TELEPROM-G: A Study Evaluating Access and Care Delivery of Telehealth Services among Community-Based Seniors with Depressive Symptoms

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Abstract— **Depression has been identified as a leading cause of frailty worldwide. Factors which contribute to an effective implementation of Telehealth/eHealth among seniors living with depressive symptoms remain understudied. Research has linked technology-geared mental health care delivery to better healthcare outcomes. Rigorous scientific evidence on the efficacy of ehealth technology, for example smartphone applications, is lacking. The solution tested in this study was a web-based Telemedicine and Client-Reported Outcome Measurement platform, using a Chromebook device. Applying a mixed method design, this pilot study generated valuable insights regarding factors which facilitate positive experiences for seniors participating in an eHealth intervention. Further research studies on the implementation of the platform with seniors appears to be feasible since the present study was able to successfully recruit 30 client participants and retain 87% until the end of study. Results related to participants' perceptions of the smart technology suggest device features need modification to facilitate older adults' comfort with the platform.**

Keywords-depressive symptoms; eHealth; mental health; seniors; technology; Telehealth.

I. INTRODUCTION

Depression is considered the single largest contributor to global disability [1], highly prevalent among older adults, 65 years old and over [2][3], and linked to poor health outcomes, including reduced quality of life, comorbidity, and increased frailty [4]. Studies suggest that health care interventions delivered through Telehealth/eHealth technology may potentially improve health outcomes among seniors with depressive symptoms [5][6], and reduce hospital emergency and rates of admissions among seniors [7].

The improvement of health outcomes attributable to technology-geared mental health care delivery has been inconsistent across studies. Aburizik et al. [8] found that mobile psychotherapy sessions had a non-significant effect on chronic disease self-management and health-related quality of life. Piette et al. [9] found that the use of interactive voice response to maximize mobile health monitoring made no difference in improving health status, medication adherence, and days in bed. Pecina et al. [10], in a web-based intervention study of 205 American patients with comorbid medical and mental health disorders involving depression, found no significant effect on reported physical and mental status. Donker et al. [11], in a recent systematic review of eight smartphone studies for mental health care delivery, found that none demonstrated rigorous scientific evidence on the efficacy of smartphone applications. The scarcity of evidence on the efficacy of eHealth may be partially due to the fact that the majority of research on the use of mobile health technology has solely investigated the pre-implementation phase [12].

The TELEPROM-G pilot-study tested the feasibility for implementation of a Collaborative Health Record (CHR), a web-based platform designed for outcome-based health services delivery.

The rest of this paper is organized as follows. Section II outlines aims of the study. Section III discusses methodology. Results and discussion of results are presented in Section IV and Section V respectively. Section VI provides conclusions from the study and suggestions for future research.

II. AIMS OF THE STUDY

The primary aims of study were to: (1) examine the feasibility of implementing and evaluating the CHR platform in the older adult population; and 2) determine if further modifications to the CHR platform or deployment would be necessary. This study was guided by the following research questions: (1) what is the rate of participant recruitment from outpatient mental health programs? (2) what are the participants' perceptions of the CHR platform? (3) what is the estimated effect size for the impact of the CHR platform on community integration, quality of life, and other health indicators of senior participants?

III. METHODOLOGY

A. Participants

Eight Health Care Providers (HCPs) identified thirty of their clients who met the criteria for inclusion into the study: being diagnosed or self-diagnosed with depression, aged 65 years or older, living in the community, and willing to give informed consent to participate. Exclusion criteria consisted of having significant cognitive deficits, as determined by a Mini Mental State Examination (MMSE) [13] score of 19 or less, and scoring less than 5 on the Geriatric Depression Scale (GDS) [14]. A member of the research team recruited client participants who met inclusion criteria by obtaining their voluntary, informed consent.

B. Procedures

The study used a mixed method design to collect quantitative interview data prior to the study's intervention and at six months after the initial interview. This paper reports on quantitative results from individual client interviews. A structured interview was conducted upon enrollment with each participant. At the end of the interview each participant received a Wi-Fi enabled Chromebook device.

Participants were trained on how to use the Chromebook device and the web-based Collaborative Health Record (CHR) created by InputHealth, a Canadian digital health company. The CHR platform allowed for both synchronous and asynchronous communication between patients and care providers. This included receiving and completing questionnaires such as personal health information and self-assessments, a comprehensive mobile client record, and the opportunity for secure HCP-client communication such as face-to-face video sessions (virtual visits).

The research team ensured CHR platform user accounts and passwords were created for both HCP and client participants, that HCP participants were capable of sending invitations for virtual visits, and that all appropriate questionnaires were added to the CHR platform. Likewise, the research team ensured that client participants understood how to complete questionnaires and respond to virtual visit requests.

Quantitative data, consisting of baseline and final interviews, were conducted utilizing eight measures to assess demographics, community integration, depressive symptoms, suicidal ideation, quality of life, physical health, utilization of emergency services, and perceptions of smart technology.

The demographics form that was used covered basic items, such as age, gender, ethno-racial identity, indigenous status, and marital status. It also included questions assessing the presence of chronic physical illnesses and psychiatric illnesses, including symptoms of mental illness, types of psychiatric diagnoses, and total number of psychiatric admissions, as well as age at first contact with the mental health system, and age at first psychiatric admission. A Likert Scale measured participants comfort with various technologies and related tasks (using computers, tablets, smartphones, technology in general, Internet browsing, sending/receiving email, sending/receiving text messages, and using social media, etc.).

Community integration was measured via the Community Integration Questionnaire (CIQ) [15]. The CIQ consists of 15 questions and is intended as a brief, reliable, objective measure of a person's level of integration in the home and community. The overall score can range from 0 to 29, with a higher score indicating better integration. The CIQ can be divided into three subscales corresponding to home integration, social integration, and productivity [16]. The CIQ is based heavily on types of activities (e.g.., shopping, cooking), and assumes independent participation is a sign of greater integration than supported or mutual co-participation.

Depressive symptoms were measured using the short version of the GDS [14][17]. The GDS has been tested and used extensively with the older population in a variety of settings including the community and acute and long-term care settings. The overall score ranges from 0 to 15, with higher scores indicating higher levels of depression. Scores above 8 are indicative of major depression; while anything less indicates subclinical depressive symptoms [14].

The Geriatric Suicide Ideation Scale (GSIS) [18] was used to measure suicide ideation. The GSIS is a 31 question scale with scores ranging from 31 (low/no suicide ideation) to 165 (high level of suicide ideation). Total scores can be divided into 4 subscales: suicide ideation, death ideation, loss of personal and social worth, and perceived meaning in life. The GSIS has shown good internal consistency (total score a = 0.93, subscales a = 0.82 to 0.84) and good construct and criterion validity when measured against other validated instruments for depression, hopelessness, life-satisfaction, and psychological well-being [18].

The Health, Social, Justice Service Use (HSJSU) questionnaire [19] was utilized to assess the number of emergency room visits, phone calls to crisis lines, visits by crisis teams, and ambulance trips made in the preceding six months.

Quality of life was measured via the Quality of Life Brief Version (QoL-BV) [20], [21]. The QoL-BV measures both objective quality of life (i.e., what people do and experience) and subjective quality of life (i.e., what people feel about these experiences). Consisting of 74 items, this tool spans eight domains: living situation, daily activities and functioning, family relations, social relations, finances, work/school, legal/safety issues, and health. Internal consistency for people with mental illness ranges from α = 0.56 to 0.87 [21].

Physical health was measured in the demographics form and by the Short-Form Health Survey (SF-12) [22]. The SF-12 measures health on eight domains: general health, physical functioning, role limitations due to physical health, bodily pain, energy/vitality, social functioning, role limitations due to emotional health, and mental health.

The Perception of Smart Technology Form [23] was used to measure several domains of participants' experience with the CHR platform. These domains include level of helpfulness, ease of use, and clarity, in addition to information on the frequency of CHR platform use and functionality preferences.

IV. RESULTS

Descriptive statistics and mean comparisons using paired sample t-tests were conducted for each of the outcome measures between time-one and two interviews. These comparisons excluded participants who did not complete the measure during time-two.

A. Characteristics of client participants

Participants had a mean age of 72.8 (SD = 4.8) and ranged from 65 to 84 years of age. The sample consisted of 12 (40%) males and 18 (60%) females, all of whom had contact with their family and were unemployed/retired. Education level of the participants varied, with three (10%) participants having completed grade school education, 14 (46.7%) having completed high school education, and 13 (43.3%) having completed post-secondary education. Sixteen (53.3 %) participants indicated that they lived alone, and 14 (46.7%) indicated that they lived with family. The top two psychiatric conditions in the sample were anxiety disorders (n = 17) and mood disorders (n = 27), with 20 (66.7%) participants having two or more psychiatric conditions (Fig 1). Regarding comorbid physical and psychiatric conditions, over 90% of participants had comorbidities, such as arthritis (33.3%), high blood pressure (33.3%), and anxiety disorders (56.7%). All participants were taking medication for their mental illness, and half of the participants stated that they had had a psychiatric hospitalization in their lifetime. At study onset, 2/3 of participants had existing Wi-Fi set up, 12 (40%) participants reported feeling extremely comfortable with technology, whereas no participants reported feeling extremely comfortable with technology at study end.
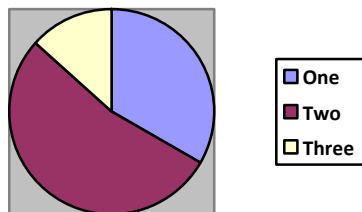

Figure I. Number of psychiatric conditions reported by client participants (N = 30)

B. Retention and attrition rates

Twenty six (87%) of the client participants completed the study. Four (13%) participants withdrew from the study before the second interview; one participant withdrew from the study shortly after enrolment for an unknown reason and three others withdrew later due to health reasons. As such, for time-two interviews there were 12 (46%) male participants and 14 (54%) female participants, with a mean age of 72.85 (SD = 4.46). On the HSJSU questionnaire, all participants who withdrew indicated that they had not talked to a health or social service provider over the phone in the past month. These participants had all experienced side effects from medication, but had not terminated their usage of the medication(s). They also obtained higher mean scores

on the SF-12 pain subscale (M = 81.25, SD = 37.5) compared to the other participants (M = 49.04, SD = 31.21) but the difference was not statistically significant (p = 0.071). Overall, these participants did not differ significantly from the other 26 participants on any measures during the interview at time-one.

C. Analysis of outcome measures

This pilot study tested the implementation of CHR platform and recruited 30 client participants. Therefore, statistically significant results of outcomes were not primarily pursued. Paired samples t-tests were utilized to compare CIQ total scores, GDS total scores, and GSIS total scores, and QoL-BV domain scores between time-one and time-two (see Table 1 for total score comparisons). As anticipated, no significant differences were found among any of the subscale domains or total scores of outcome measures between interviews. The mean difference on CIQ was 0.72 (t (17) = 0.80, p = 0.44); GSIS total scores 3.12 (t (24) = 0.67, p = 0.50); GDS total scores 0.33 (t (23) = 0.59, p = 0.56); whereas the mean differences on the QoL-BV domain scores ranged between -396.12 (t (25) = -0.45, p = 0.65) and 0.15 (t (25) = 1.2, p = 0.24). Paired samples t-tests were also employed for the HSJSU. A significant higher proportion of participants reported experiencing prescription medication side effects during interview time-one than interview time-two (t (22) = 2.31, p < 0.05). Finally, physical and mental health information from the eight domains on the SF-12 was compared utilizing paired samples t-tests. The analysis found no significant differences between mean scores on any of these domains between times one and two.

TABLE I. MEAN COMPARISONS FOR OUTCOME MEASURES

Outcome Measure	First Interview n	First Interview Mean (SD)	Second Interview n	Second Interview Mean (SD)
Total CIQ scores	23	14.89 (5.47)	23	15.04 (5.26)
Total GDS scores	28	7.93 (3.63)	25	7.72 (3.65)
Total GSIS scores	30	77.97 (21.9)	26	74.04 (22.27)
General Life Satisfaction score from QoL-BV	30	4.12 (1.06)	26	4.02 (1.17)

D. Perceptions of smart technology at time-two interview analysis of outcome measures

The Perception of Smart Technology Form was administered at the final interview to assess client participants' perceptions of the CHR platform, and the Chromebook device. On a scale ranging from one to seven, client participants found the CHR platform helpful [M (SD) = 5.10 (1.61)], enjoyable [M (SD) = 4.67 (1.59)], and fast to use [M (SD) = 4.62 (1.69)] (see Table 2). However, participants had mixed responses in terms of ease of use, with some reporting that the program was relatively easy to use [M (SD) = 4.43 (2.09)] while others rating it lower on simplicity to use [M (SD) = 3.90 (1.73)] (see Table 2). Participants also had mixed responses regarding the reliability of the tablet [M (SD) = 4.29 (1.60)], and regarding whether the tablet and program gave them more or less independence [M (SD) = 3.56 (1.69)] (see Table 3).

TABLE II. PERCEPTIONS OF CHR PLATFORM AT TIME-TWO

Perceptions	n	Mean (SD)	Standard Deviation
Helpfulness	21	5.10	1.61
Enjoyment	21	4.67	1.59
Speed	26	4.62	1.69
Ease of use	21	4.43	2.09
Simplicity	21	3.90	1.73

Responses were given on a 7 point Likert scale, with 1 indicating the most negative response and 7 indicating the most positive response.

On a section of the Perceptions of Smart Technology Form, participants were asked specific questions related to their use of the Chromebook device. In terms of how they felt about connecting with their health care providers, on average, they indicated that they felt mostly satisfied. Participants reported liking the communication abilities, personal usage and accessibility of the tablet. However, participants reported not liking the technical difficulties, small size and potential scams associated with using the tablet. Roughly one-third of participants (n = 9) felt that the tablet and CHR platform had improved their healthcare.

TABLE III. PERCEPTIONS OF CHROMEBOOK DEVICE AT TIME-TWO

Perceptions	n	Mean	Standard Deviation
Helpfulness	25	4.92	1.50
Enjoyment	25	4.84	1.97
Ease of use	25	3.76	2.12
Simplicity	25	3.20	1.94
Reliability	25	4.29	1.60
Independence	25	3.56	1.69

Responses were given on a 7 point Likert scale, with 1 indicating the most negative response and 7 indicating the most positive response.

V. DISCUSSION

The purpose of this pilot study was to examine the feasibility of implementing and evaluating the CHR platform among seniors living with depressive symptoms and to determine possible modifications to the CHR platform, through assessment of client perceptions of smart technology at six months of intervention. Regarding the feasibility of implementing and evaluating the CHR platform in the older adult population, the study was able to recruit 30 client participants; of which, 26 (86.67%) successfully completed the study. Recruiting and retaining such rates of participants until the end of the study indicates that the implementation of CHR platform is feasible among seniors with depressive symptoms. These results, related to recruitment and retention of seniors, contrast with the recruitment difficulties experienced in a RCT pilot study [6], wherein the authors had difficulties recruiting participants aged 60 years and over. The study also evaluated potential modifications to the current CHR platform through feedback provided by the Perceptions of Smart Technology Form. Perceptions of client participants regarding the tablet device were mainly positive. On a scale of one to seven, participants rated the simplicity of the device as 3.20 and helpfulness as 4.92. Viewing the results of technology questions in the Perception of Smart Technology Form and the Demographic Data Form, it is noticeable that scores were mainly positive among seniors who had previous experience of Internet use, higher education, and who were younger in age and living with a relative. Wildenbos et al. [24] found similar results in a study which examined barriers and enablers of the use of Telehealth for seniors. These authors indicated that factors enabling seniors to use technology include higher levels of education, receiving help from others to use the Internet, being aged less than 70 years old, and comfort with using the Internet. An improvement to increase seniors' comfort with the CHR platform might include being able to connect with clients' phones as well as tablets; a process that would require further development to overcome limitations posed by the current system due to its compatibility with only the Chrome browser. Furthermore, increased communication functions might enhance the delivery of mental health services among community-residing seniors, reducing crises and supporting community integration.

Consistent with results from previous studies [9][10], this pilot study found no significant effect on health outcome measures, including community integration, depression, and quality of life, along with social, health and justice service utilization variables. However, the study found significantly higher rates of participants who experienced lower prescription medication side effects during interview time-two than interview time-one.

A. Limitations

The study investigated eHealth technology with seniors experiencing depressive symptoms. While the pilot study successfully recruited the target number of client participants and retained 87% until completion of the study, there are a number of limitations. The small sample size may reduce the study power to detect the effect of the intervention on health

outcome measures. The fact that the study had no control group and had a limited length of intervention implies that caution should be used in interpreting the results. Therefore, a larger sample size of participants would be needed to determine the long-term implications of using eHealth technology to connect with seniors with depression living in the community.

B. Implications

Results from the TELEPROM-G study have implications for practice and future research. The study demonstrated potential modifications to the current CHR platform through feedback provided through the Perceptions of Smart Technology Form. To this end, senior participants indicated that they are more likely to have positive experience when eHealth devices are perceived as simple and helpful. Furthermore, the study illustrated demographic characteristics to consider for improving the uptake of eHealth among seniors with depressive symptoms. Characteristics such as having a previous experience of Internet use, higher education, being younger in age, and living with a relative were associated with the senior participants' positive perceptions of technology. The pilot study, having successfully recruited 30 client participants, retained 26 of them for a six-month follow-up, deployed the intervention, and finding 2/3 of participants with existing Wi-Fi set up, has demonstrated that future studies with this population are feasible.

VI. CONCLUSION

This pilot study highlighted the benefits of supporting community integration and reducing health crises and needs and now requires further investigation with a full study. Senior clients experiencing depressive symptoms were provided with a Chromebook device and access to the CHR platform, an application that allowed for enhanced communication with their HCP. The study explored the potential outcomes on physical and mental health as well as the participants' perspectives of the CHR platform and the use of a Chromebook device. Although there were no significant changes on a number of physical and mental health outcome measures, the study's findings illustrated that the use of the CHR platform was helpful, enjoyable and relatively easy to use. In addition, significantly fewer clients reported medication side-effects at six month post-baseline. However, clients suggested that the Chromebook was too small and had encountered technical difficulties with it, suggesting that an alternative, perhaps more familiar, piece of equipment such as a phone or desktop computer may be preferable. The implementation of tele-mental health using the CHR platform is feasible as this study was able to recruit 30 older adults and retain 87% until the completion of the study. It is recommended that future studies investigate the use of eHealth technologies with a larger sample of seniors experiencing depressive symptoms and using different platforms and personal electronic devices. A research design that includes a control group, such as a randomized controlled trial, would be ideal in investigating eHealth technologies further.

REFERENCES

[1] World Health Organization. Depression and other common mental disorders global health estimate. [Online]. Available from: http://apps.who.int/iris/bitstream/10665/254610/1/WHO-MSD-MER-2017.2-eng.pdf?ua=1/ [Retrieved: January 2018].

[2] Center for Diseases Control. Depression is not a normal part of growing older. [Online]. Available from: https://www.cdc.gov/aging/mentalhealth/depression.htm [Retrieved: January 2018].

[3] D. P. Chapman and G. S. Perry, "Depression as a major component of public health for older adults," Preventing Chronic Disease, Vol. 5 (1), pp.1, Jan. 2008. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2248771/pdf/PCD51A22.pdf [Retrieved: January 2018].

[4] C. Buigues, C. Padilla-Sánchez, J. F. Garrido, R. Navarro-Martínez, V. Ruiz-Ros, and O. Cauli, "The relationship between depression and frailty syndrome: A systematic review," Aging and Mental Health, Vol. 19, pp. 762-772, Oct. 2014, doi. 10.1080/13607863.2014.967174.

[5] E. Stanmore, B. Stubbs, D. Vancampfort, E. D. de Bruin, and J. Firth, "The effect of active video games on cognitive functioning in clinical and non-clinical populations: A meta-analysis of randomized controlled trials," Neuroscience and Biobehavioral Reviews, Vol. 78, pp. 34–43, Jul. 2017 doi:10.1016/j.neubiorev.2017.04.011.

[6] K. L. Lichstein, F. Scogin, S. J. Thomas, E. A. DiNapoli, H. R. Dillon, and A. McFadden, "Telehealth cognitive behavior therapy for co-occurring insomnia and depression symptoms in older adults," Journal of Clinical Psychology, Vol. 69, pp. 1056-65, Aug. 2013, doi:10.1002/jclp.22030.

[7] L. Godleski, D. Cervone, D. Vogel, and M. Rooney, "Home telemental health implementation and outcomes using electronic messaging," Journal of Telemedicine and Telecare, Vol. 18, pp. 17-9, Jan. 2012, doi:10.1258/jtt.2011.100919.

[8] A. Aburizik, L. Dindo, P. Kaboli, M. Charlton, K. Dawn, and C. Turvey, "A pilot randomized controlled trial of a depression and disease management program delivered by phone," Journal of Affective Disorders, Vol. 151 (2), pp. 769-774, Nov. 2013, doi:10.1016/j.jad.2013.06.028.

[9] J. D. Piette, J. B. Sussman, P. N. Pfeiffer, M. J. Silveira, S. Singh, and M. S. Lavieri, "Maximizing the value of mobile health monitoring by avoiding redundant patient reports: Prediction of depression-related symptoms and adherence problems in automated health assessment services," Journal of Medical Internet Research, Vol. 15, pp. e118, Jul. 2013, doi:10.2196/jmir.2582.

[10] J. L. Pecina, G. J. Hanson, H. Van Houten, and P. Y. Takahashi, "Impact of telemonitoring on older adults' health-related quality of life: The Tele-ERA study," Quality of Life Research, Vol. 22, pp. 2315-21, Nov.2013, doi: 10.1007/s11136-013-0361-5.

[11] T. Donker, K. Petrie, J. Proudfoot, J. Clarke, M. R. Birch, and H. Christensen, "Smartphones for smarter delivery of mental health programs: A systematic review," Journal of Medical Internet Research, Vol.15 (11), Nov. 2013, doi: 10.2196/jmir.2791.

[12] S. T. Peek, E. J. Wouters, J. van Hoof, K. G. Luijkx, H. R. Boeije, and H. Vrijhoef, "Factors influencing acceptance of technology for aging in place: A systematic review," International Journal of Medical Informatics, Vol. 83 (4), pp. 235-248. Apr. 2014, doi: 10.1016/j.ijmedinf.2014.01.004.

[13] M. F. Folstein, S. E. Folstein, and P. R. McHugh, "Mini-mental state: A practical method for grading the cognitive state of patients for the clinician," Journal of psychiatric research, Vol. 12 (3), pp. 189-198, Nov. 1975, Retrieved 2018-01-30 from: https://www.ncbi.nlm.nih.gov/pubmed/1202204

[14] J. A. Yesavage, et al., "Development and validation of a geriatric depression screening scale: A preliminary report", Journal of Psychiatric Research, Vol.17, pp. 37-49, Dec. 1983, Retrieved 2018-01-26 from: http://www.ncbi.nlm.nih.gov/pubmed/7183759

[15] B. Willer, K. J. Ottenbacher, and M. L. Coad, "The community integration questionnaire: A comparative examination," American Journal of Physical Medicine and Rehabilitation, Vol. 73 (2), pp. 103-111, Apr. 1994, Retrieved 2018-01-26 from: http://www.ncbi.nlm.nih.gov/pubmed/8148099

[16] B. M. Stalnacke, "Post-traumatic stress, depression, and community integration a long time after whiplash injury," Mental Illness, Vol. 2 (1), pp. e4, Apr. 2010, doi: 10.4081/mi.2010.e4.

[17] J. L. Sheikh and J. A. Yesavage, "Geriatric Depression Scale (GDS): Recent development of a shorter version", in Clinical Gerontology: A guide to assessment and intervention, New York, NY: The Haworth Press, pp.165-173, 1986.

[18] M. J. Heisel and G. L. Flett, "The development and initial validation of the Geriatric Suicide Ideation Scale," American Journal of Geriatric Psychiatry, Vol. 14 (9), pp. 742-751, Sept. 2006, doi: 10.1097/01.JGP.0000218699.27899.f9.

[19] P. Goering et al, "The at home/chez soi trial protocol: A pragmatic, multi-site, randomised controlled trial of a Housing First intervention for homeless individuals with mental illness in five Canadian cities," British Medical Journal Open, Vol. 1, pp. e000323, Jan. 2011, doi:10.1136/bmjopen-2011-000323.

[20] A. Lehman, "A quality of life interview for the chronically mentally ill," Evaluation and Program Planning, Vol. 111, pp. 51-62, Dec 1988, doi.10.1016/0149-7189(88)90033-X

[21] A. Lehman, E. Kernan, and L. Postrado, Toolkit for evaluating quality of life for persons with severe mental illness [Online] Available from: https://www.hsri.org/publication/toolkit_evaluating_quality_of_life_for_persons_with_severe_mental_illn [Retrieved: January 2018].

[22] J. Ware, M. Kosinski, and S. D. Keller, "A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity," Medical Care, Vol. 34 (3), pp. 220-33, Mar. 1996, Retrieved 2018-01-30 from: http://www.ncbi.nlm.nih.gov/pubmed/8628042

[23] C. Forchuk, et al. "Mental health engagement network: An analysis of outcomes following a mobile and web-based intervention," Journal of Technologies in Society, Vol. 11 (2), pp. 1-10, Jun. 2015, Retrieved 2018-01-30 from: http://www.ijt.cgpublisher.com/product/pub.297/prod.16

[24] G. A. Wildenbos, L. Peute, and M. Jaspers, "Facilitators and barriers of electronic health record patient portal adoption by older adults: A literature study," Studies in Health Technology Informatics Vol. 235, pp. 308-312, 2017, doi: 10.3233/978-1-61499-753-5-308.