

Computer software and ways that computing and engineering technology improves mental health outcomes for mental health consumers

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Date: 19 November 2016

Electronic tools and technology applications for consumers can help improve health care processes, such as adherence to medication and clinical outcomes like smoking cessation.

Consumer health informatics applications are defined as any electronic tool, technology or electronic application designed to interact directly with consumers, with or without the presence of a health care professional, and that provides or uses individualized (personal) information to help a patient better manage his or her health or health care. Personalized informatics tools can include applications such as online health calculators, interactive computer programs to aid decision making, SMS text and email messages, which can be applied to a variety of clinical conditions, including cancer, smoking, diabetes mellitus, physical activity and mental health disorders.

In the future these tools may help make health care much more patient-centered and available when needed and not just available when the office is open. They may also help us improve health disparities by increasing patient access to health-improving treatments and interventions among the poor and uninsured.

There are almost as many mobile phone subscriptions (6.8 billion) as there are people on Earth (7 billion) [1], more humans are connected and have access to a wide range of information and services than ever before. In the context of this “increased access to information” the promise of the Internet and digital technologies is especially powerful in the prevention and treatment of mental health conditions, an area that has been historically impeded by issues of stigma and misinformation as well as disease-specific, geographical, and financial barriers to help-seeking and service engagement [2-5]. Despite growing interest in the promise of e-mental health preventive/treatment interventions, little supporting literature exists to guide their design and the evaluation of their effectiveness [6-8].

In line with an extensive literature on consumer participation in health care and mental health care more broadly [9-16], human-centered design processes have been identified as a method or set of techniques that assist with good design [17-22]. Both participatory design (PD) and design thinking (DT) have emerged as approaches that hold significant potential for supporting the design of technology-based youth e-mental health and well-being interventions [8,20,23-26]. For example, large-scale PD is embedded within Young and Well Cooperative Research Centre (CRC) [20,27] practice. The CRC combines end-user engagement and youth participation to “explore and understand the role of new and emerging technologies in the lives of young people” [28]. This paper provides a brief background of the evolution DT and PD, where differences in politics and agenda are explored. We then discuss the applicability of PD and DT to design of e-mental health interventions, particularly in the context of application by novice researcher/practitioners. Finally, we present 2 case studies and highlight similarities and differences in process and outcome, mind-set, and emphasis and draw learnings from each to inform design of e-mental health interventions.

Outcomes:

A total of 191 women and 110 men (mean age 55 years, SD 4.6) with sub-threshold depression were randomized into Internet-based treatment, group CBT (Lewinsohn's Coping with Depression Course) or a waiting-list control condition.¹³⁶ The main outcome measure was treatment response after 1 year, defined as the difference in pretreatment and followup scores on the BDI. Simple contrasts showed a significant difference between the waiting-list condition and Internet-based treatment ($p=0.03$) and no difference between both treatment conditions ($p=0.08$).

Another study assessed depressive symptoms in 401 participants in an RCT of a 12-month primary care, phone, and Internet-based behavioral intervention for overweight women. A oneway analysis of variance examining the mean change in Center for Epidemiological Studies.

Depression (CESD) score from baseline to 12 months, controlling for age, education, marital status, and employment, showed that those receiving the intervention significantly decreased their CESD scores ($p<0.03$) more than those receiving standard care.¹³⁵ To evaluate the efficacy of an Internet-based cognitive-behavioral therapy (CBT) approach to the treatment of child anxiety disorders, 73 children with anxiety disorders, aged 7 to 12 years, and their parents were randomly assigned to either an Internet-based CBT (NET) or wait-list (WL) condition. The NET condition was reassessed at 6-month followup. At posttreatment assessment, children in the NET condition showed small but significantly greater reductions in anxiety symptoms and increases in functioning than WL participants. These improvements were enhanced during the 6-month followup period, with 75 percent of NET children free of their primary diagnosis.

The conclusion was that Internet delivery of CBT for child anxiety offered promise as a way of increasing access to treatment for this population.

To assess possible effects on mental and physical well-being and stress-related biological markers of a Web-based health promotion tool, 303 employees (187 men and 116 women, age 23–64 years) from four information technology and two media companies were enrolled. Half of 82 the participants were offered Web-based health promotion and stress management training (intervention) lasting for 6 months. All other participants constituted the reference group. Clinical outcomes consisted of different biological markers measured to detect possible physiological changes. After 6 months, the intervention group had improved statistically significantly compared to the reference group on ratings of ability to manage stress, sleep quality, mental energy, concentration ability, and social support. The anabolic hormone dehydroepiandrosterone sulphate (DHEA-S) decreased significantly in the reference group as compared to unchanged levels in the intervention group. Neuropeptide Y (NPY) increased significantly in the intervention group compared to the reference group. Chromogranin A (CgA) decreased significantly in the intervention group as compared to the reference group. Tumour necrosis factor α (TNF α) decreased significantly in the reference group compared to the intervention group.

To test the hypothesis that CBT, available on the Internet, could reduce test anxiety, 90 university students were randomly allocated to CBT or a control program, both on the Internet. Before and after treatment, the participants completed the Test Anxiety Inventory (TAI), an Anxiety Hierarchy Questionnaire (AHQ), the Exam Problem-Solving Inventory (EPSI), the General Self-Efficacy Scale

(GSES) and the Heim reasoning tests (AH) as a measure of test performance. Of the CBT and control groups 28 percent and 35 percent, respectively, withdrew.

According to the TAI, 53 percent of the CBT group showed a reliable and clinically significant improvement with treatment but only 29 percent of the control group exhibited such a change.

On the AHQ, 67 percent of the CBT group and 36 percent of the control group showed a clinically significant improvement, more than two standard deviations above the mean of the baseline, a change in favor of CBT. Both groups improved on the GSES, in state anxiety during exams retrospectively assessed, and on the AHQ tests. The study supported use of CBT on the Internet for the treatment of test anxiety.

A study by Christensen et al studied the impact of two different Internet interventions (MoodGym and BluePages) on community-dwelling individuals with symptoms of depression.

To measure symptom change after the intervention, the 20-item CESD score was the primary outcome measure. The mean change in score was greater in the Internet intervention groups than in the control group. The difference was significant in the MoodGym group but not the BluePages group.

To measure the impact of the “beating the Blues” (BtB) interactive multimedia CBT program on anxiety and depression, Proudfoot et al 2003 compared this program with usual treatment (or treatment as usual) for depression and anxiety. Three measures were used: the BDI, the BAI, and the Work and Social Adjustment (WSA) Scale. There was a significantly greater drop (of 5 points) in the BDI score in the BtB group compared to the usual care group. This drop was seen at 1 month post-intervention and was maintained over the six month followup period.

Significance was not reported. A similar result was seen in the BAI score with a difference in reduction in score between the BtB group and usual care of 3 points. This change was sustained over the 6 month followup period. No significance was reported. Again, similar results were seen in the WSA score with a difference in reduction in score between the BtB group and usual care of 3 points. This change was sustained over the 6 month follow up period.

ELECTRONIC SCREENING FOR MENTAL HEALTH :

Despite attention to prevention and screening for depression and alcohol use, Healthy People 2010 objectives continue to include goals to increase the detection of depression and decrease the rates of alcohol abuse. These problems remain significant. The overall goal of this study was to develop a computer-based electronic screening tool and to determine the feasibility of implementing computer-based electronic screening technology (eScreening) for rural visitors to a primary care clinic. The study called specifically for an electronic touch screen with voice prompts. This tool, called the eScreening tool, screens for alcohol abuse and depression among rural patients in a primary care setting. The screening was offered to rural adults who are not in acute distress and not at end-of-life, regardless of their stated reason for seeking medical care. Phase one of the pilot was used to determine the perceptions of nurses, other providers and consumers regarding the acceptability and perceived usefulness of an eScreening tool. Phase two involved user testing of the eScreening tool. The longer-term goals of the research program are to work with rural nurses to improve patient outcomes, develop interventions, and for educational, consultation and/or direct clinical care.

The Use of e-Screening for Assessment:

Most mobile persons in communities, even if living in rural areas, have used touchscreen technology on automated teller machines (ATMs), automated election/voting ballots or to obtain a 'made-to-order' sandwich at convenience stores. Touchscreen technology provides a safe and secure yet easy-to-use system. No typing skills or comprehensive education is required to use this type of technology. While there has been no study reported in the literature regarding patient use of laptops for self-report of key assessment information, the introduction of this technology offers a unique opportunity to dramatically change the way key information is obtained from patients.^{17, 18}

One of the first applications of the computer for assessment was the computerized psychiatric interview.¹⁹ Researchers reported that patients not only responded positively to computer interviews but also gave honest answers.²⁰ Subsequently, medical, marketing, personnel and social science researchers have explored computer administration as a means of reducing social-desirability biases and obtaining more-sensitive information from respondents than could be obtained using more-traditional formats. A belief that computer administration encourages self-disclosure has led to the development of important applications, such as computer interviews to detect risk conditions and behaviors of blood donors.²¹ While electronic screening tools have been discussed in the literature,^{17, 22-26} little is known about their use in rural areas and in the screening of topics such as depression and alcohol abuse. Weisband and Keisler conducted a meta-analysis of the literature from 1969 to 1994 to compare levels of self disclosure on a computer or paper form versus a face-to-face interview.²⁶ They found that across 39 studies using 100 measures, computer administration increased self-disclosure. Recent studies using touchscreen self report support this earlier finding.^{22, 24, 25}

One example of an electronic screening tool currently being used is the Healthy Town website in the state of Ohio.²⁷ Using innovative computer screening technology and easy-to-use health information, Healthy Town identifies health and injury risks and links seniors and families with children to community prevention services. Another study examined the use of computers to reduce medication misuse of community-based seniors.²⁸ Seniors completed a computerized simple screening for medication misuse and watched short related video clips. Almost all of the seniors found it easy and helpful.

Numerous studies reported using computers with persons having poor vision, lower levels of literacy or when eliciting answers to sensitive issues. To meet the diverse needs of patients, one computer-technology design included an audio computer-assisted, self-interviewing (ACASI) format.^{29, 30} With ACASI, the questionnaire is programmed on a computer to be displayed on the screen. Each question is voice-recorded along with accompanying instructions to navigate the computer screens. The respondent hears the questions as they are visually displayed on the screen and then answers the question by touching the computer screen. Answering questions via touchscreen does not require keyboard skills allowing for persons to answer questions without difficulty.³⁰ Results from ACASI are then immediately available to the professional as part of the health-screening assessment.

Conclusions:

The study provided useful pilot information for guiding development of an intervention trial of computer use in this vulnerable population. It also provided an estimate of the efficacy of computer

use in this patient population. The eScreen is valued and needed and is acceptable if suitably used in the routine workflow. Needed revisions and adjustments were made to the original eScreen.

There is a need to identify new and innovative applications to improve assessment and possible treatment of depression, especially with the rural adult population. This study explored the combined use of audio computer-assisted touchscreen technology with the use of existing psychometrically-tested screening instruments to screen for alcohol use and depression in a primary care population.

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