is 38.48 (SD = 13.792). A large population of client participants reported to be single and never married (69.5%), and to be living alone (41.5%). A majority of client participants completed high school (44.5%), or just grade school (31%). The most common psychiatric diagnoses in this sample population are mood disorders (59.25%), psychotic disorders (58.25%), anxiety disorders (32%), substance-related disorders (13.75%), personality disorders (6.25%), disorders of childhood/adolescence (5%) and developmental handicaps (0.75%). Most client participants indicated that they have been admitted to the psychiatric hospital at least once (85.75%) and of those individuals, most have been admitted a mean of 7.7 times (SD = 10.815) (See Table IV, V, and VI).

TABLE IV.   DESCRIPTION OF CLIENT PARTICIPANTS – AGE

Variable	Description of Client Participants (N=410)		
	Mean	*Standard Deviation*	*Range*
Age	38.5 years	13.8	18-78
Age at first contact with mental health system	22 years	9	3-61
Estimated total number of hospitalization	7.7	10.8	1-100

TABLE V.   DESCRIPTION OF CLIENT PARTICIPANTS – SEX, MARITAL STATUS, FAMILY, LIVING ARRANGEMENTS, EDUCATION LEVEL AND EMPLOYMENT

Variable	Description of Client Participants (N=410)		
	Sub Variable	*Frequency*	*Percentage*
Sex			
	Male	245	61.3
	Female	155	38.8
Marital Status			
	Married or Common Law	36	9
	Seperated Divorce	83	20.8
	Single-Never Married	278	69.5
	Widowed	3	0.8
Having Children			
	Yes	125	31.3
	No	275	68.8
Current Living Arrangement			
	Inpatients	11	2.8
	Lives alone	166	41.5
	Lives with other relative	20	5
	Lives with parent(s)	71	17.8
	Lives with spouse/partner	42	10.5
	Lives with unrelated person	88	22
	Other	2	0.5
Level of Education			
	Community College/ University	95	23.9
	High School	178	44.5
	Grade School	124	31
	Don't Know	1	0.3
	Other	2	0.5
Currently Employed			
	Yes	102	22.5
	No	298	74.5

TABLE VI.   DESCRIPTION OF CLIENT PARTICIPANTS – PSYCHIATRIC DIAGNOSIS AND HOSPITALIZATIONS

Variable	Description of Client Participants (N=410)		
	Sub Variable	*Frequency*	*Percentage*
Pscyhiatric Diagnosis			
	Developmental Handicap	3	0.75
	Anxiety Disorder	128	32
	Disorder of Childhood and Adolescence	20	5
	Organic Disorder	3	0.75
	Susbtance-related Disorder	55	13.75
	Personality Disorder	25	6.25
	Psychotic Disorder	233	58.25
	Mood Disorder	237	59.25
	Other	10	2.5
	Unknown	2	0.5
Ever had a psychiatric hospitalization			
	Yes	343	85.75
	No	56	14

Initial quantitative analysis shows that most client participants are generally comfortable with the use of technology. Most indicated that they were either extremely comfortable (26.3%) or slightly comfortable (20.3%) with technology generally, while only a minority said that they were either slightly uncomfortable (4.0%) or extremely uncomfortable (5.8%) with technology generally (See Fig. 3).
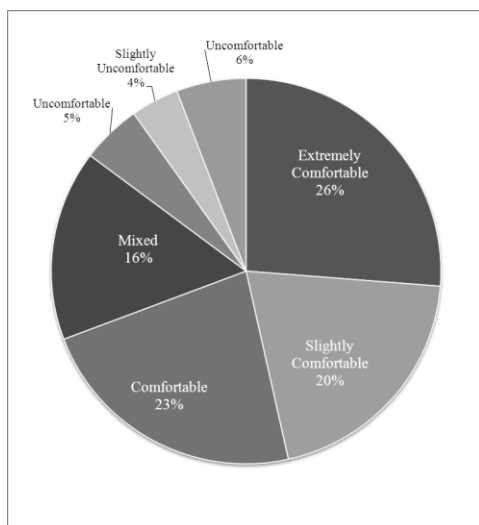

Figure 3.   How comfortable are you with technology in general?

A number of individuals owned a phone (90.3%) however, less than half of the population (43.3%) owned a cell phone (See Fig. 4 and Fig. 5). Most participants indicated that they used a phone frequently (73.1%), (See Fig. 6).

Participants also indicated that they had regular access to a computer (77%) with a large percentage of the population (60.5%) reporting regular access at home (See Fig. 7 and 8). Additionally, participants indicated frequent use of computers (43.8%) (Fig. 9) and most stated that they were extremely comfortable (31.2%) or slightly comfortable (14.6%) with using a computer, while only a smaller percentage of the population indicated that they were either slightly uncomfortable (4.5%) or extremely uncomfortable (9.8%) with using a computer (See Fig. 10).

This indicates that since most client participants are familiar and comfortable with technology and suggests that they will be receptive to the interventions smart technology training.
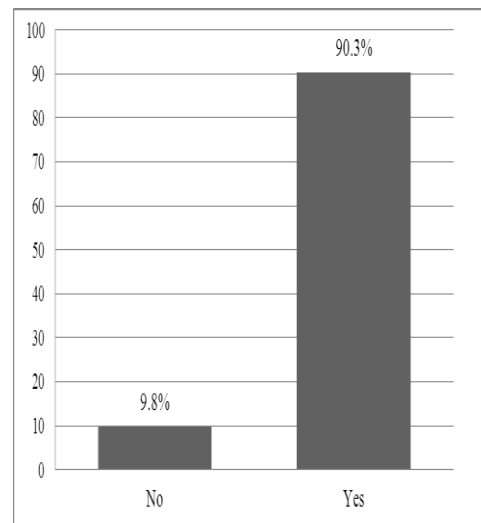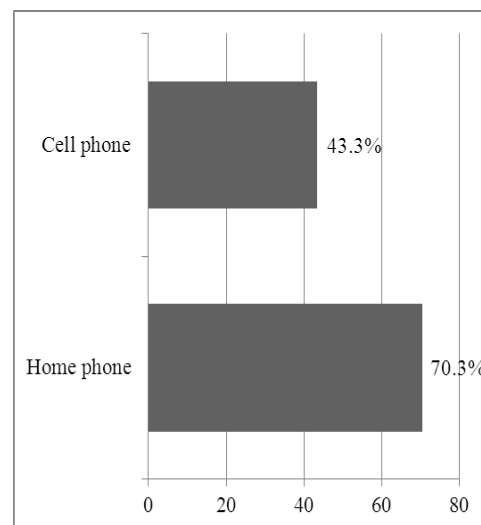

Figure 4.   Do you own a phone?
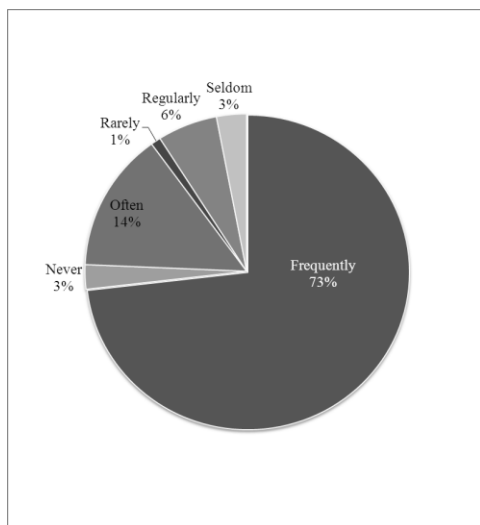

Figure 5.   Type of phone owned?
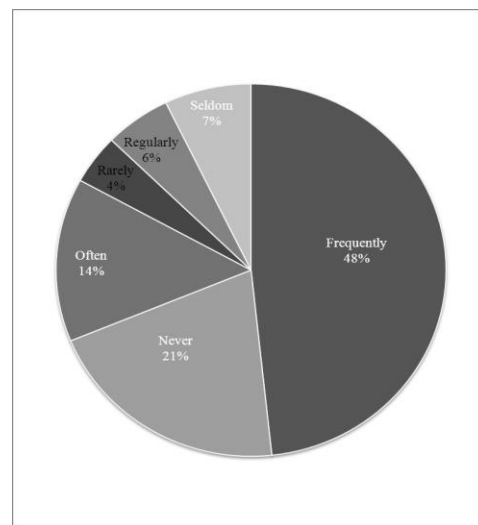
Figure 6.   Use of phone?
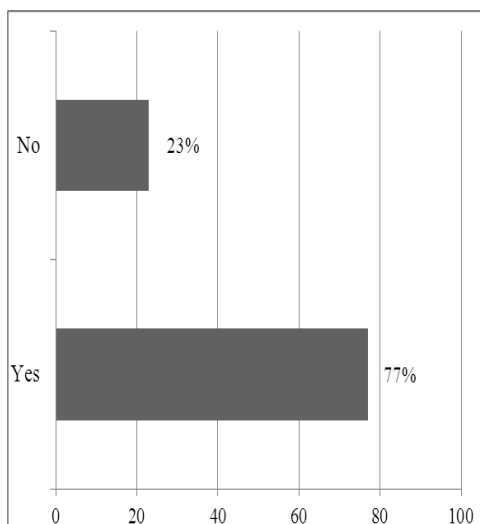

Figure 9.   Use of computer?

Figure 7.   Do you currently hace access to a computer on a regular basis?
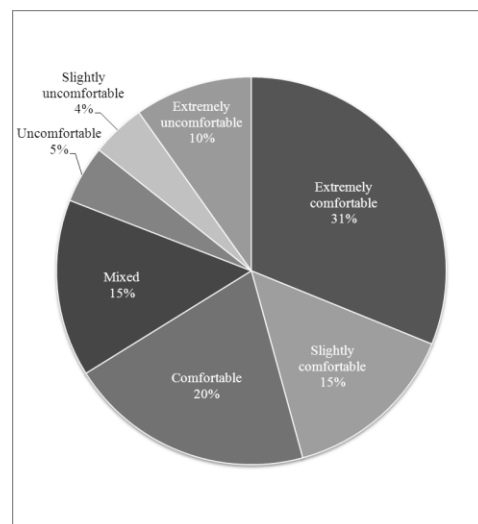

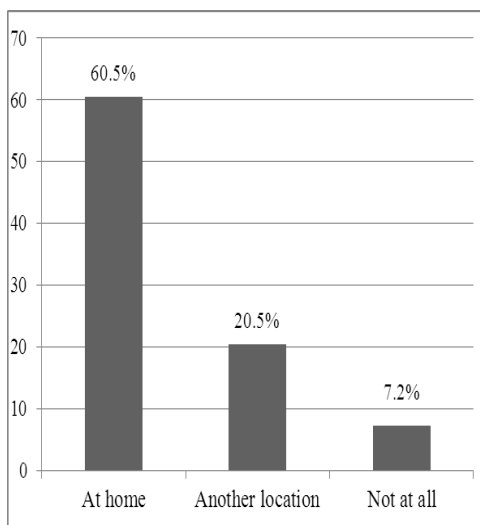Figure 10. Comfort with computers?

Figure 8.   Location of access to a computer?

B.   Initial Focus Group Sessions

Focus group sessions have been completed for the early intervention group with both client participants and mental health care provider participants. In total there were 5 client focus group sessions with 21 participants, and 3 mental health care provider focus group sessions with 21 participants (See Table VII and VIII).

Overall the feedback was positive and participants gave many examples of how the technology improved health care and health status. For example, one mental health care provider stated that a client he had been seeing for 2 years made more progress in the meeting after receiving the technology than the 2 years prior. The mental health care provider indicated that this was because the client had a focus for discussion and was able to use the device to organize himself. Client participants gave examples of having a better understanding of the patterns of their moods, which provided them more sense of control. One client

visited an emergency ward for a medical situation and was able to access his Lawson SMART record using his iPhone and show the emergency staff his list of medications.

During focus group sessions both clients and providers also identified ways the strategy could be further improved. Client participants focused on very pragmatic issues such as faster log-in, a calendar available on the homepage, and pictures of pills. Similarly mental health care providers wanted a notification mechanism for messages received from their clients and confirmation that clients had received messages they had sent. Follow up focus group sessions for both clients and mental health care provider participants will be held early 2013.

Phase II development of the Lawson SMART record began in December 2012. The project team has based this development on feedback from the initial focus group sessions. Enhancements to the Lawson SMART record are to be delivered early 2013. Once Phase II developments are complete client participants in Group 2, will receive the intervention.

TABLE VII.   FOCUS GROUP SESSIONS: MENTAL HEALTH CARE PROVIDER PARTICIPANTS

Variable	Focus Group Sessions: Mental Health Care Provider Participants (N=21)		
	Sub Variable	*Frequency*	*Percentage*
Agency			
	St. Joseph's Health Care London	5	23.81
	London Health Sciences Centre	7	33.33
	Canadian Mental Health Association	4	19.05
	WOTCH Community Mental Health Services	5	23.81

TABLE VIII.   FOCUS GROUP SESSIONS: CLIENT PARTICIPANTS

Variable	Focus Group Sessions: Client Participants (N=21)		
	Sub Variable	*Frequency*	*Percentage*
Agency			
	St. Joseph's Health Care London	9	42.86
	London Health Sciences Centre	7	33.33
	Canadian Mental Health Association	2	9.52
	WOTCH Community Mental Health Services	3	14.29

V.   EXPECTED RESULTS

Baseline data was complete in August, 2012. Training and implementation of the first 200 participants began on July 30, 2012 and was completed September 2012. Additional data, including use of technology, will be available in January, 2013.

The overall hypothesis is that smart health information technology will improve quality of life and reduce health care system costs. To test this hypothesis we will use an evaluation framework that includes four levels of analysis: effectiveness, economic, ethical and policy. Development

and testing of a more cost-effective means of addressing mental health issues will increase the ability to provide the best practice at an affordable cost which benefits consumers and taxpayers.

With the introduction of the Lawson SMART record several outcomes are expected. For example, with the introduction of medication prompts, scheduling, ongoing monitoring and regular communication, it is expected that clients will experience an improvement in mental health. Additionally, with the introduction of medication prompts, monitoring, and prescription renewal reminders, it is expected that there will be a resulting improvement in overall medication adherence.

The availability of personal health information to a client is foundational to empowerment and to the effective management of an individual's own health and wellness. The ability to store, maintain and manage one's personal health information as provided through the Lawson SMART record and is expected to increase individual empowerment.

The Lawson SMART record also provides a forum for communication between client participants and their mental health care providers. It is expected that with this increased communication, individuals will have greater access to the mental health care system. With this greater access, it is expected that mental health care providers will be able to intervene when clients are experiencing earlier stages of crisis. It is also expected that with greater access to community mental health care resources, there will be a decrease in the use of expensive emergency mental health care services.

Overall, it is expected that with the introduction of the Lawson SMART record, client participants will experience an improvement in their mental health and obtain greater access to the mental health care system.

VI.   CONCLUSION

The MHEN project is focused on putting technology in the hands of clients of the mental health system and their mental health care providers to demonstrate how to more effectively and efficiently deliver mental health care services. Employing the Lawson SMART record, the MHEN project will evaluate the use of Smart technologies in mental health care on four levels: effectiveness, economic, ethical and policy. Smart technologies, have the potential to improve the quality of care for people who access mental health services. Continued evaluation of personalized health records and specific mental health applications will provide important information for mental health system re-design.

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