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Poster

Preventing Avoidable Hospitalizations at Low-Cost Across Large Populations

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Abstract

Background: People suffering from chronic illnesses account for greater than 85% of health care spending, and in many cases these costs can be significantly reduced, but many connected health solutions have not had the scale or levels of adherence that would be required to make an impact. Part of the problem is that on most days, chronically ill individuals feel well and as such don't feel compelled to follow a regimen using connected devices or recording vital signs. Another problem is that most disease management programs address a single condition and neglect the high prevalence of people with multiple chronic conditions (comorbidities).

Objective: Our objective was to address the above concerns of compliance and multimorbidity management in an affordable and scalable way. Guided by the triple aim, our solution uses the only technology that is accepted and embraced by our entire population—the telephone. In the case of the elderly high-risk population (generally 80 and older), they have telephones and use them to communicate with their families. In the case of the younger and more mobile at risk population, the mobile phone has become ubiquitous. The second key objective was to address the multiple conditions in each patient's unique case mix. Our solution requires only a small amount of data entry including patient demographics, a listing of the multiple health conditions (chronic, acute, and behavioral), and an acuity rating such as low, medium, or high. The demographics and conditions can be prepopulated via integration with the health system's electronic medical record (EMR).

Methods: The primary study measure has been reduction in 90-day hospital readmissions comparing a control group with a study population. For each emergency department visit that is prevented, the solution saves $6000 or more.

Results: Early results have demonstrated a 75% reduction in preventable rehospitalizations. One lesson learned was that success with the solution requires an onboarding process where the patient is educated about the solution by someone they trust, and it requires monitoring of the results. Thus far the solution has been deployed by home health care organizations who are finding that they can reduce face-to-face visits while increasing patient satisfaction and reducing admissions. Another great application is for chronic care management in primary care.

Conclusions: Since the patient only needs to answer the phone or respond to a text, they can't forget to use it, and since it addresses multiple health conditions, results have the potential to surpass those of single-disease programs. Lastly, since the solution uses technology that the patients already have, the costs of deployment are minimal. We are confident that this solution can go a long way towards achieving the triple aim of high patient satisfaction, low cost, and the ability to reach a large population.

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KEYWORDS

chronic illnesses; preventing hospital readmissions; population health management; remote patient monitoring

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This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.

Multimedia Appendix 1

Poster.

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Poster

Internet-Delivered Treatment for Depression, Anxiety, and Stress in University Students: A Patient Preference Trial

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Abstract

Background: In recent years, University counseling and mental health services have reported an increase in the number of clients seeking services and in yearly visits. This trend has been observed at many universities, indicating that behavioral and mental health issues pose significant problems for many college students. With the move toward the provision of value- and quality-based health care, there is an increasing focus on person-centered health care and patient preference of treatment. A healthcare service that is person-centered considers the specific needs of an individual, and the service is subsequently tailored to meet the person's needs. As a result, health care professionals are giving increased recognition to patients' unique insights into their own health and their preferences for treatments, which is increasing patients' involvement in their own treatment decisions. This increase in patient involvement is an important step towards quality improvements in mental health services as it is associated with improved health outcomes.

Objective: The aim of this study is to assess the acceptability and proof of concept of Internet-delivered patient preference treatment for depression, anxiety, and stress for university students.

Methods: The study is an open feasibility trial of the SilverCloud programs for depression (Space from Depression), anxiety (Space from Anxiety), and stress (Space from Stress). All 3 are 8-module Internet-delivered cognitive behavioral therapy (iCBT) intervention programs. Participants (N=105) are assigned a supporter who provides weekly feedback on progress and exercises. Primary outcome measures are the Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder 7 (GAD-7), and stress subscale of the Depression Anxiety Stress Scales (DASS-21) for assessment of symptoms of depression, anxiety, and stress, respectively. Based on these initial measures, patients are given a choice between the 3 intervention programs.

Results: Preliminary results on the current sample (n=62) show that the majority of participants are female (74%). Active engagement (meaning logging on and using the program content) has been high. To date participants have shown significant decreases in symptoms of depression, anxiety, and stress across all 3 groups, indicating a positive effect for treatment across time points. The final results will be available for June 2017.

Conclusions: It is anticipated that the study will inform the researchers and service personnel of the programs' potential to reduce depression, anxiety, and stress in a student population as well as the potential for the protocols to be employed in a future trial. In addition, it will provide insight into students' preference of intervention, their engagement with the programs, their user experience, and their satisfaction with the online delivery format.

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ClinicalTrial: Clinicaltrials.gov NCT02614443; https://clinicaltrials.gov/ct2/show/NCT02614443 (Archived by WebCite at http://www.webcitation.org/6mYdXRWFY).

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KEYWORDS

depression; anxiety; stress; online interventions; university students; cognitive behavioral therapy

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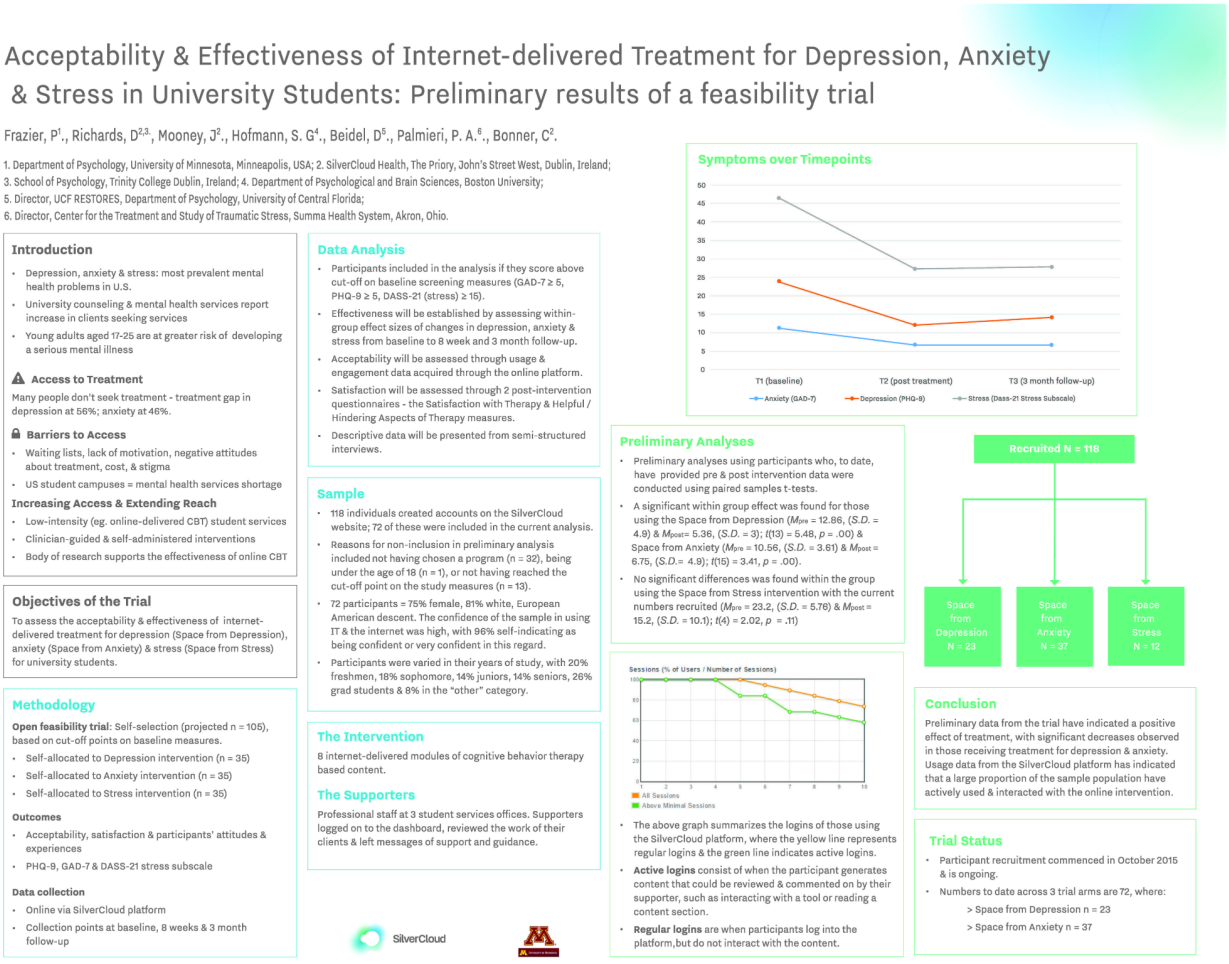
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Utilization of an Embodied Conversational Agent in an Integrative Medical Group Visit for Patients with Chronic Pain and Depression

Paula Gardiner[1], MD, MPH; N Lily Negash[1], MPH; Ameneh Shamekhi[2], BS; Timothy Bickmore[2], PhD; Katherine Gergen-Barnett[1], MD; Anna Sophia Lestoquoy[1], PhD; Sarah Stillman[1], BA

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Abstract

Background: This abstract will report on the feasibility of introducing an innovative eHealth technology called an Embodied Conversational Agent (ECA) into a diverse patient population with chronic pain and depression.

Objective: The Integrative Medical Group Visit (IMGV) is a 9-week curriculum designed for patients with chronic pain and depression. The IMGV consists of 9 weekly group medical visits during which patients learn self-management for chronic pain and depression. Tablet computers with an ECA are given to each participant to reinforce the curriculum and self-care practices. The ECA reviews material covered in IMGV sessions and allows for participants to set healthy nutritional, exercise, and mindfulness goals. This clinical trial is ongoing across 3 sites in Boston, MA.

Methods: Patients were recruited from Boston Medical Center, Codman Square Community Health Center, and DotHouse Health. Demographic characteristics collected include age, gender, race, ethnicity, and sexual orientation. Patients in the intervention were given a Dell tablet with an ECA for the duration of the study and were encouraged to interact with the ECA on a regular basis. The ECA reviewed material covered during group medical visits and served as a tool for participants to practice self-management and stress reduction techniques. Usage data were collected from the tablets at 9-weeks and at 21-weeks post enrollment.

Results: In total, 75 patients were enrolled in the intervention. The majority of patients were female (83%), 60% identified as black/African American, and nearly 90% identified as non-Hispanic. The mean age in this sample was 50 years old. Approximately half of patients reported regular computer use prior to the study (56%). For this abstract, usage data and pain and depression outcomes are reported on. Patterns of utilization will be assessed from tablet usage data. This data will be used to assess potential associations between demographic data, amount of time spent using ECA, and content delivered by ECA.

Conclusions: ECAs may represent one strategy to encourage patient use of self-management for pain and depression.

ClinicalTrial: Clinicaltrials.gov NCT02262377; https://clinicaltrials.gov/ct2/show/NCT02262377 (Archived by WebCite at http://www.webcitation.org/6maRgLIT7).

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KEYWORDS

integrative medicine; embodied conversational agent; group visits

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

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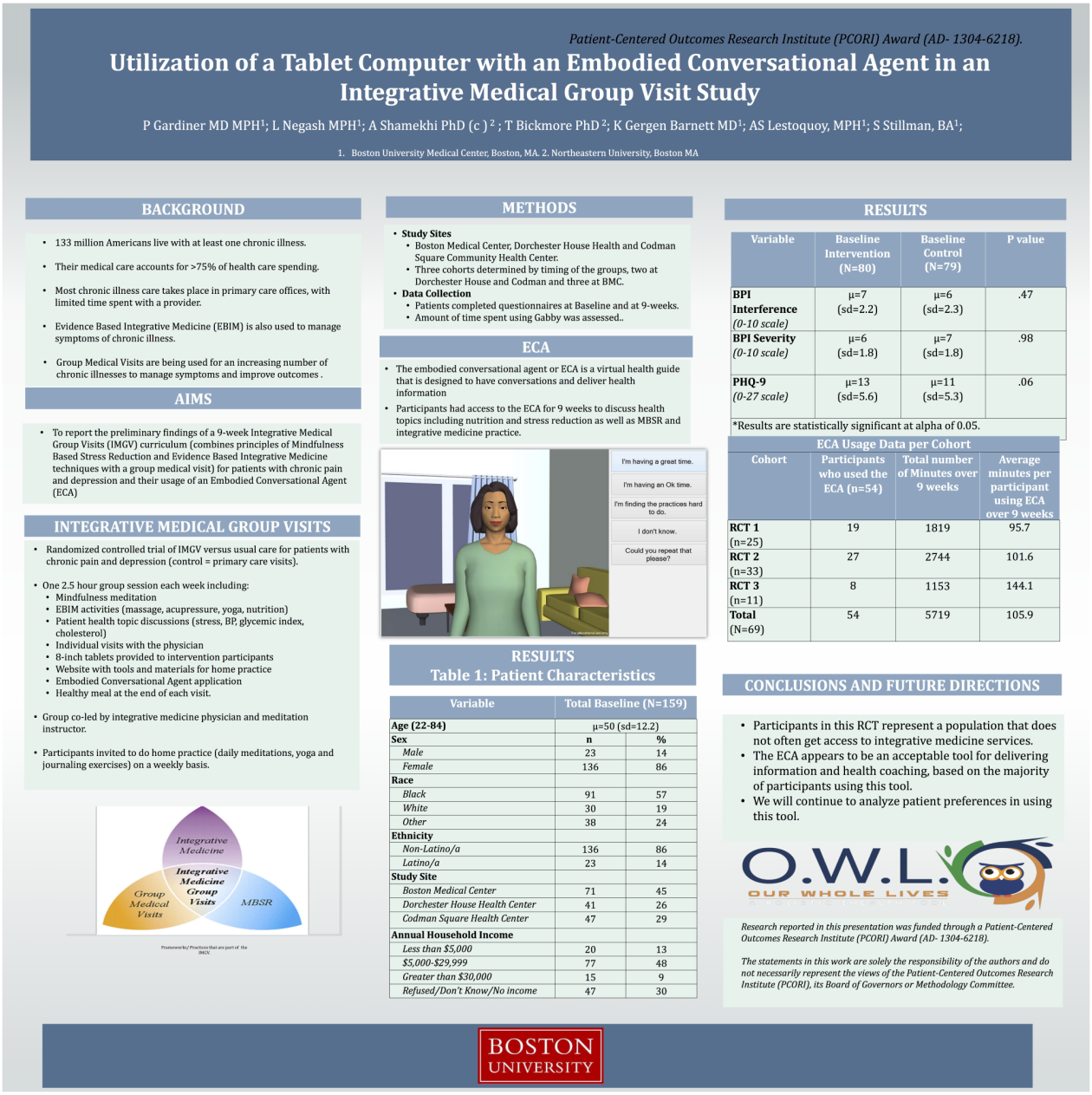
Figure 1. Poster.



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Poster

Connecting Healthcare Providers With Patients Through Mobile Technology: Formula for Shared Decision Making and Improved Patient Outcomes

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Abstract

Background: Integration of mobile devices/health-related apps into medical practice is transforming healthcare. A 2015 Healthcare Information and Management Systems Society (HIMSS) technology survey of 238 respondents revealed ~90% of healthcare providers utilize mobile devices to engage patients in their healthcare. A new app for clinicians, *Multiple Sclerosis @Point of Care* powered by IBM Watson, paired with the Multiple Sclerosis Association of America (MSAA) patient app, *My MS Manager*, is a practice-based tool designed to provide shared decision making between the clinician and patient, syncing patient data via a Health Insurance Portability and Accountability Act (HIPAA)-compliant mobile cloud platform. The *Multiple Sclerosis @Point of Care* IBM Watson cognitive learning tool answers questions clinicians pose at point of care to improve patient outcomes.

Objective: This analysis evaluates how clinicians use *Multiple Sclerosis @Point of Care*, utilize our trained IBM Watson corpus, and benefit from the app. Additionally, the analysis assesses how patients use and benefit from the patient app and how both apps are used for shared decision making to improve patient care.

Methods: To assess how clinicians utilize/value the *Multiple Sclerosis @Point of Care* and patient app as well as how patients connect with their clinicians utilizing the patient app, data collected from participating clinicians (~11,000+) caring for multiple sclerosis (MS) patients and their participating patients were analyzed. The *My MS Manager* patient app provides a tool for patients to record their daily data regarding MS management and share this data with their clinician. Additionally, the clinician can access evidence-based answers at the time it is needed from the *Multiple Sclerosis @Point of Care* clinician app. Together, these facilitate shared decision-making at the point of care. Data included demographic information, clinician and patient monthly access frequency, clinicians' questions posed to *Multiple Sclerosis @Point of Care*'s Ask Watson cognitive tool, clinicians' self-reported impact of content on their patients' health outcomes, number of registered patient app users, average active patient users/month, patient access frequency, patient record entries (including fatigue scale records), and patient perceived benefits.

Results: Overall findings include that (1) clinicians and their patients use the *Multiple Sclerosis @Point of Care* clinician app and MSAA patient app, respectively, enabling clinicians to sync with their patients' data to improve outcomes; (2) many clinicians agree the clinician app, *Multiple Sclerosis @Point of Care*, and the synched patient data from the *My MS Manager* app provide timely, relevant information that positively impacts their patients' health outcomes; (3) increasing numbers of patients are using the patient app to enter their data, track their MS management, and share this data with their clinicians; and (4) the fatigue scale entries continue to increase and represent valuable information for their treating clinicians. Frequency of use reported by patients responding to this question show 77% access the patient app daily or weekly. Better fatigue management resulting from the use of the patient app was reported by 75% of patients responding to the survey.

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Conclusions: Clinicians engaged in learning utilizing *Multiple Sclerosis @Point of Care* currently number 10,627 unique users who spend an average of 8 minutes per visit. Around 86% of *My MS Manager* patient app users revealed the app has motivated them to discuss their MS management with their clinician. Management of MS is evolving rapidly and the findings of this analysis show *Multiple Sclerosis @Point of Care* and the *My MS Manager* patient app facilitate the interface of clinicians and MS patients for shared decision making that support strategies for practice change and improved patient outcomes through point of care accessibility.

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KEYWORDS

multiple sclerosis; shared decision-making; mobile apps; mHealth

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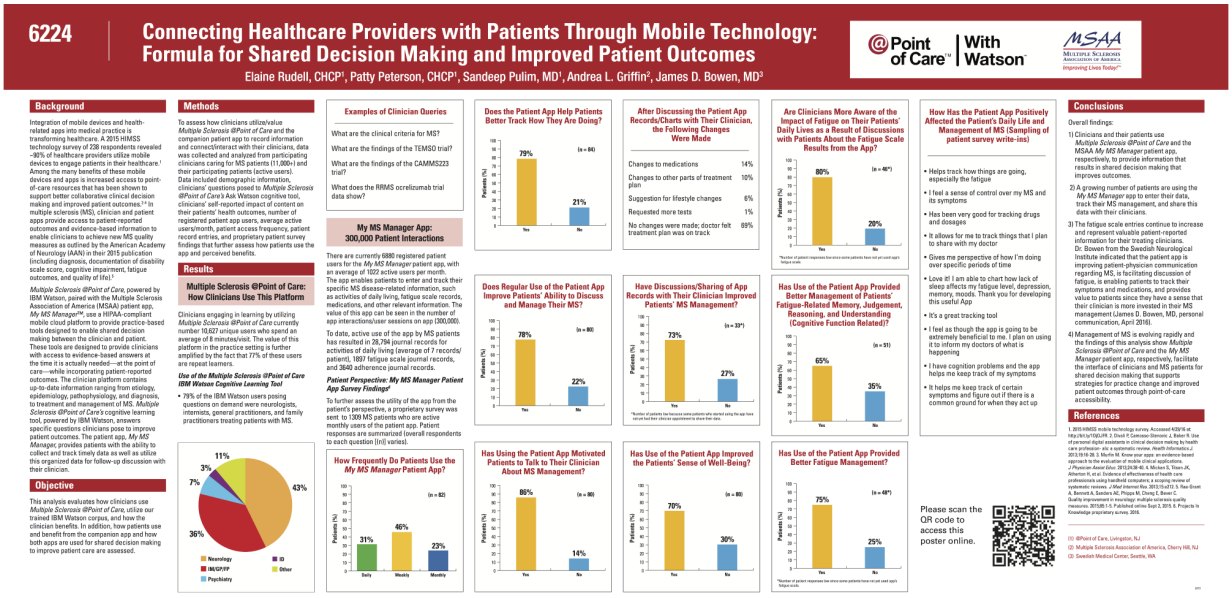

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Poster

Sleep Phenotypes in Chronic Pain Sufferers: Application of Machine Learning to a Large Database

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Abstract

Background: Chronic pain affects over 100 million American adults. There is a negative reciprocal relationship between chronic pain and sleep. As many as 80% of chronic pain patients report poor sleep quality and daytime fatigue. We have recently reported on the clinical benefits of fixed-site high-frequency transcutaneous electrical nerve stimulation (Quell, NeuroMetrix, Inc) in a chronic pain cohort. In addition to delivering therapeutic neurostimulation, this device collects health data including utilization, sleep measures, and activity metrics. The data is communicated to the patient through a smartphone app and aggregated in a cloud server. This digital health database presents a novel opportunity to study population characteristics in a large cohort of chronic pain sufferers.

Objective: Our primary objective was to use machine learning techniques on a large database of sleep data in chronic pain sufferers to determine "sleep phenotypes." The long-term goal of this research is to develop personalized therapeutic profiles that optimize sleep in chronic pain patients.

Methods: De-identified data from device users consenting to have their data uploaded to a cloud server was analyzed. Individual users were characterized by their median sleep data. The analyzed sleep parameters included total sleep time (TST, hours), sleep efficiency (SE, %), periodic leg movement index (PLMI, events/hour), position change rate (PCR, events/hour), and time out of bed (OOB, minutes). K-means clustering was used to partition the data set into 3 mutually exclusive clusters based on TST, PLMI, PCR, and OOB. The optimal number of clusters was determined by the Silhouette value. Clustering was based on the correlation metric. One-way ANOVA was used to test whether the 3 cluster groups had a common mean for each sleep parameter. For parameters with differences in group means, *t* test was used to identify which pairs of means were different.

Results: A total of 389 users with 5 or more nights of TST between 4 and 12 hours were included in the analysis. The sizes of the 3 clusters were 161 (41.4%), 147 (37.8%), and 81. None of the sleep parameters had the same mean among three clusters ($P<.001$). The 3 clusters represented 3 sleep phenotypes. The largest group (n=161) was a "good sleeper" phenotype characterized by a mean TST of 7.3, SE of 95.2, and low PLMI (2.1), PCR (1.3), and OOB (1.4). The second largest cluster was a "moderate sleeper" phenotype characterized by a mean TST of 7.4, SE of 92.4, low PLMI (3.9) and PCR (0.9), but relatively high OOB of 12.7. The third cluster was a "poor sleeper" phenotype characterized by TST of 6.6, SE of 91.2, and a high PLMI of 11.7. All pair-wise cluster means were different ($P<.025$), except for TST between good and moderate sleepers ($P=.452$).

Conclusions: We identified 3 sleep phenotypes in a large cohort of chronic pain sufferers. The phenotypes reflected a progression from good to poor sleepers. The poorer sleepers were characterized by either a large amount of time out of bed during the night or a high rate of periodic leg movements.

(iproc 2016;2(1):e7) doi:10.2196/iproc.6103

KEYWORDS

sleep phenotype; chronic pain; machine learning; clustering analysis

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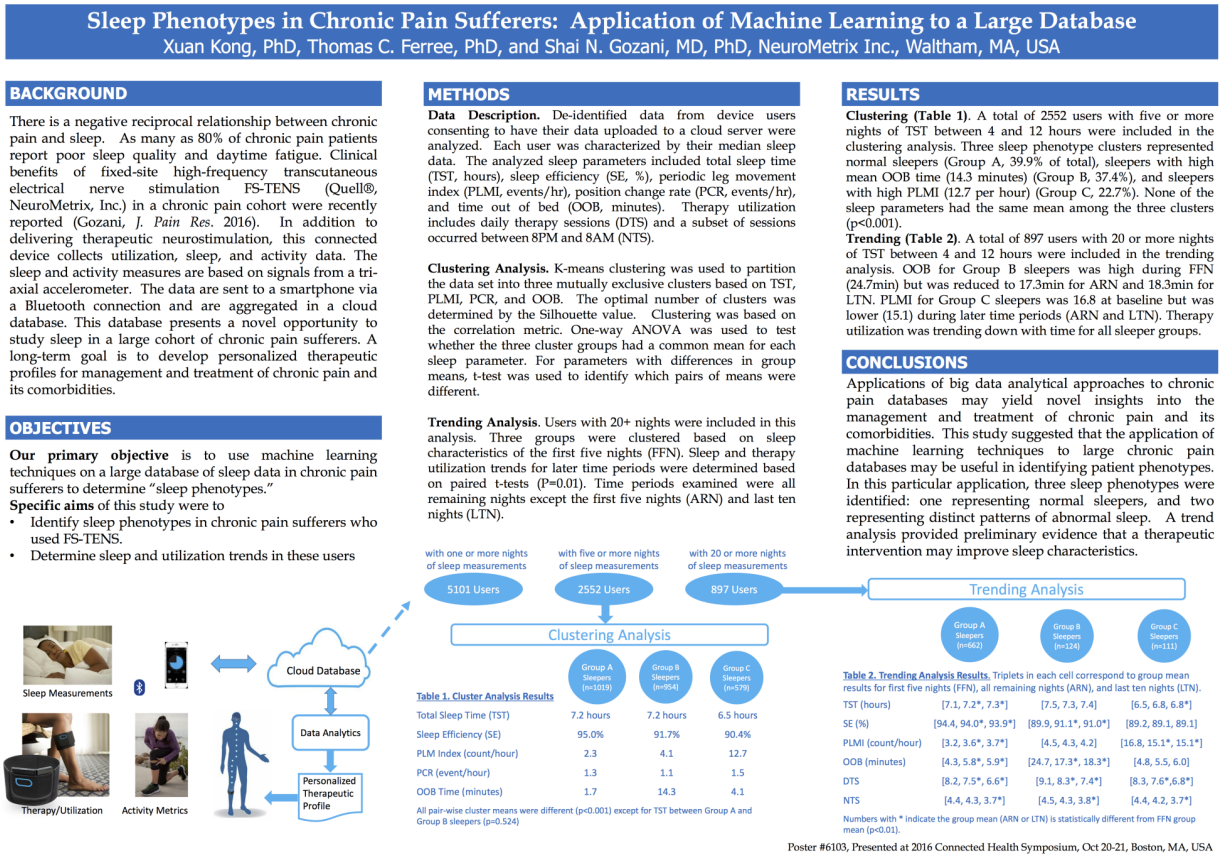
This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Philips Lifeline CareSage Analytics Engine: Retrospective Evaluation on Patients of Partners Healthcare at Home

Mariana Simons[1], MSc, PhD; Jorn op den Buijs[1*], MSc, PhD; Linda Schertzer[2*], BSc

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Abstract

Background: The most common cause of emergency transports/admissions in the aging population is deterioration in their health status due to multiple chronic conditions. To meet the needs of this population, healthcare systems are seeking cost-effective ways to monitor, diagnose, and treat patients, based on connected solutions that seamlessly integrate data and provide actionable insights. The Philips Lifeline's CareSage program for elderly and frail people utilizes a Personal Emergency Response Service (PERS) to detect medical emergencies and to promote independent living. The system tracks the types and outcomes of incidents, in particular the emergency transport-related events. Their timely detection is critical in optimizing clinical and financial outcomes.

Objective: The study objectives are to evaluate (1) healthcare utilization and expenditure and (2) the CareSage predictive model on patients of Partners Healthcare at Home who have been using the Philips Lifeline service. This study is unique in utilizing PERS connected technology as a source of data to identify patients at risk of emergency transports or admissions that cause high healthcare expenditure.

Methods: We identified 3335 patients with in-/out-patient encounters in 5 Partners Healthcare-affiliated hospitals through cross-reference of Philips Lifeline and Partners Healthcare at Home (PLL/PHH) data. The patients' demographics, clinical outcomes, and healthcare expenditure for fiscal years 2011-2015 were extracted from Enterprise Data Warehouse (EDW) of Partners Healthcare. The medical alert data related to PERS utilization were extracted from the Philips Lifeline database. Retrospective statistical analysis of hospital utilization and healthcare cost was performed. Further, the CareSage logistic regression model that uses only PERS data to predict emergency room (ER) transport was validated on PHH patients. A new model predicting ER admissions was developed using boosted regression trees on a combination of PERS and electronic health record (EHR) data. Model performance was evaluated by the area under the receiver operator characteristic curve (AUC) and the positive predictive value (PPV).

Results: Patients in the top (5%), middle (6-50%), and bottom (51-100%) segments of the cost acuity pyramid account for 40%, 55%, and 5% of the total healthcare expenditure, respectively, and these percentages stay stable across fiscal years 2011-2015. Increasing trends in total cost and average cost per patient and per encounter were detected through 2011-2015 based on linear regression analysis. The current CareSage predictive model that identifies patients at high risk of emergency transport in the coming 30 days has AUC=0.74 on the PHH population, whilst the new model that identifies patients at high risk of emergency admission in the coming 30 days has AUC=0.82. For prediction windows of one year, the PPV in the top 5% was also good: 63% and 67% for emergency transport and admission, respectively.

Conclusions: Predictive models based on PERS and EHR data can identify patients at risk of emergency transports and admissions that account for high healthcare cost. Healthcare organizations can use the outcome of the predictive models to design relevant interventions targeting their high risk patients.

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KEYWORDS

data analytics; predictive modeling; healthcare utilization; healthcare expenditure

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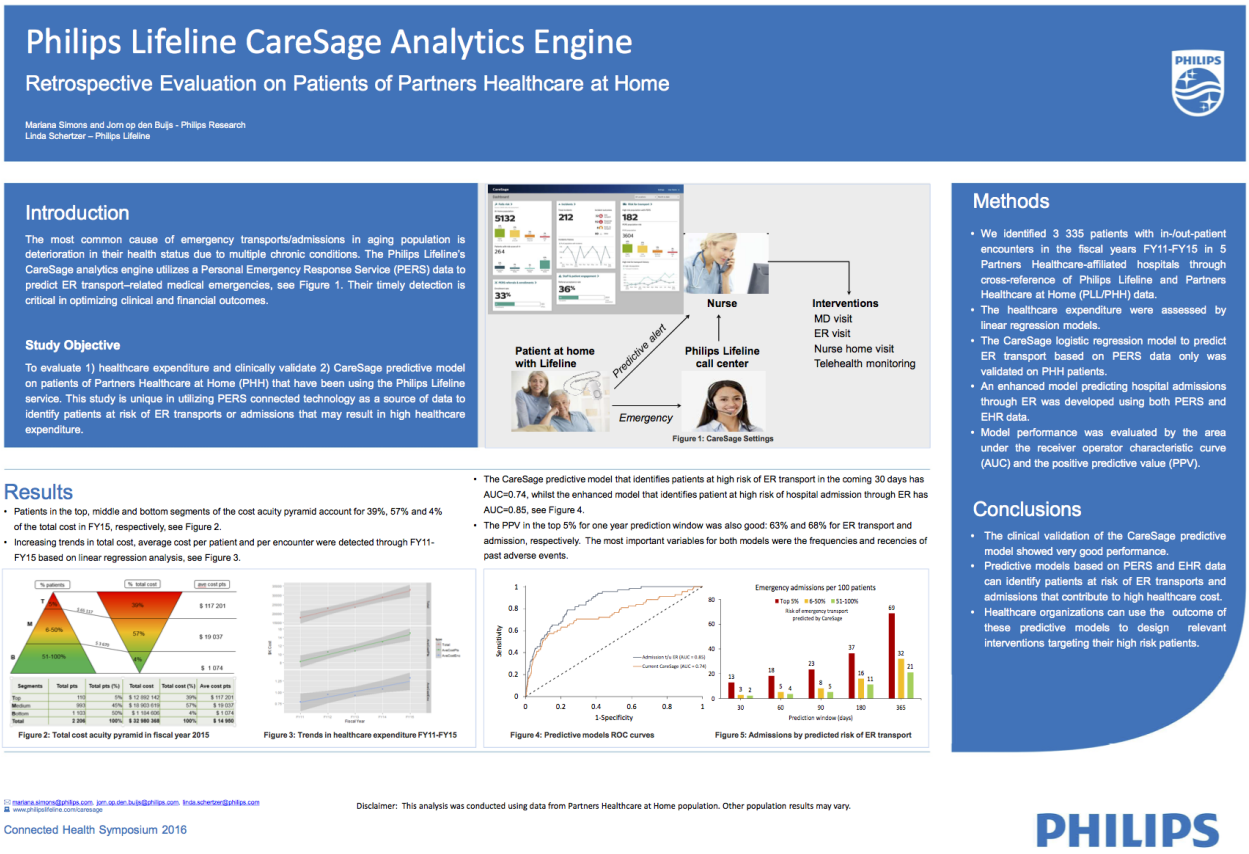
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Developing a Patient-Centered mHealth App for Diabetes

Katharine Marie Murray[1], MA; Bree Elizabeth Holtz[1], PhD; Michael Wood[2], MD; Amanda Holmstrom[3], PhD; Shelia Cotten[4], PhD; Julie Dunneback[5], MSN, APRN, BC, CPNP, CDE; Denise Hershey[6], PhD, RN, FNP; Arpita Vyas[7], MD

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Abstract

Background: Type 1 diabetes (T1D) afflicts approximately 154,000 people under the age of 20. T1D care is complex, which is why parents often manage their child's disease. Once the child reaches adolescence, they must begin to transition from parent care to self-care. As a result of the inherent complexity of managing T1D, this transition is often difficult. During this time, adherence to the prescribed treatment regimen drops. Uncontrolled T1D can lead to blindness, nervous system disease, kidney disease, amputations, and premature mortality. mHealth apps have been shown to be successful at monitoring and managing chronic diseases, including diabetes. This project is in the formative stages of developing an app for adolescents with T1D to connect with their parents to bridge the transition of care. Our proposed app, MyT1D_Hero, is unique in that it links the child's information to their parent's cell phone and promotes positive communication within families. Research suggests this interaction is imperative for a successful transition in care.

Objective: The goal of this study was to determine the perceptions of adolescents with T1D and their parents regarding how best to aid in the transition to diabetes self-management.

Methods: We conducted two sets of focus groups to examine perceptions of the proposed app. The first study included focus groups and interviews with adolescents aged 13-22 with T1D (n=12) and parents (n=9). These focus groups and interviews helped inform the development of a second set of focus group protocols conducted with adolescents aged 10-13 with T1D (n=5) and parents (n=7). Using grounded theory, the transcripts were analyzed by generating codes based on an iterative examination of the data. Members of the research team then coded the interviews independently; any discrepancies were discussed and resolved. These codes were applied to the transcripts and a list of key themes emerged.

Results: The analysis of the initial focus groups and interviews yielded the following key themes: (1) adolescents were more likely to have a phone because they have diabetes and (2) both groups felt that parents nagged and believed an app might reduce conflict. The second session yielded the following key themes: (1) parents want to feel confident in their child's ability to manage their diabetes independently, but they want to be engaged in managing their child's T1D; (2) children want more positive communication from their parents regarding their T1D; and (3) customization of the app was important, including adjusting the level of parent involvement. Both studies revealed that incentives and gamification will encourage long-term use of the mobile app.

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Conclusions: Taking a patient-centered approach to gain insight into the daily management of T1D supports the development of a T1D mHealth app to aid in the transition toward self-management. The first study established the need for and projected usefulness of an app. The second study demonstrated additional necessities for creating an app that meets the needs of adolescents and their parents. Additionally, both studies demonstrated the importance of supportive patient-centered research to tailor mHealth interventions.

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KEYWORDS

mHealth; type 1 diabetes; diabetes self-management; adolescent health

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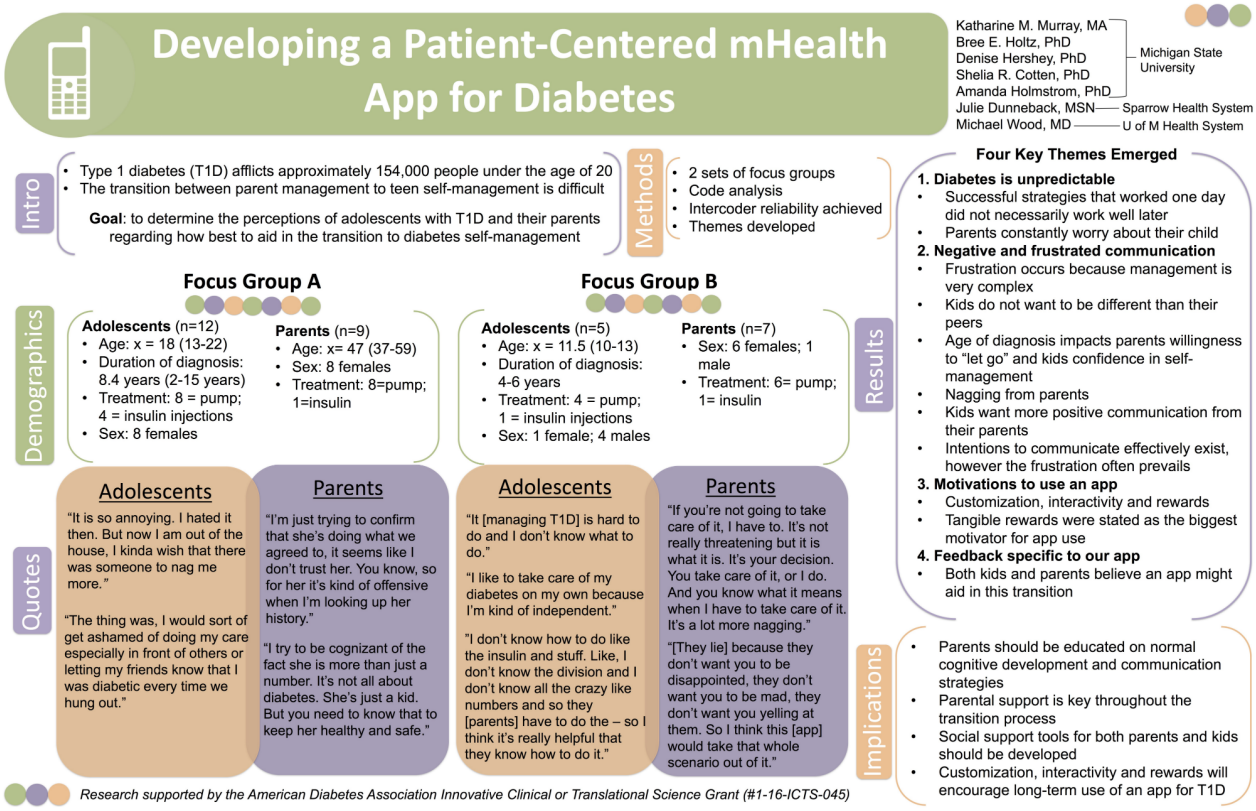
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Wearable Stress Sensors for Children With Autism Spectrum Disorder With In Situ Alerts to Caregivers via a Mobile Phone

C Matthew Northrup[1], MSc; Johanna Lantz[1], PhD; Theresa Hamlin[1], EdD

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Abstract

Background: Children with autism spectrum disorder (ASD) often exhibit unexpected and difficult to manage self-injurious, aggressive, and/or disruptive and challenging behaviors. These behaviors can lead to restrictive care settings including hospitalizations and lifelong residential care placement. Because children with ASD have significant impairments in social communication skills including lack of facial expression, an inability to clearly articulate feelings, and atypical body language, caregivers could benefit tremendously by knowing when a child is becoming stressed.

Objective: To develop a set of customized features in a wearable sensor and mobile app that monitors stress reactivity of children with autism in real time and automatically triggers in situ alerts to a caregiver via a mobile handheld device.

Methods: The Center for Discovery (CFD) is a not-for-profit internationally recognized service provider for people with complex developmental disabilities, including a large population of children and adults with autism. Neumitra Inc., is a start-up technology vendor specializing in wearable stress monitoring. Neumitra's wearable sensor called neuma featured an embedded system with automated scoring of electrodermal activity, a well-established method for recording physiological stress responses. The sensor was accompanied by a mobile app for users to self-monitor their own stress levels. The app provided a 10-point color gradient scale as an interpretation of real-time stress and arousal levels. CFD collaborated with Neumitra's development team to develop a set of customized features amenable to the use case presented by caring for children with autism. The research team at CFD trialed the neuma system extensively, developed use case scenarios, and identified the features necessary to successfully implement in situ alerts to caregivers and track stress events to review for patterns of stress.

Results: The resulting system is neuma-CFD, a coordinated technological system for in situ monitoring of stress levels to identify correlations in the user's stress increases and contextual events. The system delivers in situ alerts to caregivers via a smartphone or similar handheld devices. A new interface for the mobile app was customized to minimize user burden. The home screen now allows users to create high-frequency calendar events in only two taps. These events include common challenging behaviors and common intervention techniques. Thus, upon review, stress responses can be viewed relevant to both challenging behavioral episodes and intervention techniques. To enhance clinical review, the app now logs the detection of stress events into the calendar. Users can also access an increased granular review of electrodermal activity within a calendar event, such as behavior episodes or classroom routines.

Conclusions: In field testing, in situ alerts were reported by caregivers to be beneficial. Furthermore, the integration of color-coding calendar events and routines in an intuitive interface allows multiple users to review the contextual events correlated to stress responses with minimal training. Wear tolerance, a challenging human factor common in ASD, can be addressed through behavioral shaping protocols. The hardware form factor was not amenable to this population due impulsive behaviors including pulling on the device to remove it, causing hardware damage. Exposure to water during handwashing was another challenge in hardware. These concerns are being revised in future versions of hardware. This system can also benefit other healthcare populations, such as patients with anxiety, posttraumatic stress disorder or any other condition for which understanding patterns of stress offers improved health outcomes.

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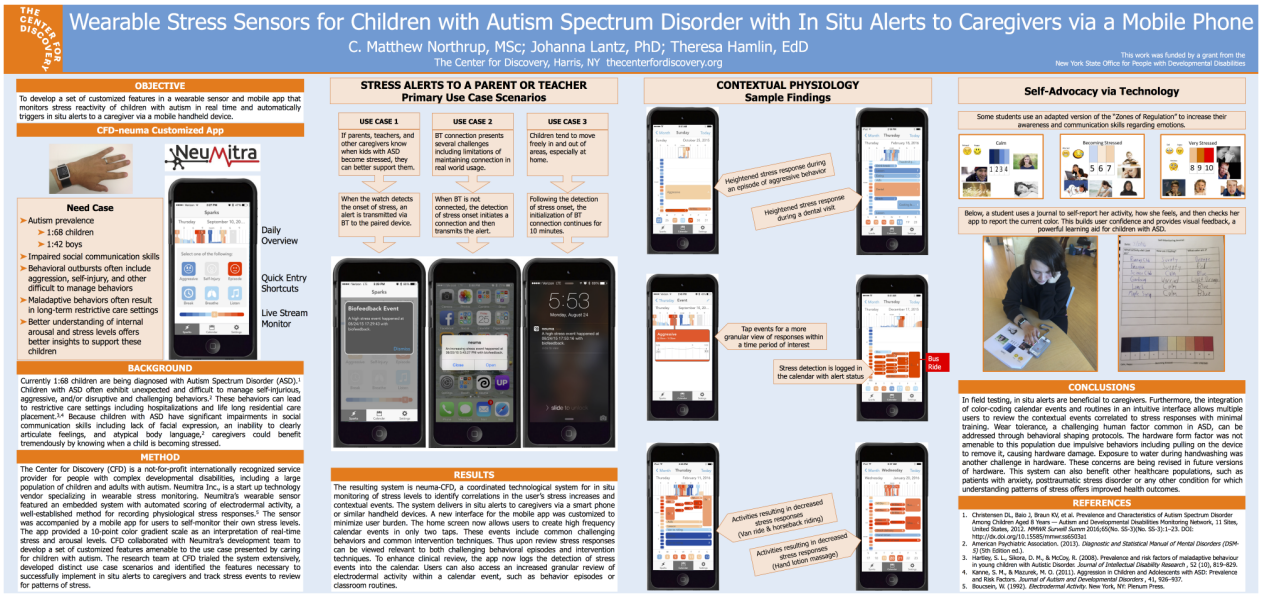
(iproc 2016;2(1):e9) doi:10.2196/iproc.6119

KEYWORDS

mHealth; wearable sensor; stress; autism; app; design

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Disruptive Innovation in Neurosurgical Outcomes Research: The Impact of Big Data, Predictive Analytics, and Wearable Technology

Aditya V Karhade[1], B Eng; Joeky Senders[2], BS; Marike L Broekman[2], MD, PhD, JD; William B Gormley[1], MD, MPH, MBA; Timothy R Smith[1], MD, PhD, MPH

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Abstract

Background: The value agenda in healthcare has created legislative reform, merit-based reimbursement systems, public reporting of surgeon scorecards, and patient-centered neurosurgical outcomes tracking. Though technological innovations for the intra-operative experience continue to abound, technological advances such as artificial intelligence, big data, and wearable technology have yet to become standard tools for outcomes measures in neurosurgery.

Objective: The purpose of this work was to review existing tools for outcomes research in neurosurgery and to characterize the disruptive innovation created by artificial intelligence, big data, and wearable technology.

Methods: Gold standards for neurosurgical patient-reported outcomes were compared to ongoing work in our center as well as major developments in the fields of mobile health, computer science, and health informatics.

Results: The gold standards for neurosurgical outcomes measures (pain scale, Oswestry Disability Index, Euro-Qol 5D, Short Form Health Survey, etc.) provide limited information on time-dependent, longitudinal patient recovery outside of the clinical setting. Our work with smartphone-enabled passively collected data allows for continuous, real-time monitoring of 9 different data streams generating over 1 million data points per day per patient. Artificial intelligence capabilities, including natural language processing and machine learning, quantify and digitize patient quality of life from electronic medical records, audio recordings, and free text notes. Quantification of patient outcomes is further aided by the creation of wearable physiological sensors specific to neurosurgery, such as a serum sodium sensing wearable with WiFi communication capabilities to prevent complications and readmissions of delayed symptomatic hyponatremia post-transsphenoidal surgery.

Conclusions: Systems-level risk adjustment, high-value care, and real-time tracking of functional recovery is enabled by passively collected data. The future of outcomes measures in neurosurgery requires the translation of validated, gold standard assessments into the modern era of big data, artificial intelligence, and wearable technology.

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KEYWORDS

neurosurgery; outcomes measures; artificial intelligence; big data; wearable technology; predictive analytics

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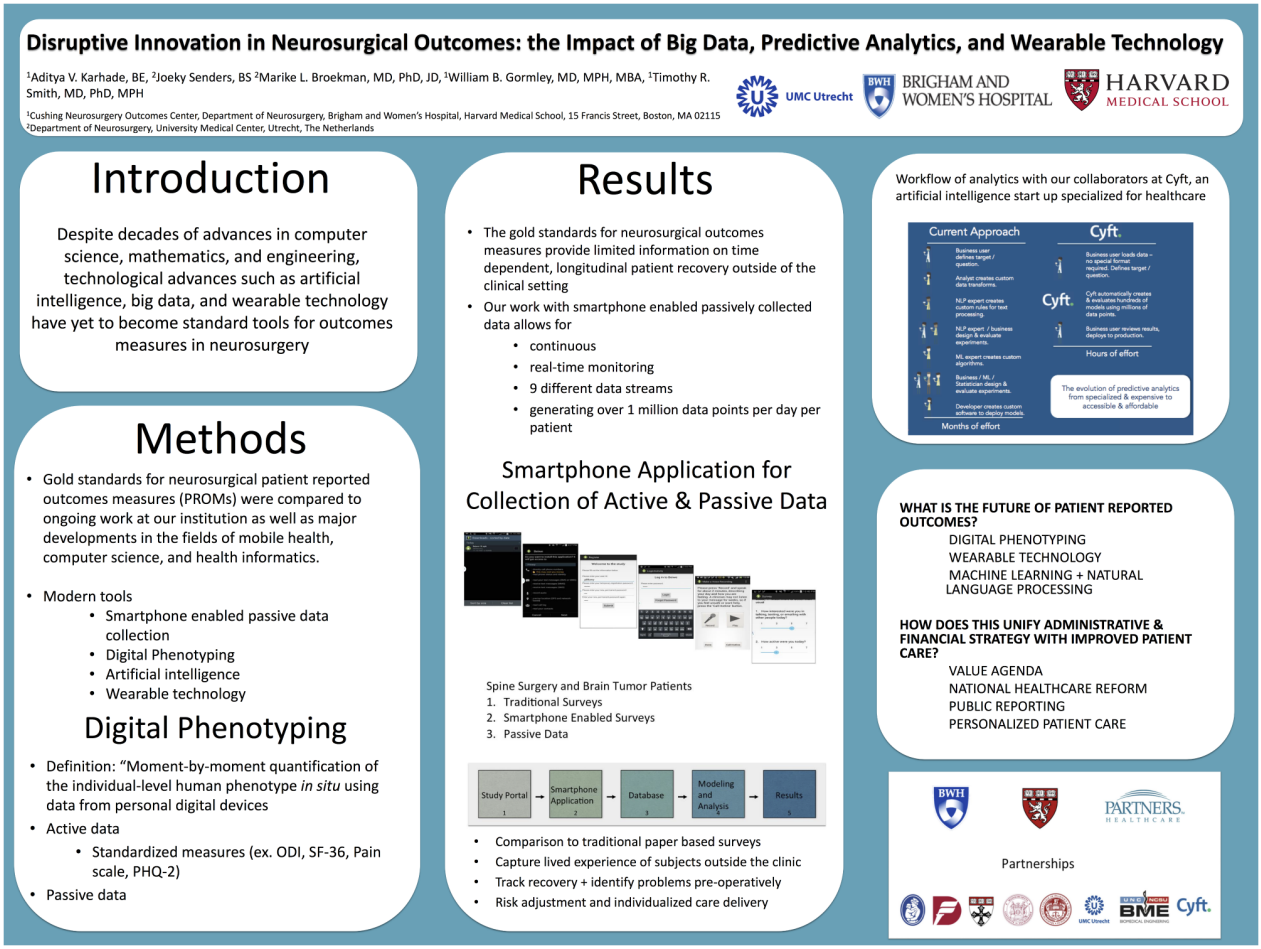
Figure 1. Poster.



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Poster.

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Poster

Can a Free Wearable Activity Tracker Change Behavior? The Impact of Trackers on Adults in a Physician-Led Wellness Group

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Abstract

Background: Wearable activity trackers (trackers) are increasingly popular devices used to track step count and other health indicators. Trackers have the potential to benefit those in need of increased physical activity, such as adults who are older and who face significant health challenges. These populations are least likely to purchase trackers and most likely to face challenges in using them, yet may derive educational, motivational, and health benefits from their use once these barriers are removed.

Objective: The aim of this research was to investigate the use of trackers by older adults with chronic medical conditions who had never used trackers previously. Our primary research questions were (1) if participants would accept and use trackers to increase their physical activity; (2) if there were barriers to use besides cost and training; (3) if trackers would educate participants on their baseline and ongoing activity levels and support behavior change; and (4) if clinical outcomes would show improvements in participants' health.

Methods: This study was conducted with 10 patients in a 12 week physician-led wellness group offered by Family Doctors, LLC. Patients were given trackers in the second week of the wellness group and were interviewed 2-4 weeks after it ended. The study investigators analyzed the interview notes to extract themes about the participants' attitudes and behavior changes and collected and analyzed participants' clinical data, including weight and LDL-Cholesterol (LDL), over the course of the study.

Results: Over the 12-14 weeks of tracker use, improvements were seen in clinical outcomes, attitudes towards the trackers, and physical activity behaviors. Participants lost an average of a half-pound per week (SD=0.408), with a mean total weight loss of 5.97 pounds (P=.0038). Other short-term clinical outcomes included a 9.2% decrease in LDL levels (P=.0377). All participants reported an increase in well-being and confidence in their ability to lead more active lives. We identified 6 major attitudinal themes from our qualitative analysis of the interview notes: (1) barriers to tracker purchase included cost, perceived value, and choice confusion; (2) attitudes towards the trackers shifted for many, from half of the participants expressing excitement and hope and half expressing hesitation or trepidation, to all participants feeling positive towards their tracker at the time of the interviews; (3) trackers served as educational tools for baseline activity levels; (4) trackers provided concrete feedback on physical activity, which motivated behavior change; (5) tracker use reinforced wellness group activities and goals; and (6) although commitment to tracker use did not waver, external circumstances influenced some participants' ongoing use.

Conclusions: Our findings suggest that adding trackers to wellness groups comprising older adults with chronic medical conditions can support education and behavior change to be more physically active. The trackers increased participant self-efficacy by providing a tangible, visible reminder of a commitment to increasing activity and immediate feedback on step count and progress towards a daily step goal. While acceptance was high and attitudes ultimately positive, training and support are needed and short-term drop-off in participant use is to be expected. Future research will further consider the potential of trackers in older adults with chronic medical conditions who are unlikely to purchase them, and studies will use larger samples, continue over a longer period of time, and evaluate outcomes independent of a wellness group.

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(iproc 2016;2(1):e1) doi:10.2196/iproc.6245

KEYWORDS

wearable activity trackers; fitness trackers; trackers; physical activity; chronic disease; behavior change; wellness group; wellness; older adults; digital health

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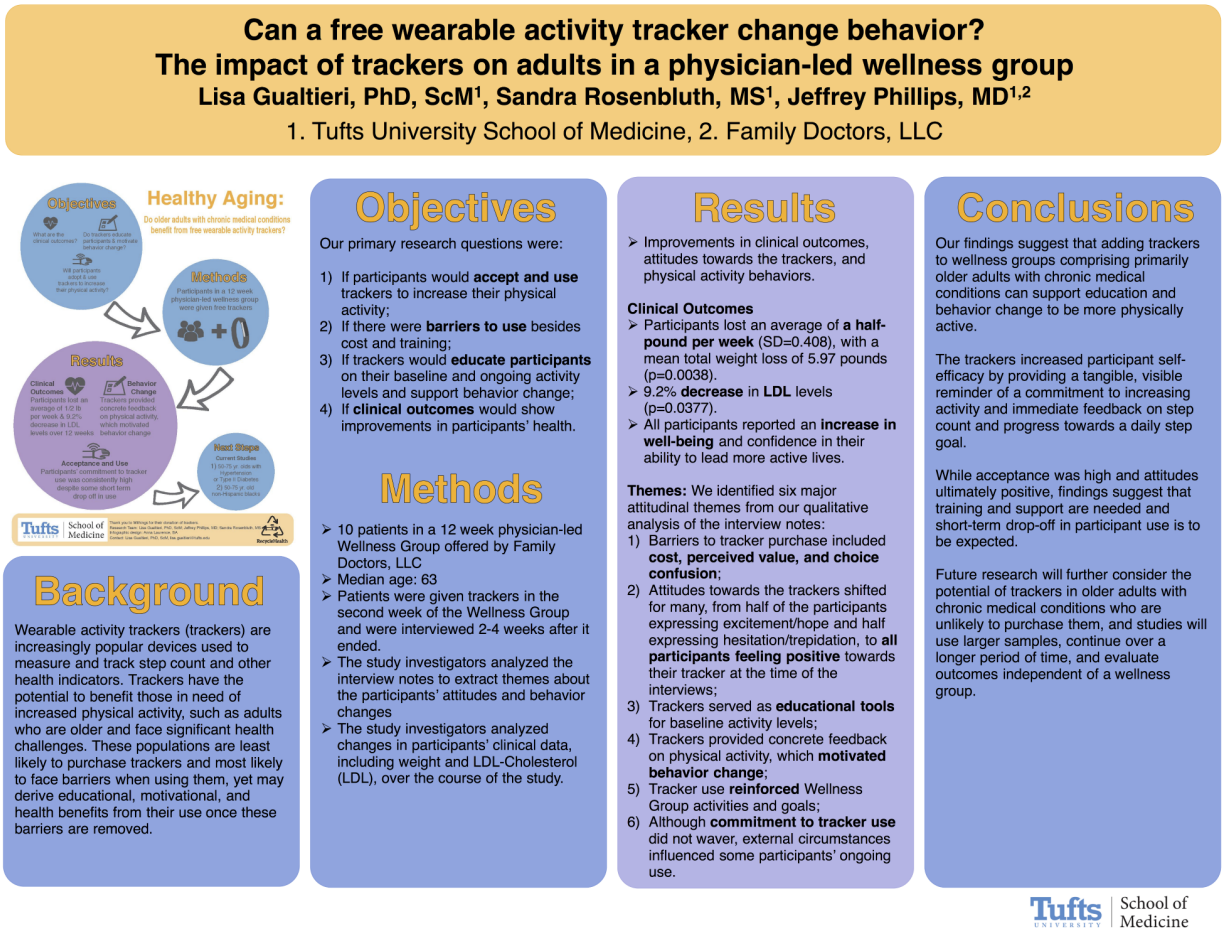
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Prototype Development of a Responsive Emotive Sensing System (DRESS): System Operations Testing Outcomes

Diane Mahoney[1*], ARNP, PhD; Winslow Burleson[2*], PhD; Jeremy Rowe[2], EdD; Edward Mahoney[3], MS

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Abstract

Background: Smart-home consumer technologies have been criticized for failing to disclose their operational performance characteristics to the marketplace. As one result, some users of wearable fitness technologies have reported being frustrated by invalid motivational responses based on fluctuations in accurate performance measurement by certain brands. Gerontechnology researchers have similarly documented the critical importance of valid operations and technical stability as major influences on whether older adults and their caregivers adopt and use new cognitive assistive technologies. We have been iteratively developing the DRESS (Development of a Responsive Emotive Sensing System) system, integrating context aware computing with effective sensor and interactive technologies, to customize coaching persons with dementia to dress independently. Our prior testing focused on components and clothing identification, not the overall system performance. Consequently, we initiated system testing, as part of our alpha version development phase, to assess key metrics and disclose the performance outcomes.

Objective: To assess the operational accuracy (validity) and stability (reliability) of the DRESS system alpha prototype model.

Methods: We conducted a 110 day device trial run-in study. The system operated 24/7 in a studio-sized testing unit using the local WiFi network. A 69-year-old tester documented any usability issues during this period. Automatic log reports were generated daily by the system and validated and annotated by the project manager. A content analysis of the user and log reports was conducted, and descriptive statistics were used to describe the operational findings.

Results: The system functioned error free for the majority of the trial (75% of days) with stable performance for 95.5% of days. Thirty-seven correctable error events occurred during 28 of the 110 days and resulted in 4 categories of errors: Hardware (0.9%), from a defective IPad charger; Network (3.6%), from host network disconnects/power outage; Usability (4.5%), from the visual displays/buttons on the caregivers' device being too small in size; and Re-initialization (24.5%), from the operating system/Indigo software updates.

Conclusions: Overall, the system performed very favorably for an alpha prototype. As expected, the initial deployment required an immediate debugging period primarily rectified by software recoding. Notably no fatal or irresolvable errors occurred. The system remained stable except for a disconnect due to a weather-related regional power outage. Lessons learned, such as integrating a remote automatic reboot capability, will be used to further optimize system performance before advancing to an in-home study with persons experiencing dementia.

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KEYWORDS

cognitive assistive technologies; context-aware computing; dementia caregiving

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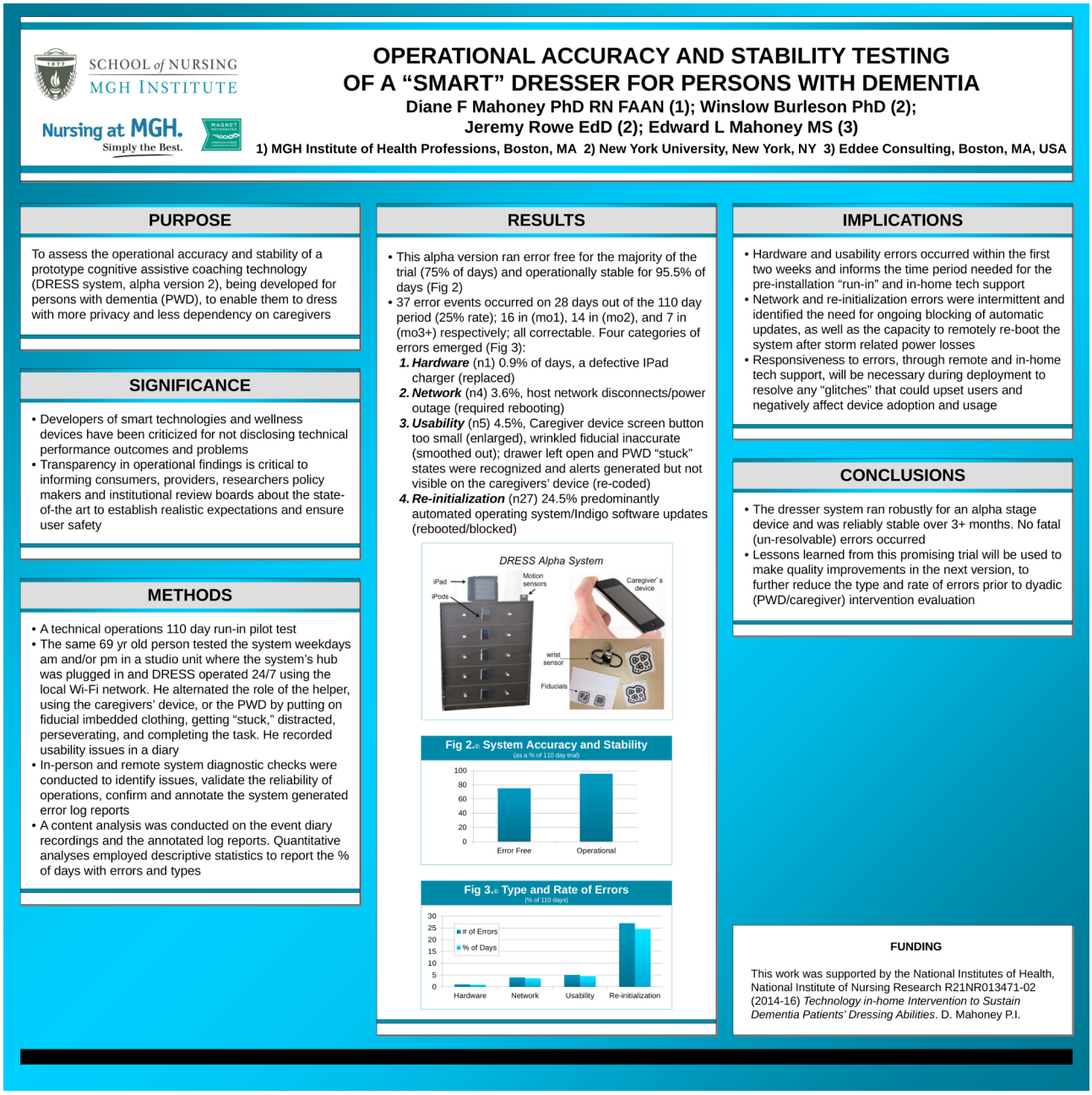
Figure 1. Poster.



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Poster

Lower Risk of Home Hemodialysis Attrition in Patients Using Nx2me Connected Health Technology

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Abstract

Background: Home hemodialysis is a growing treatment modality for end-stage renal disease. Home hemodialysis facilitates increased treatment frequency, which may reduce intradialytic symptoms, decrease risk of cardiovascular morbidity, and improve quality of life. However, patients may elect to discontinue home hemodialysis for medical or psychosocial reasons and to convert to in-center hemodialysis. Tools that improve communication and coordination between patients and providers and reduce therapy burden on patients may reduce risk of attrition. Nx2me Connected Health (NxStage Medical, Inc, Lawrence, MA) is a telehealth platform that collects NxStage System One cycler data and patient factors (eg, blood pressure, weight), transmits data to providers after each dialysis session, and enables providers to review data in the Nx2me Clinician Portal regularly; in contrast, usual care involves monthly review of patient-completed session records on paper.

Objective: To assess whether use of Nx2me Connected Health was associated with reduced risk of home hemodialysis attrition in patients on the System One cycler.

Methods: We collected data from home hemodialysis patients that initiated use of Nx2me Connected Health. At first use of Nx2me, we identified cumulative time with the System One cycler and treatment setting (in-center training or home). From NxStage records, we identified 3 matched controls for each Nx2me user. Specifically, for a Nx2me user who had accumulated t days with the System One cycler at first use of Nx2me, we identified potential controls who had also accumulated at least t days with the System One cycler (without use of Nx2me) and retained those in the same treatment setting as the Nx2me user at t days after first use of the System One cycler. We randomly selected 3 matched controls from this subset. We followed Nx2me users and matched controls until home hemodialysis attrition and classified the cause of attrition as non-controllable (due to transplant or death) or controllable (due to health issues, therapy burden, or other reasons). We used Fine-Gray competing-risks regression to model incidence of attrition, with stratification by matched cluster and adjustment for race, vascular access modality, and number of dialysis sessions per week.

Results: We identified 401 Nx2me users (cumulative follow-up years, 356) and 1203 matched controls (1111). Crude attrition rates in Nx2me users and matched controls were 39.6 and 50.6 stops per 100 patient-years, respectively. For Nx2me users versus matched controls, adjusted hazard ratios of attrition due to controllable causes were 0.64 (95% CI 0.49-0.83) overall and 0.52 (95% CI 0.36-0.76) in the subset of patients with <3 months on the System One cycler at first use of Nx2me (and their respective matched controls). In contrast, adjusted hazard ratios of attrition due to non-controllable causes were 1.09 (95% CI 0.79-1.51) overall and 1.01 (95% CI 0.55-1.84) in the aforementioned subset.

Conclusions: Use of Nx2me Connected Health reduced risk of home hemodialysis attrition due to health issues, therapy burden, and other reasons that ordinarily lead to conversion to in-center hemodialysis. The magnitude of risk reduction was larger in patients who initiated use of Nx2me shortly after first treatment with the NxStage System One cycler.

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KEYWORDS

end stage renal disease; home hemodialysis; technique failure; telehealth

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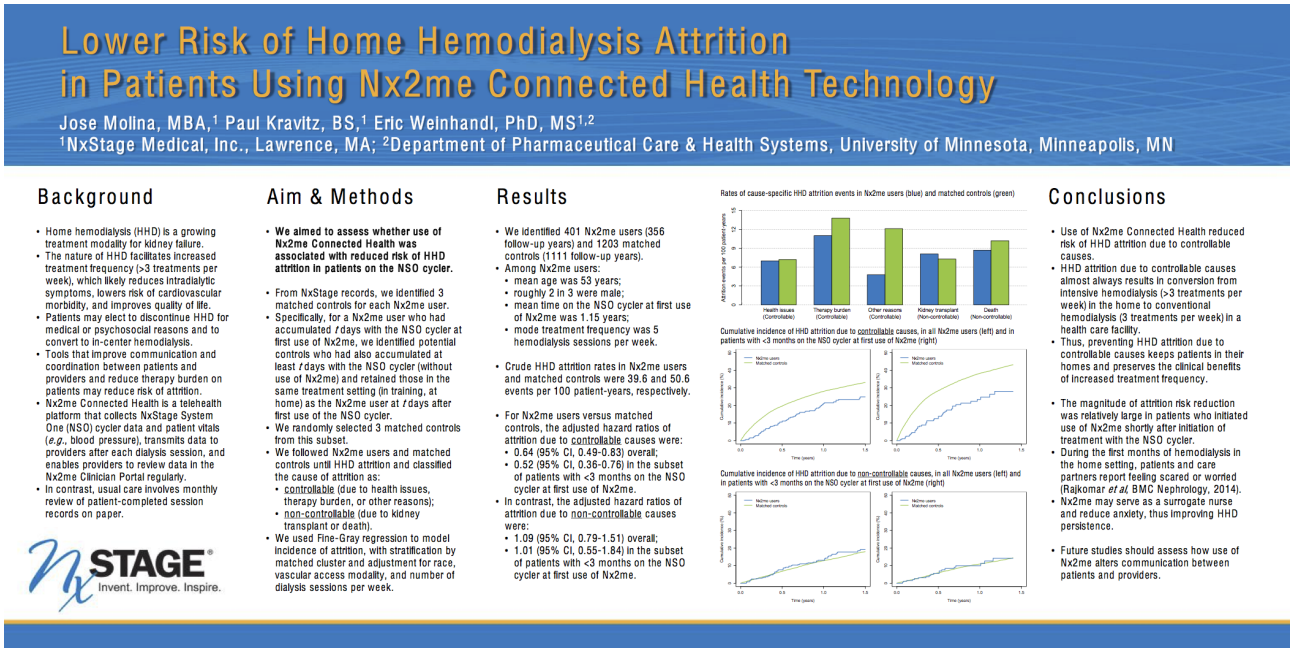
Figure 1. Poster.



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Poster

Preliminary Analysis of Worldwide Usage Patterns in a Mobile Palliative Care Reference App

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Abstract

Background: Fast Facts and Concepts for iOS and Android is the world's most downloaded point of care mobile reference application for palliative care providers. This free mobile app leverages the Fast Facts and Concepts article repository that was started in 1999 at the End-of-Life/Palliative Education Resource Center at the Medical College of Wisconsin. Our team released the initial iOS version of the app in summer of 2014. Since then, it has been downloaded over 13,000 times.

Objective: The purpose of this project is to evaluate and describe user behaviors of palliative care clinicians on a global scale using an analytics layer integrated into Fast Facts and Concepts.

Methods: An analytics layer was integrated and disclosed with version 1.0.3; an analytics event is triggered when an article is read or when a search is made. The event, along with anonymous user metadata, was sent to a Web server where it was segmented. Summary statistics were generated using Python scripts and include category weight, article rank, and search term clusters. We evaluated user behavior of the Fast Facts and Concepts app during a 3-month window to better understand the needs of the userbase.

Results: Our dataset had 26,733 events and 1461 unique users from 41 countries collected over 3 months. Prognosis was the most active category, with searches for Palliative Performance Scale accounting for a third of prognosis reads. Articles about dosage featured heavily, especially on methadone titration. On the spectrum of illness, physiological categories such as gastrointestinal and renal diseases were generally more popular than psychiatric disorders. Articles about interpersonal skills from categories such as Communication; Ethics, Law, Policy; and Psychosocial and Spiritual Experience were the least read. All of our conclusions are supported by chi-squared tests with P values <.01. More detailed results are included in the poster.

Conclusions: This analysis shows that most users consult the app for guidance in symptom management and prognosis. The usage patterns described above suggest that the app is likely being used at the point of care as a clinical reference for medical decision making and therapeutic guidance. Our study provides evidence that mobile applications can be effective tools to distribute quality palliative care resources on a global scale. Our results also indicate which topics should be emphasized in medical education and how increased vigilance about these topics can optimize patient care; with a large active user base, we have the opportunity to make even more precise conclusions in the future.

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KEYWORDS

palliative care; mHealth; hospice

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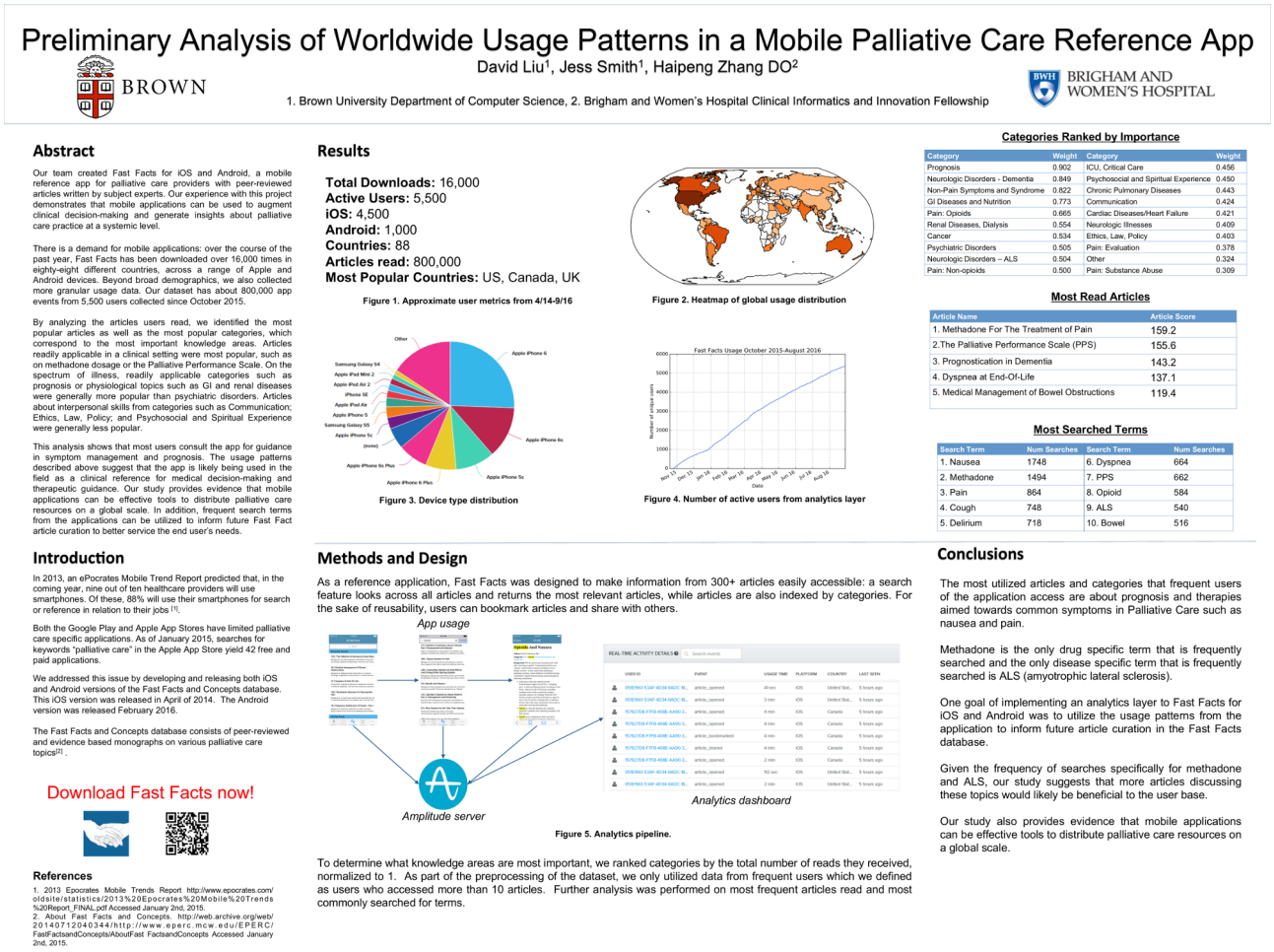

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Poster

Appraising the Value of Digital Health Technologies From the Managed Care Perspective: Insights for Evidence Assessment and Reimbursement in the United States

Thomas Walters[1*], PharmD, MBA, MS; Benjamin Parcher[1*], PharmD; Alexander Kravetz[2], PharmD; Chelsey Campbell[1], PharmD, MBA, MS; Manasee Shah[1], MPH

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Abstract

Background: Digital health technologies (DHTs) have accelerated in both number and utility in recent years, prompting managed care organizations (MCOs) to define the segment's value and role in improving the health care of their members. In this context, many technology manufacturers have initiated clinical trials to generate evidence supporting DHTs; however, limited guidance remains on how MCOs formally evaluate these products.

Objective: To understand how medical and pharmacy directors assess the value of DHTs in the United States and to identify best practices for supporting their reimbursement determinations.

Methods: Medical and pharmacy directors within Xcenda's Managed Care Network (MCN) were invited to complete a 10-part, web-based questionnaire. Respondents were asked to grade their organization's current demand and coverage policy of 9 distinct categories of DHTs. Eleven major disease classes were evaluated based on the potential impact DHTs can have for addressing unmet needs. Specific evidence requirements for reimbursement of DHTs were then proposed and rated. Finally, strategies for manufacturers to interface with MCOs were examined.

Results: In total, 37 pharmacy directors (60.7%) and 24 medical directors (39.3%) completed the questionnaire. The respondents' MCOs cover approximately 180 million lives in the United States, with a mix of national (34.4%) and regional (65.6%) plans. Of the 9 technologies evaluated, mobile apps (80.3%), fitness trackers (60.7%), and medication adherence platforms (57.4%) scored the highest in demand for implementation as a covered benefit. Diabetes (88.5%) and cardiovascular disease (86.9%) were ranked highest in potential impact for DHTs to address unmet needs. Peer-reviewed literature (96.7%) was rated as the most important evidence resource in evaluating the DHTs, followed by real world analysis (95.1%), and cost-effectiveness models (78.7%). Clinical benefit (96.7%) was the top evidence criteria selected for coverage determination. Advisory board meetings (70.5%), continuing education sessions (57.4%), and dedicated peer-reviewed journals for DHTs (55.7%) were identified as the preferred communication strategies between manufacturers and MCOs.

Conclusions: MCOs are actively evaluating a wide range of DHTs in a variety of disease states. Traditional appraisal strategies used in the evaluation of medical devices and pharmaceutical products are seen to also apply in evaluating DHTs. Respondents indicated that more robust evidence communication strategies with technology manufacturers and MCOs are needed for coverage decision making.

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KEYWORDS

digital health technology; value; managed care; evidence assessment; reimbursement

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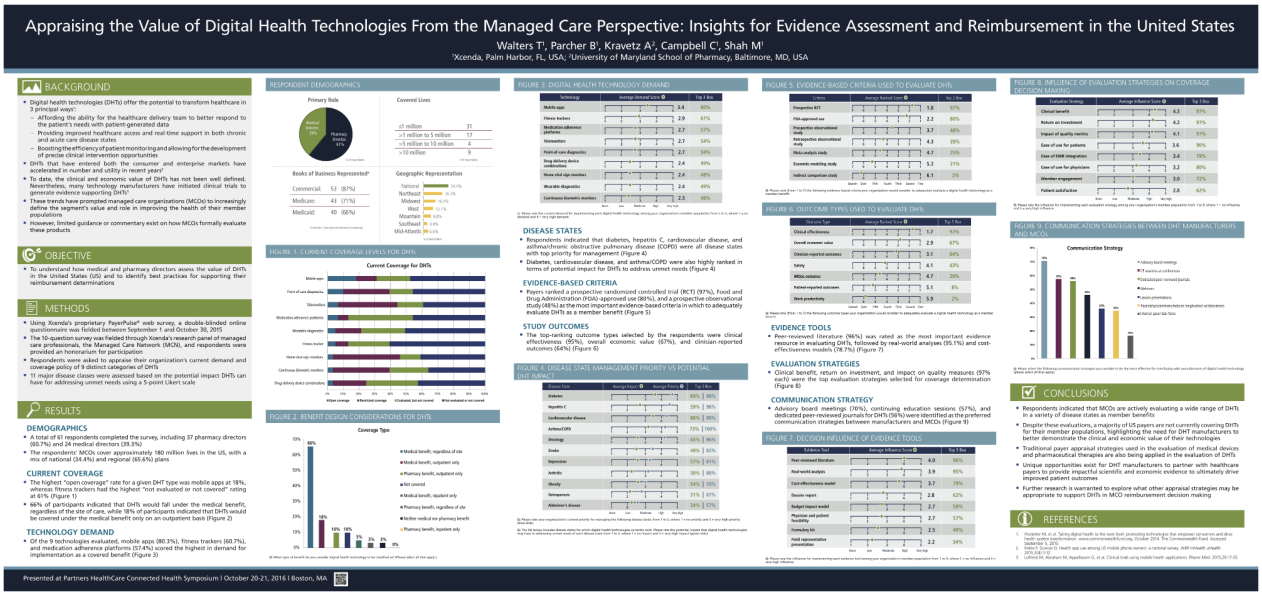
Figure 1. Poster.



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Poster

Check Up GP: A Co-Designed Health and Lifestyle Screening App to Improve Patient-Centered Care for Young People in Primary Care

Marianne Julie Webb[1], MYHEM; Greg Wadley[2], PhD; Sylvia Deidre Kauer[1], PhD; Lena Amanda Sanci[3], MBBS, PhD, FRACGP

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Abstract

Background: During adolescence and young adulthood, a wide range of mental health disorders and risky behaviors can emerge and co-occur. Primary care practitioners (PCPs) are ideally positioned to identify areas of concern as part of young people's routine health care, and screening tools can help to surface problems the young person may be facing. When administered via technology, screening tools are more readily adopted by young people and can deliver results immediately to the PCP. Technology-based screening tools help PCPs to normalize sensitive issues, guide discussion about risky behavior, and promote healthy lifestyles, and they make young people more likely to disclose sensitive health issues. Despite these advantages, there is a paucity of research about how using these screening tools may affect the patient-doctor relationship and whether young people would like to use such tools again in the future.

Objective: The aim was to investigate how using a health and lifestyle screening app would affect young people's relationship with their PCP, their perception of the care they received, and whether they would like to use the app regularly.

Methods: A health and lifestyle screening app (Check Up GP) for young people aged 14 to 25 was developed through a series of participatory design workshops with users and stakeholders. The app was implemented within an action research program with 4 PCPs in one primary care clinic in Melbourne, Australia. We first collected baseline data on young people's experience of attending the clinic without using the app. Then, in the intervention phase, young people were sent a link to the app via their smartphone at the time of their appointment and asked to complete the screening prior to their appointment. The PCPs reviewed a summary report of issues immediately before seeing the young person, along with tips on youth-friendly practice and suggested actions to take on areas of concern.

Results: Compared with those in the baseline group, young people using Check Up GP were significantly more comfortable asking questions and reported that their doctor knew them well, advised them how to prevent problems in the future, and was interested in the effect of the problem on their everyday lives. Check Up GP was also highly acceptable to young people, with 91% thinking it was a "good idea," 74% reporting they would like to use the app at least once a year, and a further 21% reporting they would like to use it every time they saw their PCP.

Conclusions: The results show that integrating a health and lifestyle screening app into face-to-face regular care can significantly improve and enrich young people's experience of seeing a PCP. Using this technology has the potential to ensure typically unrecognized and preventable health and lifestyle issues in young people are not only uncovered but appropriately addressed through targeted health promotion and early intervention.

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KEYWORDS

medical screening; adolescent health; primary care practitioners; mHealth; health apps

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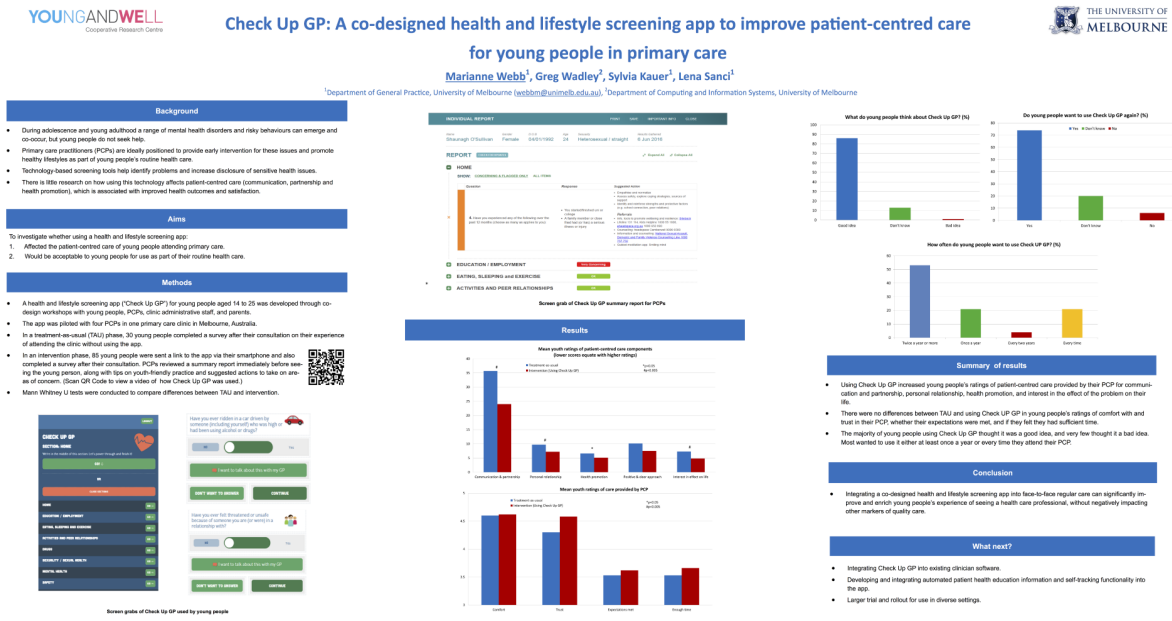

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Poster

Collaborative Care Drives Triple Aim Success in Patients With Uncontrolled Hypertension

Melanie McMinn[1], MD; Greg Weidner[1], MD, FACP; Angie Stevens[1], RN, CDE; Monique Lucas[1], RN, BSN, CCM, CCTM

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Abstract

Background: We are an outpatient internal medicine practice that has developed a team-based technology-enabled approach to managing chronic medical conditions.

Objective: To develop a collaborative approach to managing chronic conditions that is patient-centric, while achieving better outcomes at a lower cost.

Methods: We chose to focus on patients with hypertension. Target patients were identified by partner referrals and by our own data registry reports of patients with blood pressure >140/90. Individuals were then invited to participate in a 90-day program with the focused intent of actively engaging the patients in managing their blood pressure. The invitations were either conducted in person, sent via a patient portal, or sent in a mailed letter. Each interested patient was assigned a health advocate and asked to record their blood pressure in an online application daily. There was no charge to the patient. Individual goals were determined by the patient, with the guidance of the physician and health advocate using a shared decision-making tool, and strategy focused on a habit-based behavior change model. Patients either purchased a Bluetooth-enabled digital blood pressure cuff from our office or were permitted to use their own blood pressure cuff, which was calibrated by our nursing staff. Patients communicated with their health care team via an online shared message board as well as through a patient portal. Virtual visits were conducted as needed throughout the 90-day program with either the physician, health advocate, or dietician. Both curated and created educational materials were shared with the patient. Health coaching was ongoing, and communication frequency and modality preference was collaboratively determined by the patient and care team.

Results: Overall, we invited 920 patients to participate in our program. Of these, 224 patients enrolled and completed the 90-day program. We tracked metrics including blood pressure values, frequency of in-office and virtual visits, time spent by all team members engaged in the online platform, and money saved by averting office visits. Our hypertension patients visited the primary care office half as often as traditionally managed hypertension patients and achieved their target blood pressure faster. In standard hypertension care, research would tell us that 30% of patients will have a normal blood pressure in 1 year. In this study, 80% of our patients had a controlled blood pressure in 3 months. In the few cases where blood pressure control could not be achieved with the above-mentioned methods, a search for secondary causes of hypertension was initiated by the primary care physician. We also demonstrated US $350 in primary care direct cost savings annually by avoiding an average of 2 office visits over these 90 days. The successes, however, are not only improvement in cost and blood pressure values; 93% of patients in this program report a “very high quality” or “high quality” overall patient experience.

Conclusions: Our program achieves higher quality care at a lower cost with higher patient satisfaction than traditional care. We are confident that this approach to hypertension can be applied to other chronic disease states with equally as impressive results.

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KEYWORDS

collaborative care; triple aim; hypertension; connected health; patient engagement

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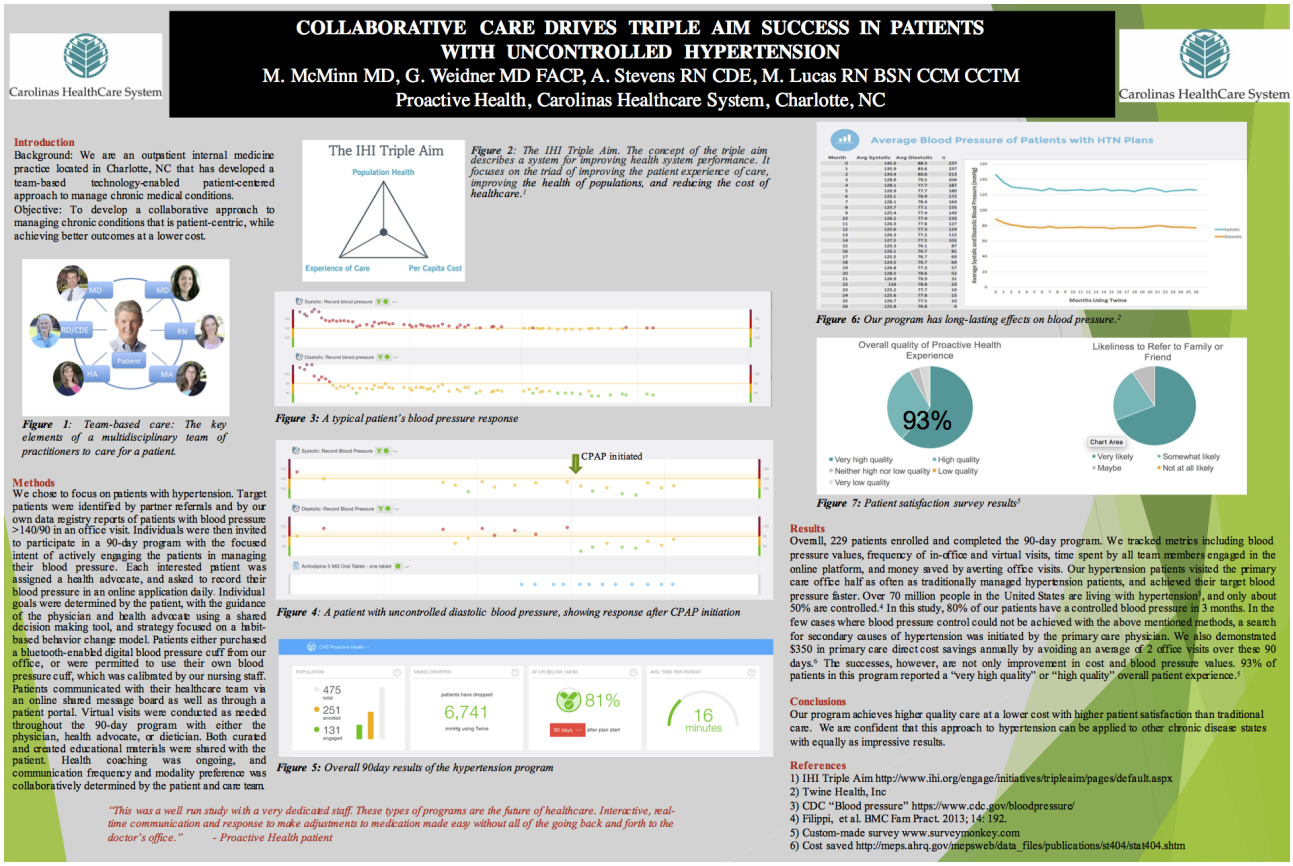
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Utilization, Reliability, and Validity of a Smartphone App for Chronic Pain Management: A Randomized Controlled Trial

Robert N Jamison[1], PhD; Edgar L Ross[1], MD

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Abstract

Background: There has been an explosion of smartphone applications (apps) that have been used to track health data and change the management of chronic diseases. However, there have been very few studies designed to comprehensively examine the usability, acceptability, reliability, utility, and content and face validity of a smartphone pain app.

Objective: The overall aim of this study was to determine the effect of introducing a smartphone pain app, for both Android and iPhone devices, that enables chronic pain patients to assess, monitor, and communicate their status to their providers.

Methods: This study recruited 105 chronic pain patients to use a smartphone pain app. The patients were randomized to either receive 2-way messaging or a standard message on the smartphone app using a stratified randomization table. Those in the experimental group (n=53) received 2-way messaging of weekly supportive text messages and feedback about their progress by the study research assistant (eg, “Hello Dave! It looks like your pain, mood and activity interference this week have improved - way to go!”). Those in the control group (n=52) received a standard reply of “Thank you. Your message has been received” every time the participants sent a message through the app. All subjects completed baseline measures and were asked to record their progress every day for 3 months, with the opportunity to continue for 6 months. All participants were supplied a Fitbit to track daily activity. Summary line graphs were posted to each of the patients’ electronic medical records, and physicians were notified of their patients’ progress.

Results: Ninety patients successfully downloaded the pain app. Average age of the participants was 47.1 (range 18-72), 63.8% were female, and 32.3% reported multiple pain sites. Adequate validity and reliability was found between the daily assessments and standardized questionnaires (r=0.50) and in repeated daily measures (r=0.69 pain; r=0.83 sleep). Patient satisfaction survey results showed that the app was easy to use and easy to navigate, and those subjects with more daily assessments were found to be more satisfied with the app compared with those who used the app less often (P<.05).Those patients assigned to the 2-way messaging condition on average tended to use the app more and submit more daily assessments (95.6 vs 71.6 entries) and found the app more appealing, easier to use and to navigate, and less bothersome than those without the 2-way messaging (P<.05), but differences between groups in adherence to the pain app over time were not significant. Seven pain management physicians and six pain fellows completed an anonymous satisfaction survey at the end of the trial. A total of 85.7% reported being satisfied with the way the app was used in the clinic and liked receiving the pain app summary messages. Also, 85.7% believed that using the app would improve their overall practice, while none of the physicians felt that the pain app was an added burden to the clinic.

Conclusions: This study highlights some of the benefits and challenges in utilizing smartphone apps to manage chronic pain patients, and provides insight into those individuals who might benefit from mHealth technology. Overall, the smartphone pain app was found to be usable, valid, reliable, and easily accepted among patients and providers alike. The 2-way messaging feature was also found to moderately improve compliance with daily assessments. Mobile application technologies possess advantages

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and possibilities that have not previously existed and future programs are needed that tailor to the needs of the individual to engage and motive the user to make changes that enhance health care management.

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KEYWORDS

chronic pain; innovative technology; pain app; mHealth; smartphone

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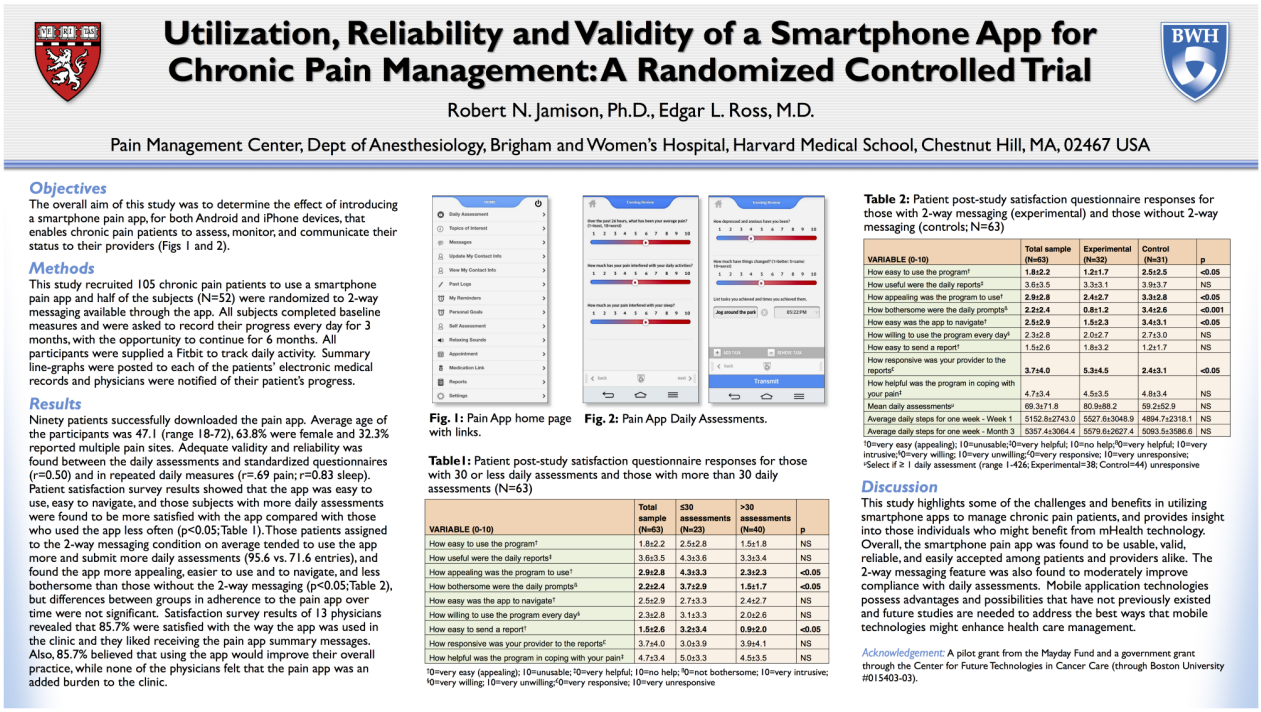
Figure 1. Poster.



Utilization, Reliability and Validity of a Smartphone App for Chronic Pain Management: A Randomized Controlled Trial

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Objectives

The overall aim of this study was to determine the effect of introducing a smartphone pain app, for both Android and iPhone devices, that enables chronic pain patients to assess, monitor, and communicate their status to their providers (Figs 1 and 2).

Methods

This study recruited 105 chronic pain patients to use a smartphone pain app and half of the subjects (N=52) were randomized to 2-way messaging available through the app. All subjects completed baseline measures and were asked to record their progress every day for 3 months, with the opportunity to continue for 6 months. All participants were supplied a Fitbit to track daily activity. Summary line-graphs were posted to each of the patients' electronic medical records and physicians were notified of their patient's progress.

Results

Ninety patients successfully downloaded the pain app. Average age of the participants was 47.1 (range 18-72), 63.8% were female and 32.3% reported multiple pain sites. Adequate validity and reliability was found between the daily assessments and standardized questionnaires (r=0.50) and in repeated daily measures (r=.69 pain; r=0.83 sleep). Patient satisfaction survey results showed that the app was easy to use, easy to navigate, and those subjects with more daily assessments were found to be more satisfied with the app compared with those who used the app less often (p<0.05;Table 1).Those patients assigned to the 2-way messaging condition on average tended to use the app more and submit more daily assessments (95.6 vs. 71.6 entries), and found the app more appealing, easier to use and to navigate, and less bothersome than those without the 2-way messaging (p<0.05;Table 2), but differences between groups in adherence to the pain app over time were not significant. Satisfaction survey results of 13 physicians revealed that 85.7% were satisfied with the way the app was used in the clinic and they liked receiving the pain app summary messages. Also, 85.7% believed that using the app would improve their overall practice, while none of the physicians felt that the pain app was an added burden to the clinic.

Fig. 1: Pain App home page with links.

Fig. 2: Pain App Daily Assessments.

Table1: Patient post-study satisfaction questionnaire responses for those with 30 or less daily assessments and those with more than 30 daily assessments (N=63)

VARIABLE (0-10)	Total sample (N=63)	≤30 assessments (N=23)	>30 assessments (N=40)	p
How easy to use the program†	1.8±2.2	2.5±2.8	1.5±1.8	NS
How useful were the daily reports‡	3.6±3.5	4.3±3.6	3.3±3.4	NS
How appealing was the program to use†	**2.9±2.8**	**4.3±3.3**	**2.3±2.3**	**<0.05**
How bothersome were the daily prompts§	**2.2±2.4**	**3.7±2.9**	**1.5±1.7**	**<0.05**
How easy was the app to navigate†	2.5±2.9	2.7±3.3	2.4±2.7	NS
How willing to use the program every day¶	2.3±2.8	3.1±3.3	2.0±2.6	NS
How easy to send a report†	**1.5±2.6**	**3.2±3.4**	**0.9±2.0**	**<0.05**
How responsive was your provider to the reports£	3.7±4.0	3.0±3.9	3.9±4.1	NS
How helpful was the program in coping with your pain‡	4.7±3.4	5.0±3.3	4.5±3.5	NS

†0=very easy (appealing); 10=unusable; ‡0=very helpful; 10=no help; §0=not bothersome; 10=very intrusive; ¶0=very willing; 10=very unwilling;£0=very responsive; 10=very unresponsive

Table 2: Patient post-study satisfaction questionnaire responses for those with 2-way messaging (experimental) and those without 2-way messaging (controls; N=63)

VARIABLE (0-10)	Total sample (N=63)	Experimental (N=32)	Control (N=31)	p
How easy to use the program†	**1.8±2.2**	**1.2±1.7**	**2.5±2.5**	**<0.05**
How useful were the daily reports‡	3.6±3.5	3.3±3.1	3.9±3.7	NS
How appealing was the program to use†	**2.9±2.8**	**2.4±2.7**	**3.3±2.8**	**<0.05**
How bothersome were the daily prompts§	**2.2±2.4**	**0.8±1.2**	**3.4±2.6**	**<0.001**
How easy was the app to navigate†	**2.5±2.9**	**1.5±2.3**	**3.4±3.1**	**<0.05**
How willing to use the program every day¶	2.3±2.8	2.0±2.7	2.7±3.0	NS
How easy to send a report†	1.5±2.6	1.8±3.2	1.2±1.7	NS
How responsive was your provider to the reports£	**3.7±4.0**	**5.3±4.5**	**2.4±3.1**	**<0.05**
How helpful was the program in coping with your pain‡	4.7±3.4	4.5±3.5	4.8±3.4	NS
Mean daily assessments#	69.3±71.8	80.9±88.2	59.2±52.9	NS
Average daily steps for one week - Week 1	5152.8±2743.0	5527.6±3048.9	4894.7±2318.1	NS
Average daily steps for one week - Month 3	5357.4±3064.4	5579.6±2627.4	5093.5±3586.6	NS

†0=very easy (appealing); 10=unusable;‡0=very helpful; 10=no help;§0=very helpful; 10=very intrusive;¶0=very willing; 10=very unwilling;£0=very responsive; 10=very unresponsive; #Select if ≥ 1 daily assessment (range 1-426; Experimental=38; Control=44) unresponsive

Discussion

This study highlights some of the challenges and benefits in utilizing smartphone apps to manage chronic pain patients, and provides insight into those individuals who might benefit from mHealth technology. Overall, the smartphone pain app was found to be usable, valid, reliable, and easily accepted among patients and providers alike. The 2-way messaging feature was also found to moderately improve compliance with daily assessments. Mobile application technologies possess advantages and possibilities that have not previously existed and future studies are needed to address the best ways that mobile technologies might enhance health care management.

Acknowledgement: A pilot grant from the Mayday Fund and a government grant through the Center for Future Technologies in Cancer Care (through Boston University #015403-03).

Multimedia Appendix 1

Poster.

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Poster

I-Change: A Randomized Controlled Trial of Cognitive Bias Modification-Interpretation as an Augmentation to Partial Hospitalization

Courtney Beard[1], PhD; Lara Rifkin[1], BA; Throstur Bjorgvinsson[1], PhD, ABPP

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Abstract

Background: The tendency to resolve ambiguity in a negative manner (ie, interpretation bias) has been implicated in the etiology and maintenance of a range of emotional disorders. Cognitive bias modification computer training tasks targeting interpretation (CBM-I) have successfully improved interpretation bias in anxiety and depression, with subsequent positive effects on symptoms and behavior. CBM-I has great potential for dissemination as it targets a transdiagnostic mechanism, is computerized, can be reliably administered across settings, and does not require clinician contact or patients to apply complicated concepts. However, few studies have tested CBM-I's effectiveness in real-world settings. Moreover, few studies have examined patient experiences with this type of intervention.

Objective: The current study tested the effectiveness of CBM-I as an augmentation to a cognitive behavioral therapy (CBT) based partial hospital. We also examined patient acceptability, experience, and perceived mechanisms of action.

Methods: Patients (N=62) were randomly assigned to complete a word-sentence association paradigm (WSAP) that reinforced patients ("you are correct!") for making benign interpretations and rejecting negative interpretations of ambiguous scenarios or to a neutral control task. Patients completed the 10-minute task daily while attending the partial hospital (average duration=8 days). The primary outcome measure was the patient-rated Clinical Global Improvement Scale, and treatment response was defined as a rating of "very much improved." We assessed patient experiences with an exit questionnaire completed on discharge day. Three authors independently coded qualitative data and generated a potential coding scheme. We then met and reached a consensus on the final themes.

Results: Patients successfully learned the interpretation contingencies in the task (ie, significant increase in benign interpretations and decrease in negative interpretations, $P<.001$). In patients who demonstrated an interpretation bias at baseline, 36% of patients completing CBM-I were classified as responders ("very much improved") compared to 0% in the control, $\chi 2 = 4.41$, $P<.04$. There was also a moderate between-group effect size for improvement in well-being (d=0.6). Qualitative data revealed that patients believed CBM encouraged them to broaden their interpretations of situations and to question initial reactions. Patients identified the repetitive nature of the task as a crucial aspect of the program, stating that the repetition facilitated their ability to make positive interpretations in everyday life. Patients also appeared to be quite engaged in the task, often verbalizing that they were striving to improve their accuracy and that the task felt like a game. However, a few patients initially expressed concerns that the program was "bogus" and that they disliked being told that their subjective interpretation of a situation was "incorrect."

Conclusions: In a subgroup of patients with interpretation bias, CBM-I may be an effective augmentation to psychiatric hospitalization. Patients understood the purpose of the task and felt that it reinforced information learned in other treatment modalities (eg, CBT). This very brief and simple task has the potential to improve outcomes in a high-risk population characterized

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by comorbidity, suicidality, and chronic mental health problems. We will present data from the final sample (N=100), including moderators of treatment response.

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KEYWORDS

cognitive bias modification; interpretation bias; emotional disorders

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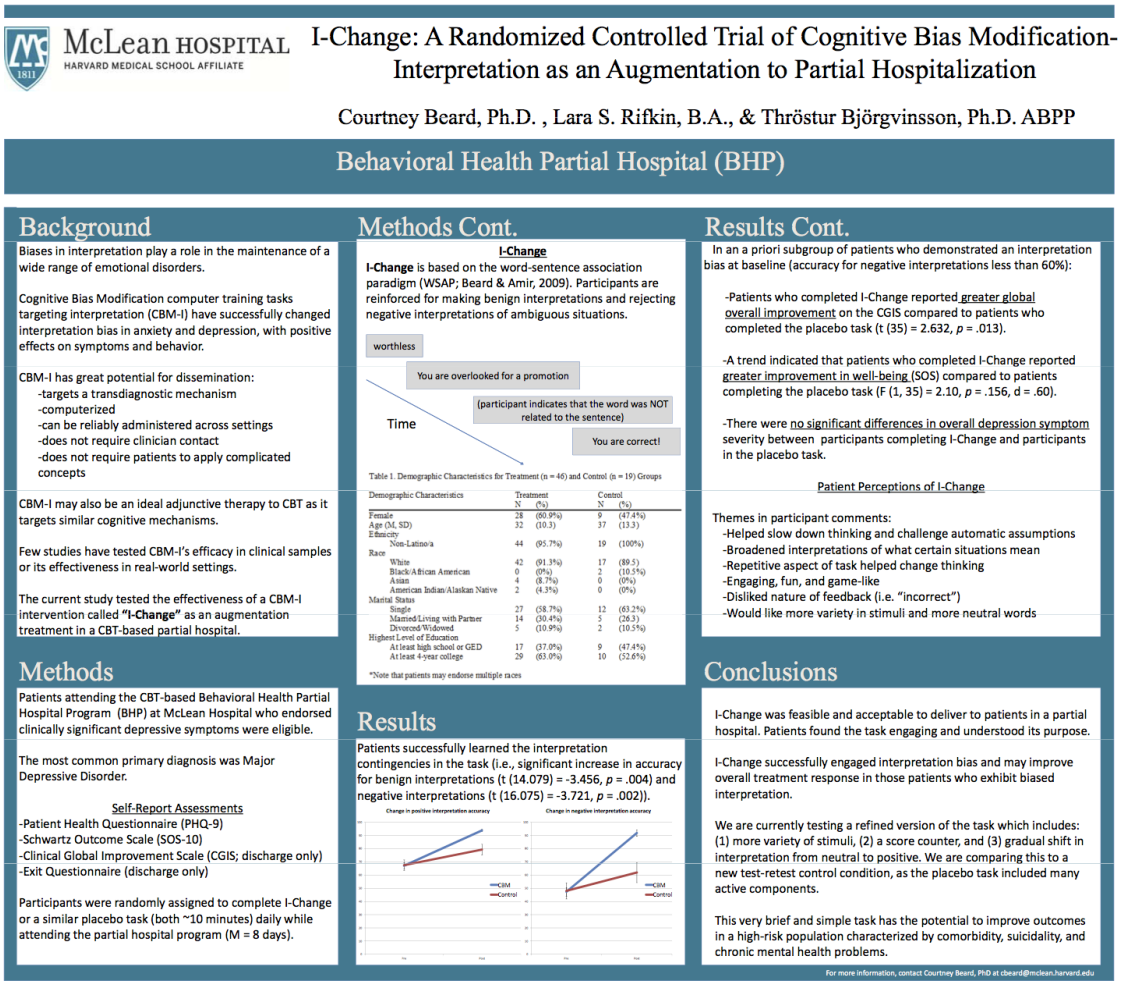
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Can We Predict Depression From the Asymmetry of Electrodermal Activity?

Szymon Fedor[1], PhD; Peggy Chau[2], BA; Nicolina Bruno[2], MA; Rosalind W Picard[1], ScD; Joan Camprodon[2], MD, MPH, PhD

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Abstract

Background: Historically, diagnosing and tracking depressive symptoms has been accomplished by assessing subjective diagnostic criteria, either from the Diagnostic and Statistical Manual of Mental Disorders (DSM) or from standardized rating scales. Though useful for semantic and billing purposes, this approach has limited utility for (1) determining subtypes of depression, (2) capturing variations over relatively short time periods (eg, over the course of a day), and (3) predicting the course of the illness. Despite recent research efforts, no clinically useful, non-invasive, inexpensive biomarkers for the diagnosis and prognosis of depression have been identified.

Objective: There is a critical need to identify and discover objective biomarkers for the diagnosis, prognosis, and treatment of depression. Brain imaging and recent findings have led us to hypothesize that depression, especially of the anxious type, might lead to larger right amygdala activation than left in most right-handers and that this would map to larger electrodermal activity (EDA) on the right than on the left.

Methods: We monitored EDA on both inner wrists of 9 patients diagnosed with depressive episode without psychotic features, aged 18-80, undergoing transcranial magnetic stimulation (TMS) at the Massachusetts General Hospital. Three patients attended 36 daily TMS sessions and six patients attended 72 sessions lasting 25-45 minutes each. In addition, a clinician, blinded to the EDA, assessed severity of depression every 10 TMS sessions using the following psychometric scales: Hamilton Depression Rating Scale, Quick Inventory of Depressive Symptoms (QIDS), and Patient Health Questionnaire. We obtained an objective measure of laterality by (after noise filtering) calculating the average EDA on each wrist for every session and subtracting the left from the right hand mean value (EDAR-L). We used a linear mixed-effects model with random intercepts and slopes to assess the relationship between the EDAR-L and the depression measures (as assessed by the blinded clinician), delayed by 3 days using the following model: $QIDSi=\beta 0i+\beta 1i\times EDAR–Li+\varepsilon i$, where EDAR-Li=mean difference between EDA signal on the right and left wrist; QIDSi=QIDS score for i-th person delayed by 3 days; 0i=i-th person intercept; $\beta 0i=\beta 0+\mu 0i$ and $\mu 0i\sim N(0,\sigma 02)$; $\beta 1i$=i-th person slope, $\beta 1i=\beta 1+\mu 1i$, and $\mu 1i\sim N(0,\sigma 12)$; and εi=i-th person error, and $\varepsilon i\sim N(0,\sigma 2)$.

Results: We tested the model by varying the delay between –11 and 11 days. The corresponding slopes were always positive ($0.2<\beta 1<5.8$) and usually not statistically significant ($P>.1$). However, a delay of 3 days was significant with a value for intercept ($\beta 0$) 13.9 and for slope ($\beta 1$) 2 ($P=.03$). This indicates that QIDS score follows the pattern of the EDA asymmetry with a delay of 3 days—when the EDA on the right hand becomes more (less) dominant, the depression worsens (improves).

Conclusions: Initial findings show that asymmetry of the EDA signal from wrists measured during TMS sessions may indicate depression. These data have the potential to provide objective biomarkers to advance the understanding and treatment of depression. The results, if confirmed in a larger population, may potentially contribute to early diagnosis and monitoring of depression.

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KEYWORDS

depression; biomarker; electrodermal activity

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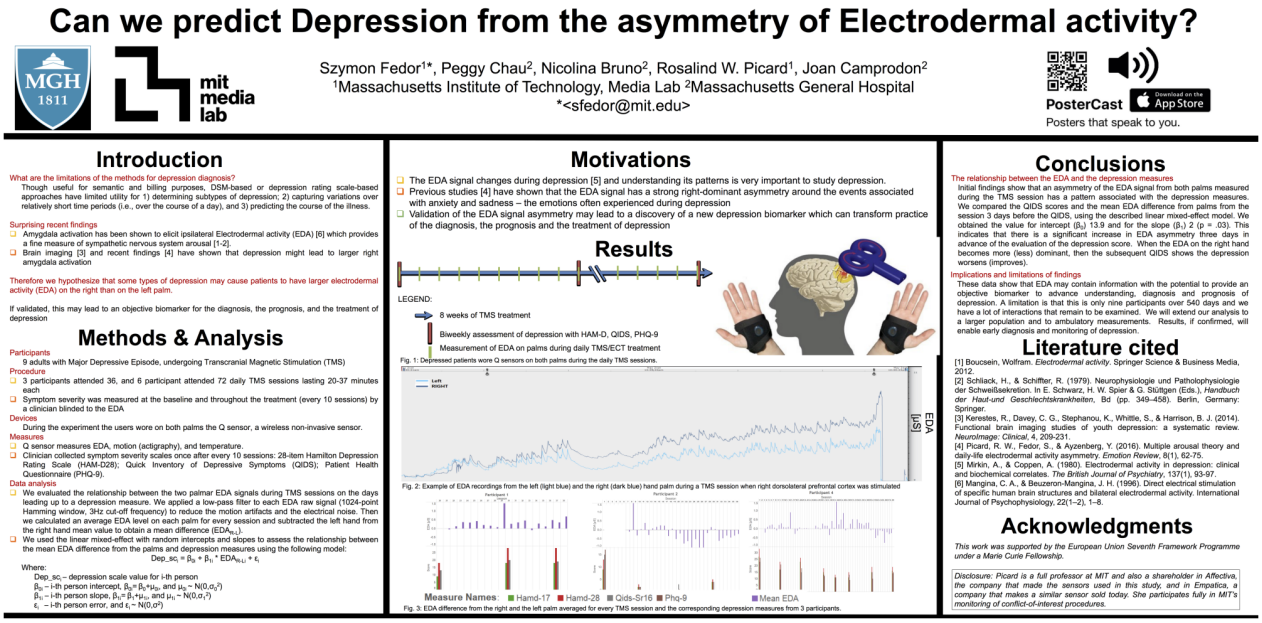
Figure 1. Poster.



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Poster

A Patient-Centered Approach to Developing a Mobile-Based Self-Management Intervention, Featuring a Virtual Coach, for Adolescents With Irritable Bowel Syndrome

Elizabeth Donovan[1], PhD; Tara Cousineau[1], PhD; Jennie CI Tsao[2], PhD; Lonnie K Zeltzer[2], MD; Subhadra Evans[3], PhD

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Abstract

Background: Irritable bowel syndrome (IBS) is a complex, chronic, functional disorder that has no cure and is characterized by abdominal pain/discomfort and altered bowel habits; other symptoms may include nausea, vomiting, and bloating; and it can also result in social isolation and shame. While in-person self-management skills training for IBS has been shown to be effective in adults and older adolescents, this training is inaccessible for most. Mobile technology may be a feasible way to deliver an intervention to adolescents designed to promote self-management and positive coping skills.

Objective: To conduct in-depth interviews with key stakeholders to inform the development of a mobile-based intervention, featuring an empathetic virtual coach, designed to promote self-management skills and positive coping skills in adolescents with IBS.

Methods: A total of 12 adolescents with IBS and 12 parents recruited from the UCLA Pediatric Pain Program (PPP) and Whole Child LA, and 12 multi-disciplinary health care providers, including gastroenterologists, nutritionists, and mental health providers, participated in 60-minute in-depth interviews. Interview guides were designed to elicit information about functioning challenges and coping strategies and to gather feedback about preliminary features for a mobile-based intervention and preferences for new features. Participants were shown images of three proposed main features and a video animation of a virtual coach. Thematic analysis informed coding and analysis of interview data.

Results: Results of the in-depth interviews revealed 6 main themes around adolescents' functioning, coping, and preferences for a mobile-based intervention. Data from the interviews were incorporated into a demonstration version of the mobile app using emotional modeling algorithms for a virtual coach.

Conclusions: A patient-centered approach is a useful way to inform development of a mobile-based intervention for adolescents struggling to manage IBS. A next phase of the research includes a pilot study with 24 adolescents using the application and acceptance testing with caregivers and providers.

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KEYWORDS

virtual coach; mobile application; irritable bowel syndrome; adolescence; emotional modeling; mHealth

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Figure 1. Poster.

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Poster.

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Poster

The Effect of Information and Communication Technologies Utilization Patterns on Self-Rated Health

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Abstract

Background: An increasing number of older adults are using information and communication technologies (ICTs), and ICTs have become a major resource for older adults for improving health-related quality of life. ICTs possibly help older adults seek health information online, collaborate with other users in their decision making process, and receive social support. Although there have been some studies highlighting positive associations between ICT utilization and health, there is still limited knowledge about various patterns of ICT utilization among older adults.

Objective: This study aims to extend the empirical evidence regarding the patterns of older adults' ICT utilization, investigate different attributes across various ICT utilization patterns, and further examine how these patterns influence self-rated health.

Methods: Data came from the 2012 and 2014 Health and Retirement Study, a nationally representative sample of Americans aged 51 and older. Our sample was restricted to individuals who responded to a special survey about technology use asked only to a subsample of 2012 interviews (N=1504). Latent class analysis was used to identify ICT utilization patterns based on ICT utilization variables: (1) communication-related utilization, including use of email, social networking sites, online video call, instant messenger, and smartphones; (2) finance-related utilization, such as online bill payment and online banking; (3) health-related utilization, including exercise equipment, exercise videos, online wellness programs, online health information, health monitoring devices, and Wii Fit; and (4) entertainment-related utilization, including e-readers/tablets, mp3 players, online streaming media, and video game. Ordinary least squares regressions were used to examine the effects of ICT utilization patterns on self-rated health at follow-up as compared to baseline.

Results: Four ICT utilization patterns were identified: multifarious (n=90: high level of ICT utilization across most variables), e-commerce-oriented (n=147: high level of finance-related utilization), fundamental (n=280: email and online search focused utilization), and minimal users (n=552: low level of ICT utilization across most variables). We found that multifarious users were younger, more often female, married, and had higher education and income levels and better physical and mental health than other groups. Minimal users were more likely to be older, non-white, and single, and more likely to have lower level of education and income and poor physical and mental health. Regression models showed multifarious users were most likely to have better self-rated health, and minimal users tended to have the worst self-rated health over time, even after controlling for sociodemographic attributes and health conditions. E-commerce-oriented users were more likely to have better self-rated health than fundamental users.

Conclusions: This study identified clearly different ICT utilization patterns among older adults and demonstrated positive effects of ICT utilization on health among older adults. Improving access to ICTs and ICT education programs will help to improve health outcomes of older adults, but the effects of different ICT utilization patterns need to be highlighted in future studies.

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KEYWORDS

information and communication technologies; self-rated health; older adults

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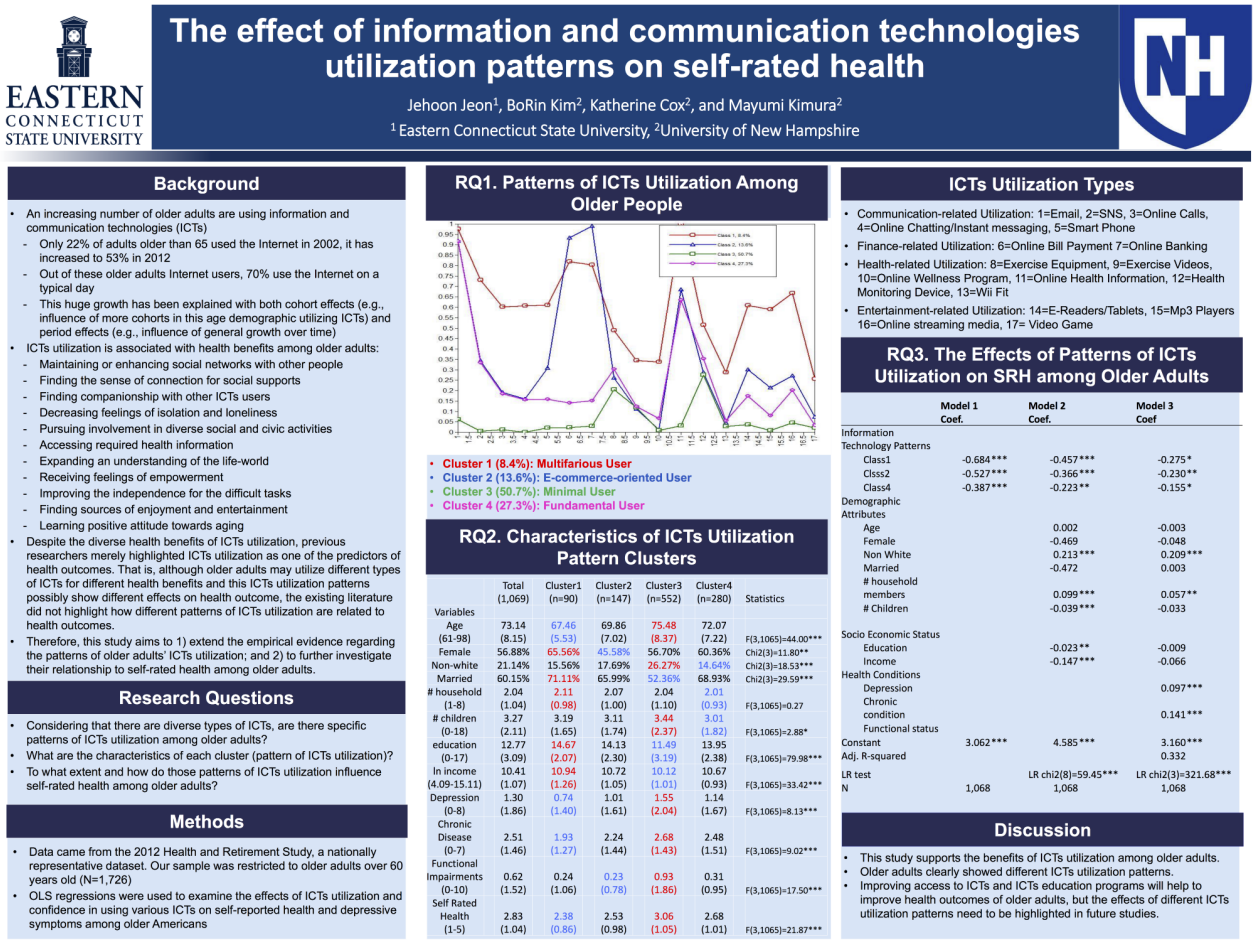
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Mobile Insulin Dosing System Formative Study

Tanushree Bose[1*], BPharm, MBA, PhD; Sam Wynbrandt[2*]; Michael Greenfield[1*], MD

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Abstract

Background: Titrating long acting insulin is a significant challenge for physicians and patients. The most advanced method is a paper titration form, which is often error prone, especially if the patient has low numeracy skills. The limitations of the paper titration form can be mitigated by using a smartphone-based, mobile insulin dosing system (MIDS). Reducing barriers to insulin therapy, including dosing and titration, can empower clinicians and patients to achieve glycemic control.

Objective: The objective of this human factor formative study was to obtain feedback, from healthcare providers (HCPs) and insulin-treated patients with type 2 diabetes, on a prototype of a MIDS. MIDS consists of an easy to setup patient instruction form (PIF), configured by HCPs, and easy to understand mobile prompts and reminders for patients to assist with self-adjustment of their insulin dose. The MIDS will use patients' fasting blood glucose (BG) readings, synced from their glucose meter using Glooko, for insulin dose calculations. Clinicians can monitor patients' progress via Glooko's Web-based user interface.

Methods: A total of 15 HCPs, including 7 certified diabetes educators, 2 primary care physicians, 1 pharmacist, 1 medical informatics leader, and 4 endocrinologists, as well as 4 patients with type 2 diabetes and 1 patient with hemochromatotic diabetes, on insulin therapy, were interviewed. The structured one-on-one interviews lasted 60 minutes and were conducted in person or virtually. During the structured interview, a discussion guide was used to pose questions in a specific order. The order of questions was determined by the order of screenshots in the Web-based patient instruction form and mobile messages received by patients. Probing questions were asked to evaluate the reasons behind the responses.

Results: All of the HCPs interviewed stated that the ability to share an insulin titration template with colleagues and a mobile insulin dosing for patients were valuable. Other findings include the following: 80% of HCPs use age and weight to determine starting insulin dose; about 70% of HCPs would set up reminders in the application to instruct their patients to test fasting BG and administer insulin at specific times; and all HCPs wanted patients to be alerted to contact their physician if their fasting BG reading was beyond the provider-set hypoglycemic or hyperglycemic threshold. Findings from patient interviews include the following: 75% of the participants said that they would not get reminder fatigue but wanted the ability to edit or dismiss the reminders; 80% of the participants wanted the ability to pause the MIDS program and let the program provide them prompts and reminders even when they were within their target fasting BG range; and all of the patients stated that being able to see their dose adjustment history was helpful.

Conclusions: Key design recommendations emerged from this formative evaluation. Based on feedback received from the HCPs and patients, the reminders setting will be refined. Results led to improvements and optimization of the MIDS and supports further development of MIDS as a mobile system that helps with basal insulin dose titration was positively received by providers and patients.

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KEYWORDS

type 2 diabetes; insulin titration; remote monitoring; long acting insulin; basal insulin; patient centered

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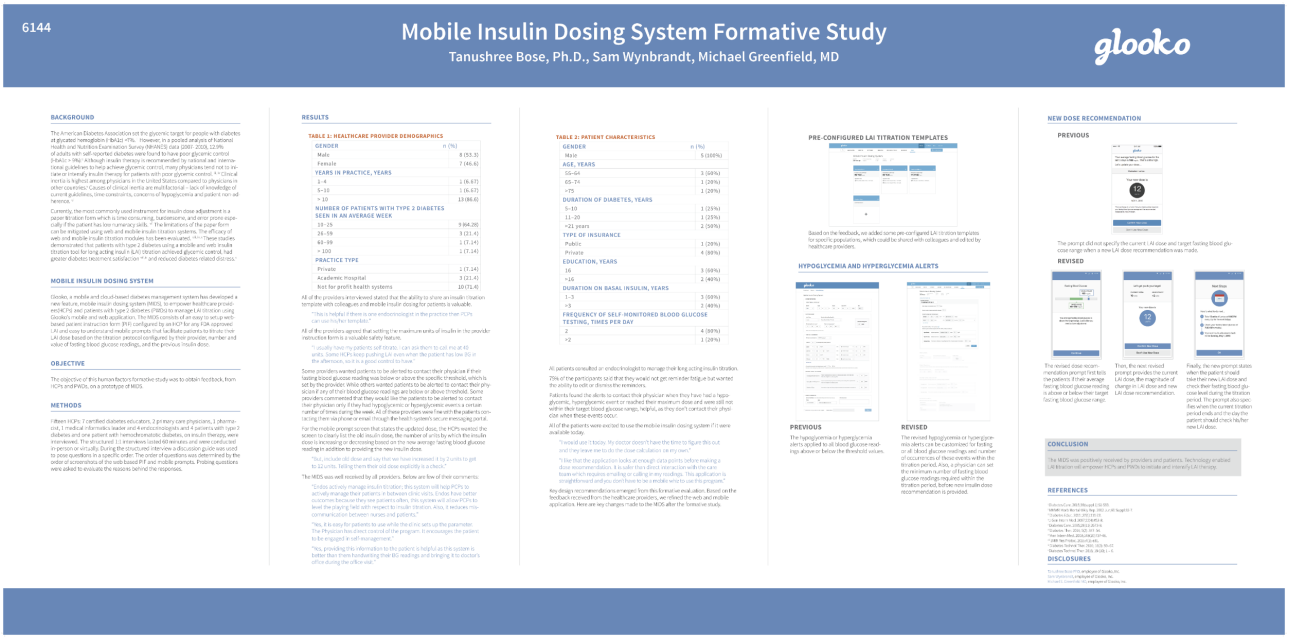
Figure 1. Poster.



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Poster

Health eRide: Outcomes of a Pilot Program Leveraging Principles of Gamification and SMS Messaging to Help Veterans Self-Manage Chronic Pain

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Abstract

Background: Chronic pain creates a significant public health burden and disproportionately affects veterans. Over 56% of Operation Iraqi Freedom (OIF), Operation Enduring Freedom (OEF), and Operation New Dawn (OND) veterans have a diagnosis of chronic pain. The frequency and extent of pain, posttraumatic stress disorder (PTSD), traumatic brain injury, and the co-occurrence of all three conditions (post-deployment multi-symptom disorder, PMD) can complicate and reduce the effectiveness of traditional treatments for pain. Taken in combination with the opioid crisis in the United States, there is an urgent need for innovative and integrative approaches to non-medical pain management. However, readiness to engage in pain self-management varies.

Objective: The objective of this Phase I pilot was to design, develop, and establish the feasibility of a theoretically-grounded, mobile-optimized, interactive pain self-management intervention for veterans that leverages principles of gamification.

Methods: The development of Health eRide: Your Journey to Managing Pain included extensive end-user input including a veteran advisory panel (n=5), formative focus groups (n=20), and iterative usability testing (n=20). Health eRide is tailored not only to veterans' preference for pain self-management strategies but also their readiness to adopt those strategies as measured by a Transtheoretical Model-based stage of change assessment. The program incorporates core components of promising treatments for PMD by intervening on sleep hygiene and stress management. Health eRide includes (1) an online computer-tailored intervention that provides tailored behavior change guidance and (2) an individually tailored subway-themed "map" of their pain management journey. Stops along the map include stage-based interactive activities designed to further users along in their journey to self-managing pain. The program also included optional text messaging and a Facebook page. A pilot study with a 30-day follow-up was conducted with 69 veterans (81% male, 58% Caucasian, average age=50) to examine the acceptability and preliminary effectiveness of Health eRide. Users completed stage of change algorithms and pain rating scales at baseline and follow-up and completed a measure of acceptability and the System Usability Scale (SUS) at follow-up.

Results: A total of 44 veterans (64%) completed the follow-up assessment (no significant differences on baseline demographics between those who completed the follow-up assessment and those who did not). The mean rating of acceptability for Health eRide was 3.20 on a 4 point scale, indicating that users found the program useful, informative, reliable, and easy to navigate. Likewise, the mean score on the SUS was 65.4, indicating the program meets standards for usability. The results show significant changes in movement to readiness to adopt strategies to self-manage pain (54.5% at baseline vs 79.5% at follow-up, P=.007) and effectively manage stress (50% vs 88.6%, P<.001). While there was movement to readiness to adopt healthy sleep habits (25% vs 38.6%), the change was not significant. There were significant improvements in ratings of pain: "How would you rate your pain right now?" (partial $\eta 2$=.205, P=.002) and "How would you rate your usual pain in the last week?" (partial $\eta 2$=.378, P<.001).

Conclusions: Findings provide encouraging evidence of the acceptability and effectiveness of incorporating principles of gamification into a theoretically grounded intervention for veterans at all levels of readiness for self-managing chronic pain.

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KEYWORDS

gamification; intervention; veterans; serious games; pain management

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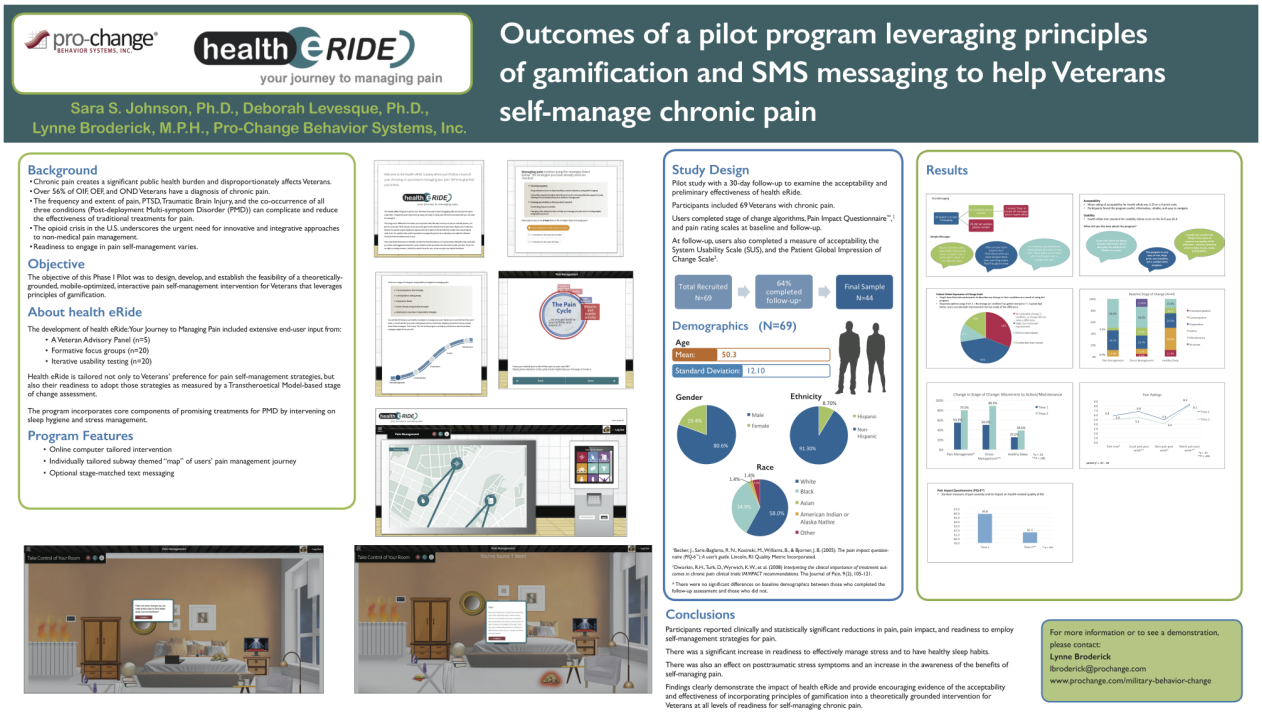
Figure 1. Poster.



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Poster.

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Poster

A Stage-Based Mobile Intervention for Substance Use Disorders in Primary Care

Deborah Levesque[1], PhD; Cindy Umanzor[1], MPH; Emma de Aguiar[1], BA

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Abstract

Background: Over 20 million American adults meet diagnostic criteria for a substance use disorder (SUD). However, only 10-11% of individuals requiring SUD treatment receive it. Given their access to patients, primary care providers are in a unique position to perform universal screening, brief intervention, and referral to treatment (SBIRT) to fill gaps in services and make referrals to specialty treatment when indicated. While SBIRT has shown success in reducing tobacco and non-dependent alcohol use, the data on SBIRT for dependent alcohol use and illicit drug use are less promising. Major barriers to SBIRT include limited time and resources for SBIRT among providers and low motivation to change among many patients.

Objective: The objective of this research was to develop and test the acceptability of a prototype of a mobile-delivered substance use risk intervention (SURI) for primary care patients and a clinical dashboard for providers that can address major barriers to SBIRT for risky drug use. To reduce provider burden, SURI delivers universal screening and feedback on SUD risk via mobile tools to patients at home or in the waiting room. For patients at risk, it also delivers a brief intervention based on the Transtheoretical Model of Change to facilitate progress through the stages of change for quitting the most problematic drug and for seeking treatment if indicated. The prototype also delivers 30 days of stage-matched text messages and four online activities addressing key topics (eg, managing cravings). For providers, the clinical dashboard summarizes the patient's SUD risk scores and stage of change data and provides stage-matched scripts to guide in-person sessions.

Methods: Feasibility test participants were 3 providers at a federally qualified health center and 5 of their patients with a known SUD. Providers completed a 45-minute webinar training session on the SURI tools, delivered dashboard-guided SBIRT session(s), and completed a brief acceptability survey. Patients completed an online SURI session and in-person SBIRT session, accessed other program components, and completed 3 acceptability surveys over 30 days. Questions in the surveys were adapted from the National Cancer Institute's Education Materials Review Form. Response options ranged from 1=strongly disagree to 5=strongly agree. The criterion for establishing feasibility was an overall rating of 4 or higher across items.

Results: For providers, mean acceptability ratings ranged from 3.7 to 5.0, with an overall mean rating of 4.3. Notably, all providers gave a rating of 5.0 for the item "The program can give me helpful information about my patient." One patient dropped out of the study before accessing any study materials. For the remaining patients, mean acceptability ratings for the mobile- and provider-delivered SBIRT session ranged from 4.0 to 5.0, with an overall mean rating of 4.5; mean ratings of the follow-up text messages and online activities ranged from 3.6 to 4.8, with an overall rating of 4.0. One of the most highly rated items was "The program could help me make some positive changes" (4.5).

Conclusions: The SURI program and clinical dashboard, developed to reduce barriers to SBIRT in primary care, were well received by care providers and patients.

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KEYWORDS

screening, brief intervention, and referral to treatment (SBIRT); primary care; mobile intervention; Transtheoretical Model of Change

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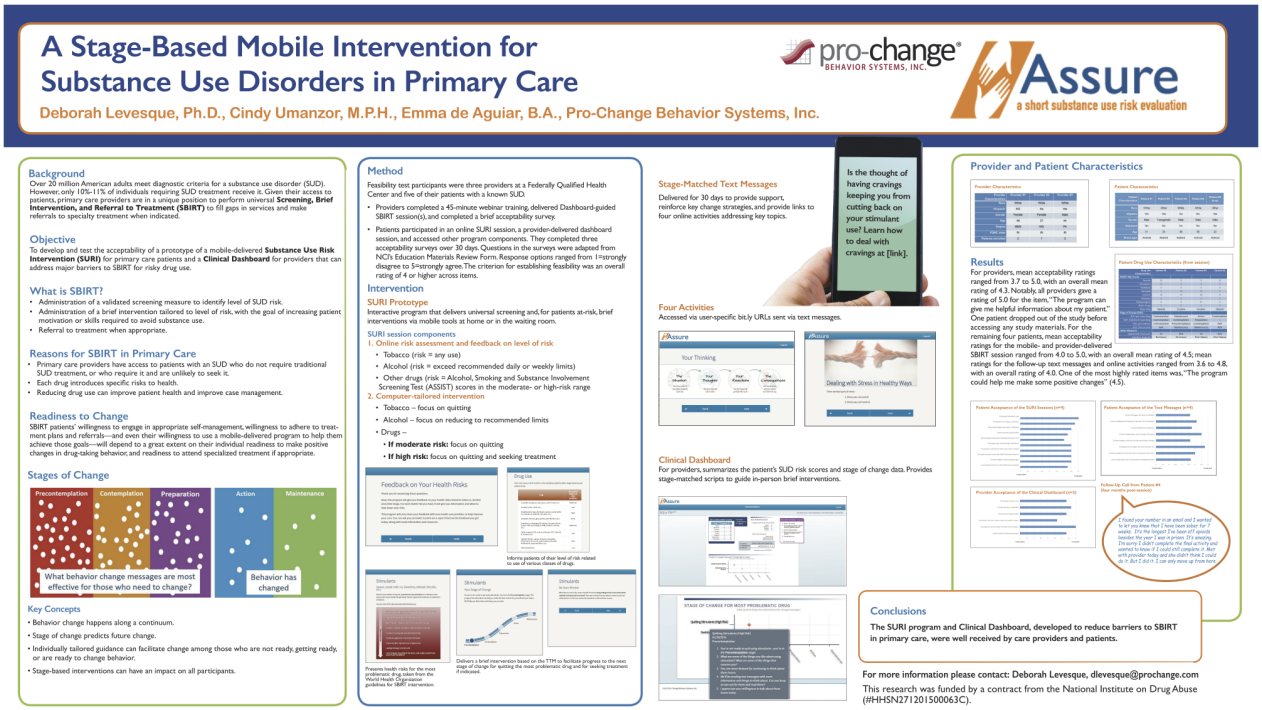
Figure 1. Poster.



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Poster.

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Poster

Acceptability of Responsible Drinking, a Theoretically Tailored mHealth Intervention to Target Risky Drinking Among Employed Adults

Deborah F Van Marter[1], MPH; Deborah A Levesque[1], MA, PhD; Leanne M Mauriello[1], PhD; Emma L de Aguiar[1], BA

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Abstract

Background: A sizeable proportion of employed adults consume alcohol at non-dependent but risky levels, which is defined by the National Institutes of Health for men as drinking more than 14 drinks per week or more than 4 in a day and for women as drinking more than 7 drinks per week or more than 3 drinks in a day. Risky levels of drinking impact the health, well-being, and productivity of employees, with employers bearing the costs in lost employee productivity and increased absenteeism and health care costs. Behavior change programs targeting reduction in alcohol consumption can trigger resistance from end users.

Objective: The primary aim of this research is to evaluate the acceptability of a stage-matched and individually tailored behavior change mHealth intervention for employed adults who exceed the recommended weekly and/or daily limits for alcohol consumption. The intervention, delivered over 6 months, is based on the Transtheoretical Model of Change and consists of (1) computer-tailored intervention (CTI) sessions: three 15-20 minute sessions that include onscreen assessments and personalized feedback; (2) Personal Activity Center (PAC): an online activity center that includes stage-matched activities, information, testimonials, and resources designed to support the change process; and (3) tailored text messages: mobile-delivered stage-matched intervention ideas and tips to support change. This acceptability evaluation was conducted as part of a larger study evaluating the efficacy of the intervention in a randomized trial.

Methods: Participants were recruited online via an email invitation from Survey Sampling International, a survey research company. Treatment group participants who completed the final CTI session at 6 months were invited to complete a brief acceptability survey.

Results: A total of 399 out of 497 participants enrolled in the treatment arm of the randomized trial completed the 6-month CTI session and acceptability survey, indicating high program engagement. Data from the acceptability survey suggest that the intervention was well-received by study participants. For example, 94.8% agreed or strongly agreed with the statement that they learned new information by using the program, 92.4% said that the program helped them to make changes, and 87.5% said the program was designed for people like them. Most importantly, 95.8% indicated that they would recommend the program to someone else. In response to the question, “What did you like most about the program?” participants most often said that the program was informative and raised their awareness (38.1%), and that the program helped them to make changes (34.8%). In response to the question, “What did you like least about the program?” a majority (71.2%) either provided a positive comment regarding the program or did not supply a response at all. The most common concern raised by participants was that the program contacted them too much (7.3%) or that the program in general did not apply to them (5.5%).

Conclusions: Participant engagement and acceptability is a critical component of delivering effective mHealth programs. Responsible Drinking is a cost-effective, feasible, and sustainable offering for adults who exceed the low-risk drinking threshold.

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Acceptability data indicate that the program is viewed favorably by participants, which addresses an important hurdle in delivering effective programs.

ClinicalTrial: Clinicaltrials.gov NCT02126163; https://clinicaltrials.gov/ct2/show/NCT02126163 (Archived by WebCite at http://www.webcitation.org/6myhFUImY).

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KEYWORDS

risky drinking; alcohol; behavior change; mobile health; theory based; transtheoretical model; tailored communications

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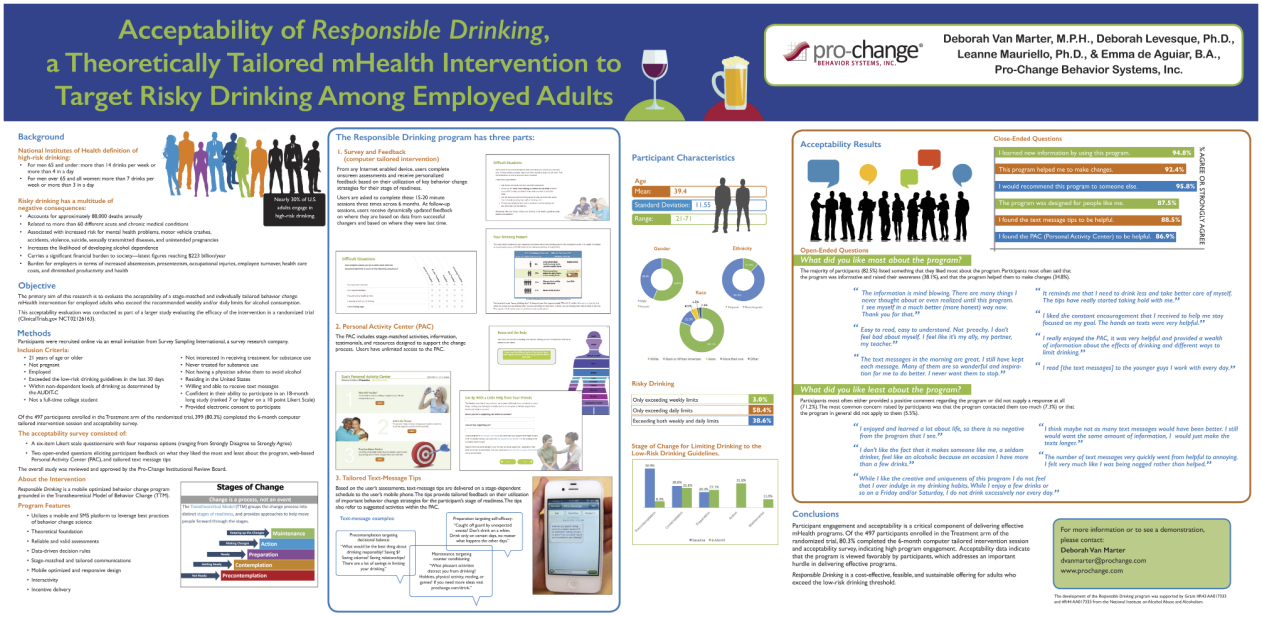
Figure 1. Poster.



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Poster

Enhancing Video Chat Applications for Home Health Care

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Abstract

Background: Estimates show that up to 87% of seniors would like to "age in place." Often, such people are remote from their families and health care providers. Acquisition and telemetry of data and bio-signals from personal health care instrumentation is of great value, but we feel that this does not tell the complete story, because we are dealing with humans. A brief video chat, via personal computer, can usually provide a great deal of information concerning a person's well-being. An individual's mood, physical status, and energy level and the state of their surroundings can frequently be determined in a one-minute video chat. While these evaluations are qualitative, they can be very useful in answering the simple, important question "Is this person OK?" A video chat can also help build constructive social bonds between patients and providers because the telecommunication is no longer "faceless." People who are aging in place are generally not the best computer users. Even if a person is proficient with the use of computers, issues with vision and manual dexterity can present obstacles to the use of video chat applications such as Skype. We have designed and implemented a low-cost system, comprised of a small "helper" program and a wired keypad, which operates with a personal computer and obviates the difficulties experienced by many less experienced and older users. Very simply, this system makes it easier for many people to communicate with their families and healthcare providers.

Objective: Our goal was to simplify the use of video chat applications. A conventional desktop is often visually cluttered or has one application window obscuring another. Navigation with a mouse or other pointing device can be difficult for people with impaired vision and those with tremors, arthritis, or other dexterity limiting factors. We designed and built a "helper" program that, in conjunction with a dedicated large symbol keypad, lets a user initiate a video chat just by pressing a couple of buttons.

Methods: At present we have conducted a small pilot study (N=8) with naïve computer users who want to video chat with family members. Participants in the study were chosen because they had difficulty initiating video chats. We asked this group to use our system and measured time required to initiate a video chat.

Results: All subjects were able to initiate video chats in <30 seconds. The users were all able to terminate the chats when desired. In simple terms, the naïve users were able to start and end calls when they wanted to. Users expressed satisfaction at being able to control this aspect of their computers without technical support from others and enjoyed chat interactions.

Conclusions: Video chat applications can be made simpler and easier to use, empowering a person who is aging in place to engage with family and healthcare providers.

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KEYWORDS

video chat; patient-physician interaction; age in place

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Figure 1. Poster.

Multimedia Appendix 1

Poster.

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Poster

Real-Time Tailoring of Depression Counseling by Conversational Agent

Lazlo Ring[1]; Timothy Bickmore[1]; Paola Pedrelli[2]

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Abstract

Background: Depression is the leading cause of disability in the world, with over 350 million people affected worldwide. To address this, many researchers have developed computer-based therapy systems to treat this condition. However, many of these systems have been shown to have significantly worse retention than face-to-face counseling, limiting their effectiveness. We believe this discrepancy is partially due to these systems' inability to respond to a user's emotional state in real time.

Objective: We have developed an affectively aware virtual agent for depression counseling: an animated computer character that responds to users' affective states in real time during virtual therapy sessions. The virtual agent guides users through a manualized cognitive behavioral therapy (CBT) intervention, while sensing users' affect from their facial expressions and changes in speech prosody. During this simulated face-to-face conversation, the agent provides real-time tailored responses in response to sensed user affect. The automatically generated responses corresponded to empathic statements that allowed participants to pause the interaction in order to calm and compose themselves and reflective statements that rephrased emotionally sensitive content elicited from participants to emulate empathic listening.

Methods: We conducted a quasi-experimental pilot study to assess acceptance of the system by individuals with mild to moderate depression. Ten individuals (5 male, 5 female, aged 18-28) participated in a single 30-minute CBT-based session with the affectively aware virtual agent. We measured depression (Patient Health Questionnaire-9, PHQ-9) and state anxiety before and after the session and self-reported attitudes towards the system on scale measures and via a semi-structured interview.

Results: Participants scored between 5 and 15 (mean=6.6, SD=2.7) on baseline depression measures (PHQ-9). No significant changes were found in pre-post tests for depression (pre-interaction mean=8.0, SD=4.62, post-interaction mean=6.4, SD=3.13) or anxiety (pre-interaction mean=23.3, SD=6.46, post-interaction mean=21.78, SD=7.61), although both trended towards improvement. Agent ratings were generally neutral across the board, with satisfaction (mean=4.5, SD=1.35), desire to continue using (mean=4.2, SD=1.6), trust (mean=3.9, SD=1.66), and likability (mean=4.4, SD=1.7) scoring around the mid-point. Thematic analysis of the semi-structured interviews indicated that 50% of participants reported that the agent evoked emotional responses in them during the interactions and that 70% of participants felt the agent understood their emotional state. Participants stated that this was caused by the agent presenting them with "information they did not realize" (Patient 5) and that the agent "… understood my emotions because I felt that it gave me the right responses" (Patient 8).

Conclusions: This study suggest that it is possible for a virtual agent to evoke and respond to a user's emotional state in real time during counseling sessions. Although we did not design this study to produce significant changes in depressive symptoms due to its size and duration, the majority of users expressed that they felt the agent understood their emotional state and responded appropriately.

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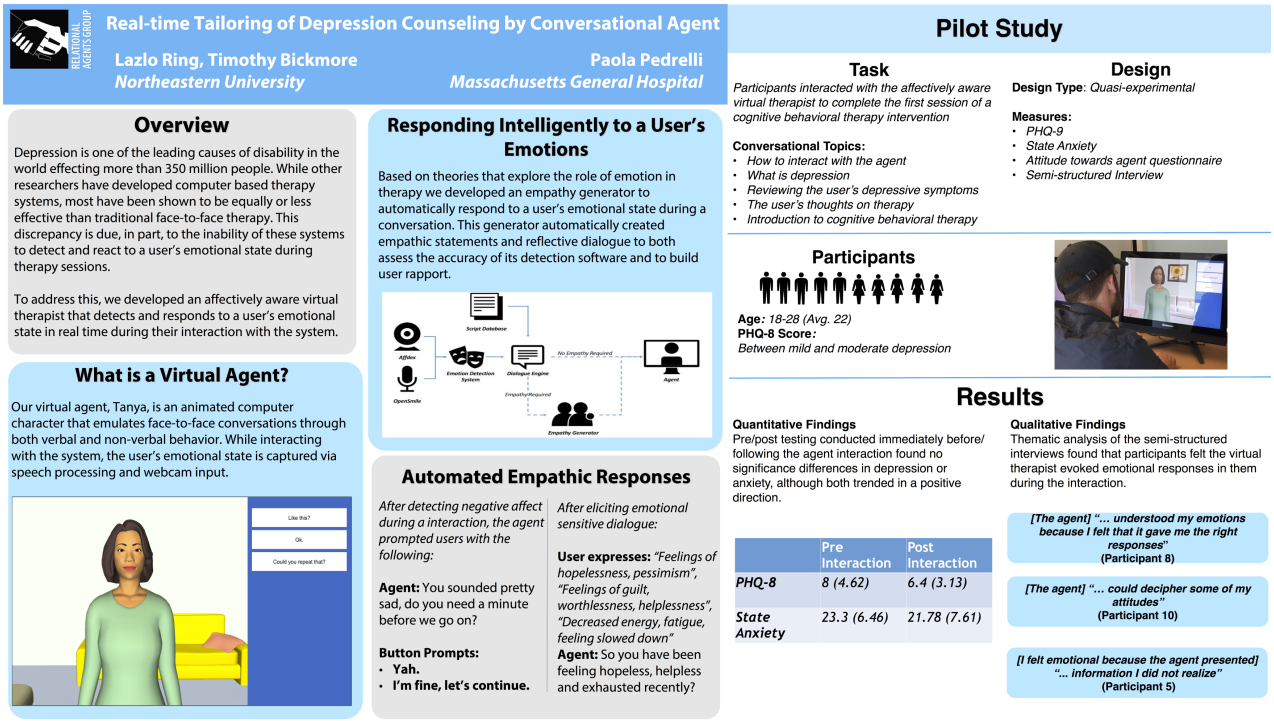
KEYWORDS

depression; virtual counseling; computer-mediated therapy

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

A Review of the Influence of Interactivity on Health-Related Outcomes and Recommendations for Future Study

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Abstract

Background: Interactivity is a foundational characteristic of mediated communication that may influence persuasion and attention. Interactivity refers to the two-way exchange of information contingent on previous input, meaning that websites and mobile systems can be more or less interactive depending on system affordances. There are multiple types of interactivity, including functional interactivity, which is based on the affordances of the system, and perceived interactivity, which is based on users' perceptions of the responsiveness of the system as opposed to actual system features. Previous research has suggested that interactivity may be vital to the success of technologically driven health communication interventions.

Objective: The purpose of this project was to examine how interactivity has been assessed in relation to health outcomes, including what types of interactivity are discussed, how interactivity is measured, and the influence of interactivity on health-related outcomes.

Methods: We conducted a systematic review of the published literature in PubMED and EBSCO in fall 2015. Search terms included "interactivity" and "health" as well as a variety of words related to media and new media (eg, media, electronic, SMS, communication). To be included in the review, articles needed to (1) focus on studying the impact of interactivity (content analyses and intervention descriptions that did not explicitly assess interactivity effects were not included) and (2) examine outcomes related to health (eg, health knowledge, comprehension, attitudes, intentions, or behaviors). After articles had been located, we conducted backward and forward searches. Of the more than 1200 articles examined, 11 articles met the inclusion criteria.

Results: Studies that assess the role of interactivity on health-related outcomes varied greatly in the types of interactivity assessed as well as health outcome variables. All studies used an experimental design. Health topics included mental health, physical activity, skin cancer, fibromyalgia, appendicitis, allergies, and smoking. Interactivity was defined differently in many of the studies, but most focused on the functional features as opposed to perceptions of interactivity. If assessed, perceived interactivity was used primarily as a manipulation check or mediator. Effects of interactivity on health-related outcome variables were mixed, with effects mainly appearing in the connection between interactivity and attitudes toward the health topic. Knowledge was directly related to interactivity in one study, but no significant effects were found in three other studies that assessed the connection between interactivity and knowledge.

Conclusions: This study highlights that definitions of interactivity in the literature are inconsistent and ambiguous, as some scholars did not define interactivity, and others' definitions varied. Scholars should work to clearly operationalize what they mean by interactivity so that work can be compared and expanded upon. While all studies focused on functional interactivity, some also looked at perceptions as a mediator or manipulation check. With some outcomes, such as attitudes, interactivity did have an effect. Future research should continue to examine the role of interactivity and potential mediating variables on health outcomes. Interactivity may work as one technological attribute that is part of a larger system impacting the effectiveness of health behavior interventions and influencing health outcomes.

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KEYWORDS

interactivity; health; communication; health promotion; technology

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.

A review of the influence of interactivity on health-related outcomes and recommendations for future study

Jessica Fitts Willoughby, Ph.D., and Zhaomeng Niu, M.A.
The Edward R. Murrow College of Communication

Abstract

We conducted a systematic review to assess how interactivity is defined in health-related research. Articles (k=11) used experiments to assess interactivity effects, although interactivity definitions varied greatly. Results were mixed—some found an influence on comprehension or attitudes, and others found no effects. Researchers should continue to explore the impact of interactivity on health outcomes, paying particular attention to operationalization.

Background

- Interactivity is a foundational characteristic of mediated communication
- Interactivity refers to the two-way exchange of information contingent on previous input, meaning that websites and mobile systems can be more or less interactive depending on system affordances
- Previous research has suggested that interactivity may be vital to the success of technologically driven health communication interventions.

Objective

- To examine how interactivity has been assessed in relation to health outcomes, including types of interactivity discussed, how interactivity is measured, and the influence of interactivity on health-related outcomes.

Methods

•We conducted a systematic review of the published literature in PubMED and EBSCO in fall 2015.
•Search terms included "interactivity" and "health" and words related to media and new media
•Inclusion criteria: 1) focus on studying the impact of interactivity (content analyses and intervention descriptions that did not explicitly assess interactivity effects were not included), and 2) examine outcomes related to health (e.g., health knowledge, comprehension, attitudes, intentions, or behaviors).
•Of the more than 1200 articles examined, 11 articles met the inclusion criteria.

Results

•Studies varied by type of interactivity assessed.
•Health topics included mental health, physical activity, skin cancer, fibromyalgia, appendicitis, allergies, and smoking.
•Most studies focused on the functional features as opposed to perceptions of interactivity.
•Effects of interactivity on health-related outcome variables were mixed, with effects mainly appearing in the connection between interactivity and attitudes toward the health topic. Knowledge was directly related to interactivity in one study, but no significant effects were found in three other studies that assessed the connection between interactivity and knowledge.

Conclusions

- Definitions of interactivity are inconsistent and ambiguous.
- Scholars should clearly operationalize interactivity
- Future research should continue to examine the role of interactivity and potential mediating variables on health outcomes.
- Interactivity may work as one technological attribute that is part of a larger system impacting the effectiveness of health behavior interventions.

Table: Findings from interactivity studies related to health outcomes

Citation	Findings
Camerini and Schultz (2012)	-Functional interactivity had no impact on *empowerment dimensions* -Functional interactivity had no observable effects on *knowledge* -Participants who experienced the whole intervention (static and interactive) scored significantly lower in *meaning* than people with the static only version
Hurling, Fairley and Dias (2006)	-The more interactive system was more *engaging to users* -The more interactive system lead to *higher expectation* and *satisfaction with motivation to exercise* -The more interactive system led to greater *satisfaction with fitness*
Jaffe (1997)	-No significant differences on *knowledge gain* based on condition -No significant differences in *self-efficacy* based on condition -There was an interaction effect for interactivity and processing style on *self-efficacy gains*
Kalet et al. (2012)	-Participants did not differ in terms of *knowledge* -Participants in an interactive condition (click or drag) had small to moderate improvements in *performance of clinical skills*
Kerwin (2006)	-Participants in the interactive conditions reported being less *satisfied* with aspects of the instruction -Participants in the 100% interactive condition spent the most *time* on the intervention, followed by participants in the 50% interactive condition -*Knowledge* was not increased in the interactive condition

Table: Findings from interactivity studies related to health outcomes

Kim (2011)	-Website interactivity was a significant predictor of *attitudes toward the website* -There was a cross over effect between sponsor and web site interactivity on *behavioral intentions*. When web site interactivity was low, the government sponsor had favorable influence on intentions to engage in allergy prevention measures. The pattern was reversed when website interactivity was high
Kim and Stout (2010)	-Increased interactivity was positively associated with *message comprehensibility*, but the effects of interactivity decreased when involvement with communication is accounted for -Interactivity had positive effects on *perceived dangerousness of people with mental illness* -Interactivity had positive effects on *perceived severity of mental illness*, but involvement with communication accounted for a significant amount of the interactivity effects -Interactivity had positive effects on *perceived severity of mental illness*, but involvement with communication accounted for a significant amount of interactivity effects
Lu, Kim, Dou & Kumar (2014)	-Higher levels of interactivity was associated with greater *recommendation* of the fitness center to friends (one type of behavioral intention) -Interactivity significantly impacted *knowledge and trustworthiness*
Lustria (2007)	-Participants in the high interactivity group had higher mean *comprehension* scores than participants in the low interactivity group -Participants in the high interactivity group had greater mean *attitudes toward the site*
Oh and Sundar (2015)	-Modality interactivity positively impacted *interface assessment* -Modality interactivity (having a slider) was positively associated with *cognitive absorption* -Modality interactivity enhanced participants' *attitudes toward the website* -Modality interactivity *influenced attitudes toward the antismoking messages*, with mediating effects of interface assessment and cognitive absorption on attitudes -Modality interactivity was associated with *perceptions that smoking was a less attractive behavior* -Message interactivity enhanced *message elaboration*, which translated to more favorable attitudes toward the antismoking messages for those with average or below-average involvement with the topic
Skalski and Tamborini (2007)	-For the attractive source model, interactivity induction was positively associated with perceived interactivity, which positively impacted *social presence*, which was positively associated with positive source thoughts and message processing. Message processing was associated with more positive attitudes toward blood pressure -For the unattractive source model, interactivity induction was positively associated with *perceived interactivity*, which was positively associated with social presence. Increased social presence was associated with source thoughts, which were negatively associated with attitude toward blood pressure -For the combined model, interactivity induction was associated with *perceived interactivity*, which was positively associated with social presence. Social presence was positively associated with source thoughts and message processing with messaging processing impacting attitudes

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Multimedia Appendix 1

Poster.

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Poster

Targeted Diabetes Education Text Messaging Program Increases Requests for Certified Diabetes Educator Coaching and Improves Blood Glucose Trends

Jodi Pulizzi[1], RN, CDE; Jennifer Bollyky[1], MD; Anastasia Toles[1], MD, MPH; Michael Boulos[1], BEng; Jennifer Schneider[1], MD, MSc

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Abstract

Background: Livongo Diabetes Program offers a cellularly enabled blood glucose monitoring system that measures blood glucose, captures contextual data (eg, relationship to food, exercise, illness), and stores this data in the cloud. Depending on the blood glucose value, personalized recommendations are delivered back through the glucose meter. Livongo members receive an unlimited supply of glucose test strips as well as access to a diabetes coaching team for questions, goal setting, and support for extreme glucose excursions. We have previously reported that members who establish contact with Livongo coaches experience an HbA1c reduction of 0.7% on average after 90 days with the program. We hypothesized that a targeted, text-message campaign designed to provide education about taking diabetes medications would encourage members to connect with Certified Diabetes Educator (CDE) coaches available to them by phone, email, or text.

Objective: To determine whether diabetes medication education offered to a targeted diabetes population via text messages will increase requests for telephonic coaching.

Methods: We examined a 4-week text message program offered to Livongo members with a calculated or self-reported HbA1c>7% to provide education about medication adherence. A total of 20 text messages were delivered during the weekdays over one month. Weekly topics included (1) Why are medications important? (2) Tips for remembering to take medications, (3) Medication myths, and (4) Overcoming barriers to taking medications.

Results: Out of the 2017 members offered the program, 514 (25%) opted into the program and 21 (1%) members opted out. Text messaging content triggered 38 personalized CDE coaching session requests, a rate of 7.4% of participating members, which is 85% more than the rate for members who did not participate in text message program (4%).

Conclusions: These preliminary findings suggest that engaging people with diabetes through a cellular-enabled blood glucose meter with real-time, personalized education in a targeted and personalized manner helps connect members with CDE coaches and may improve blood glucose control.

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KEYWORDS

diabetes; mobile health; blood glucose

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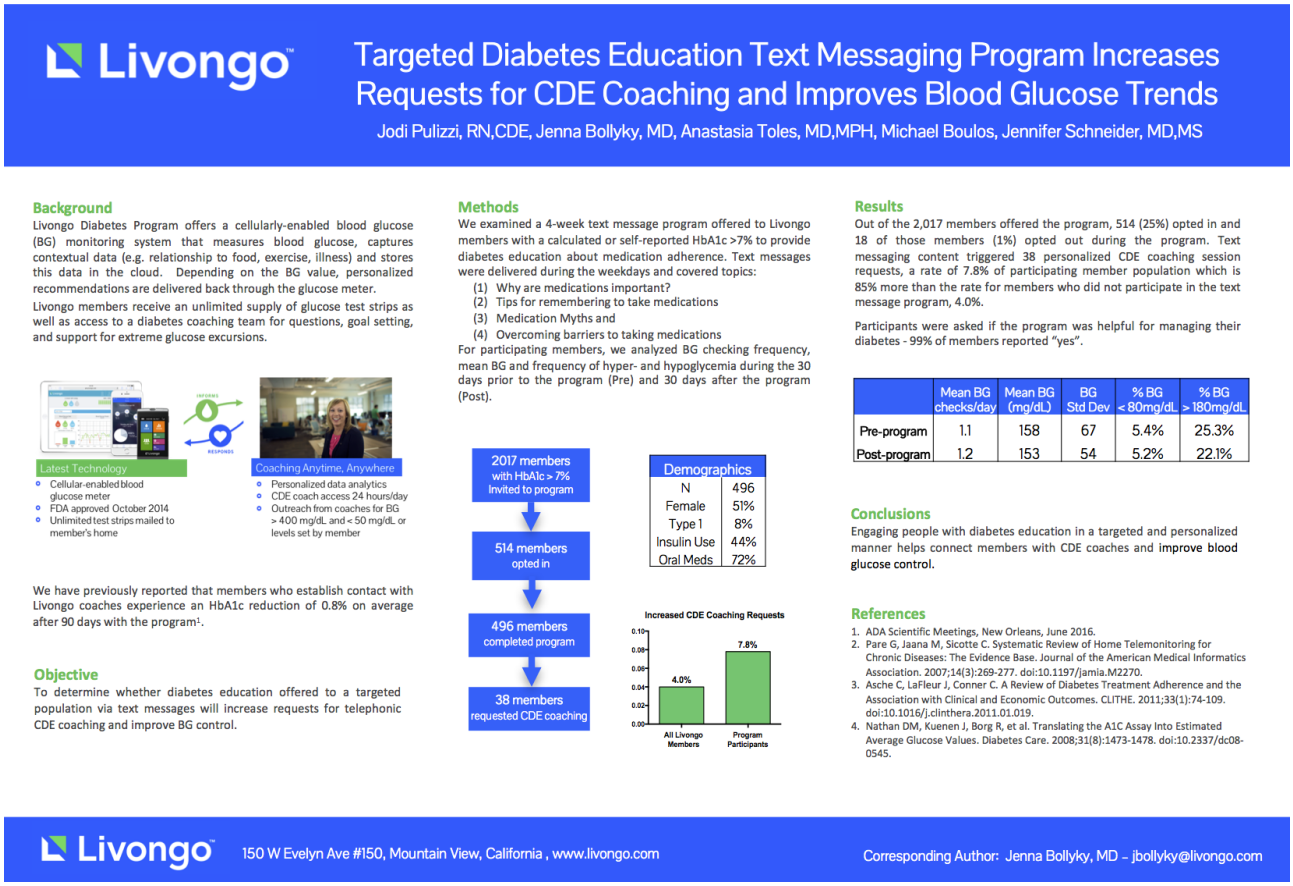
Figure 1. Poster.



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Poster.

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Poster

Using Artificial Intelligence to Measure and Optimize Adherence in Patients on Anticoagulation Therapy

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Abstract

Background: The introduction of direct oral anticoagulants (DOACs), while reducing the need for monitoring, have also placed pressure on patients to self-manage. Suboptimal adherence goes undetected as routine laboratory tests are not reliable indicators of adherence, placing patients at increased risk of stroke and bleeding.

Objective: To evaluate an artificial intelligence (AI) platform that visually confirms medication ingestion on smartphones in elderly stroke patients on anticoagulation therapy.

Methods: A randomized, parallel-group, 12-week study was conducted in adults (N=28) with a recently diagnosed ischemic stroke. Patients were randomized to daily monitoring by the AI platform (intervention) or to no daily monitoring (control). The AI app visually identified the patient and the medication and confirmed ingestion. Adherence was measured by pill counts and plasma sampling in both groups.

Results: For all patients (N=28), mean age was 57 (SD 13.2) years and 53.6% were female. Mean cumulative adherence based on the AI platform was 90.5% (SD 7.5%). Plasma drug concentration levels indicated that adherence was 100% (15 of 15) and 50% (6 of 12) in the intervention and control groups, respectively, and mean cumulative pill count adherence was 97.2% (SD 4.4%) and 90.6% (SD 5.8%), respectively.

Conclusions: Patients, some with little experience using a smartphone, successfully used the technology and demonstrated a 67% absolute improvement in adherence to DOACs based on plasma drug concentration levels. Real-time monitoring has the potential to increase adherence and change behavior, particularly in patients on DOAC therapy.

ClinicalTrial: Clinicaltrials.gov NCT02599259; https://clinicaltrials.gov/ct2/show/NCT02599259 (Archived by WebCite at http://www.webcitation.org/6n6GS3vQ3).

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KEYWORDS

artificial intelligence; smartphone; adherence; stroke; medical informatics; mobile-phone app

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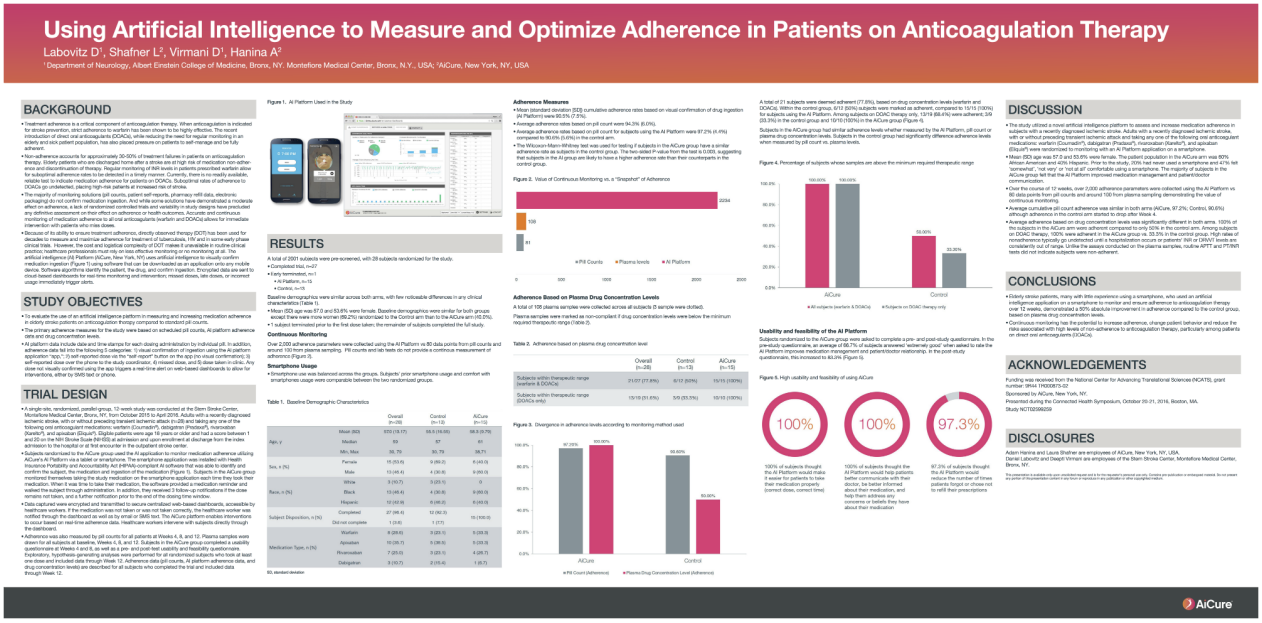
Figure 1. Poster.



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Poster.

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Poster

Gait Variability and Assessment of Cognitive Impairment

Jenna Blumenthal[1], BSc; Mark Chignell[1], PhD; Tammy Sieminowski[2], MD, MEng

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Abstract

Background: Walking has long been considered to be an autonomic process involving little or no higher cognitive input. In healthy adults, stride-to-stride fluctuation of many gait parameters (eg, gait speed, stride time) is on the order of just a few percent, testimony to the accuracy and reliability of the fine-tuned systems that regulate locomotion. When the systems regulating walking are disturbed as a result of neurological disease or abnormal aging, movement control may be impaired leading to increased variability of several gait parameters. Gait assessment while the patient performs a cognitively challenging secondary task ("dual-tasking") has been widely used to assess interaction between cognition, gait, and the risk of falling. Dual-task testing is clinically relevant, as most activities of daily living require the simultaneous performance of two or more cognitive and motor tasks. Traditionally, gait variability has been difficult to quantify and has been carried out in specialized laboratory settings. Current motion analysis systems are expensive, require trained personnel to operate, and limit evaluation to a few strides. Advances in consumer electronics allow for the development of a system that is cheap, unobtrusive, and easy-to-use in unconstrained ambulation. In addition, the use of a portable electronic device facilitates the development of a gamified Go/NoGo response inhibition task, which enables an automated approach to measuring relative trade-off in dual-task conditions.

Objective: Our primary objectives were as follows: (1) to develop a simple mobile-based tool to enable collection, aggregation, and visualization of gait variability data through a co-design process with clinicians; (2) to examine the feasibility of integrating a gamified dual-task assessment; and (3) to answer the question "If we build it, will they come?" Our secondary objective was to explore the factors that influence rehabilitation therapists' willingness to use mobile/wearable technology in clinical practice.

Methods: We took an iterative design approach to incorporate user feedback during the development of the mobile application. To validate the gait assessment data, we utilized a convenience sample of 12 healthy adults and evaluated 30 seconds of walking data using the mobile application against a Vicon Motion Capture System. In parallel, we developed a questionnaire to gain insight into the barriers and motivating factors that affect use of consumer technology in clinical practice by physiotherapists. The questionnaire was pilot tested for content validity and internal consistency at a rehabilitation center and was distributed online.

Results: Preliminary validation demonstrates good agreement between the mobile application and the Vicon system for mean stride time (r=0.89, $P<.001$) and stride time variability (r=0.79, $P<.01$), n=12. However, further testing is required among cognitively impaired older adults.

Conclusions: Assessment of gait in single and dual-task conditions is suitable using a mobile device and allows for simple development of a game to assess cognitive challenge during ambulation. Barriers to clinical use exist, but physical therapy is a promising area to assess ideas and implementation strategies in mHealth. Consequently, more research is needed to understand the attitudes of physical therapists toward emerging consumer-grade technology in practice.

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KEYWORDS

gait; cognitive impairments; falls; neurorehabilitation; mHealth; Technology Acceptance Model (TAM); user-centred design

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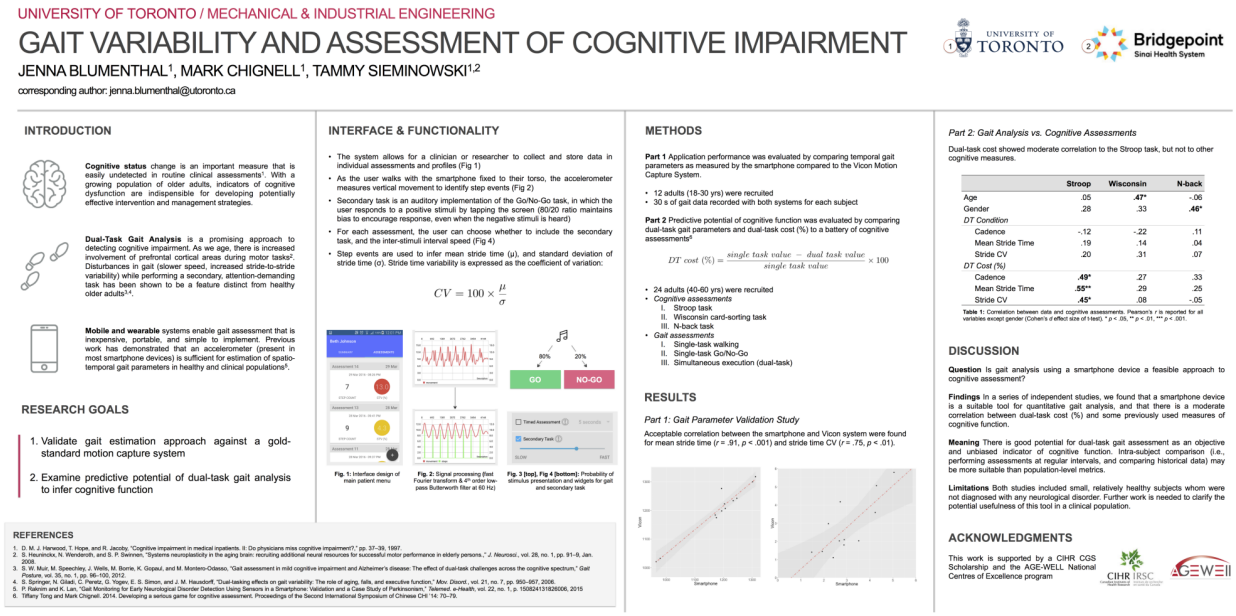
Figure 1. Poster.



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Poster

Early Indications Human-Centered Decision Aids Help People Make More Appropriate Care Decisions

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Abstract

Background: Conditions like chronic low back, hip, and knee pain and low-risk prostate cancer are frequently over-treated. The Agency for Healthcare Research and Quality reports that for chronic low back pain, spinal fusion surgery increased from 61,000 in 1993 to 465,000 in 2011. This has not improved outcomes or reduced disability rates. Patients frequently catastrophize their pain and avoid beneficial activities like walking. Likewise, men with low-risk prostate cancer often react with fear and opt for more invasive treatments like surgery over active surveillance. These are often stressful decisions that patients do not make based solely on data and information but contain strong emotional factors as patients consider the tradeoffs and the short- and long-term effects on their lives and those of their partners and families. A previous randomized controlled trial showed that a multimedia program created with a human-centered approach reduced anxiety. Web-based multimedia decision aids created with patient input through a human-centered approach may better engage patients; address their emotions, concerns, and understanding; and promote calm deliberation.

Objective: Our objective was to gain insight into whether patients who viewed the chronic low back pain, chronic hip osteoarthritis (OA) pain, chronic knee OA pain, and low-risk prostate cancer multimedia decision aids developed with patient input and a human-centered approach are now more interested in less aggressive (non-surgical) treatment options. We also aimed to gain insight into whether patients who view multimedia decision aids designed with a human-centered approach about conditions such as end stage renal disease, benign prostatic hyperplasia, and early-stage invasive breast cancer now understand that there is more than one way to treat their condition, if they now have a better understanding the pros and cons of their treatment options, and if they now have a better sense of which treatment(s) make the most sense for them.

Methods: Web-based multimedia decision aids developed using a human-centered approach were prescribed to patients who needed to make a treatment decision and engage in shared decision making about chronic low back pain, chronic hip or knee pain due to OA, low-risk prostate cancer, and a variety of other conditions where shared decision making is needed. After viewing a multimedia decision aid program, patients could opt to take a standard Web-based survey. An open field was also provided to allow patients to provide additional thoughts or comments. The program was viewed by over 50,000 patients across over 300 US hospitals and providers; 7300 of those patients completed surveys.

Results: A total of 7300 surveys from July 1, 2012, through November 4, 2015, across 15 decision aids found that 97% now understand there is more than one way to treat their condition, 95% better understand the pros and cons of treatments, and 90% have a better sense of which treatment(s) are right for them. Of those with low back, hip, or knee pain or low-risk prostate cancer, 36%-42% reported a change of mind and now lean away from aggressive treatment (2826 with low back pain [36%], 1176 with hip pain [42%], 1759 with knee pain [38%], and 466 with low-risk prostate cancer [37%]). Patient comments also revealed improved understanding of patient conditions and how serious they may or may not be; many reported less anxiety and felt they would now be able to have better shared decision making conversations with their physicians.

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Conclusions: A significant number of patients (37%-44%) who viewed Web-based multimedia decision aids for chronic low back, hip, or knee pain or low-risk prostate cancer indicated that they are now interested in less aggressive treatment options (such as physical therapy for pain or active surveillance for prostate cancer). Patient comments reinforced that patients felt less anxious about chronic pain or low-risk prostate cancer and understood they had time to make a decision and did not have to rush into more aggressive or invasive treatments like surgery. Most patients who viewed Web-based multimedia decision aids created with a patient-informed, human-centered approach about the conditions mentioned above as well as conditions such as early-stage invasive breast cancer, end-stage renal disease, benign prostatic hyperplasia, and uterine fibroids reported now understanding they have more than one treatment option, the pros and cons of those options, and which option makes the most sense for them. Human-centered decision aids that address patient concerns, experiences, and emotions can help people make more appropriate care decisions.

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KEYWORDS

decision aids; multimedia; patient decision aids; patient-centered care; human-centered care; care decisions; shared decision making; informed decision making

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Figure 1. Poster.

Multimedia Appendix 1

Poster.

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Poster

Using Technology to Identify Risk and Meet Demands: An Innovative Clinical Pathway

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Abstract

Background: Over the past decade, there has been a significant push by the Australian government to fund youth-friendly mental health services that are non-stigmatizing, low cost, and accessible. One such organization is headspace: the National Youth Mental Health Foundation. This initiative has been highly successful; unfortunately, workforce and funding resources have not been able to keep up with the ever-growing demand, resulting in increasingly lengthy wait times for young people.

Objective: The aim was to investigate how technology could be integrated into current pathways of care to reduce wait times for young people accessing headspace centers and to help identify those young people at greatest risk. Objectives were to understand current clinical pathways, determine the technological requirements needed to ensure seamless integration, identify indicators of risk that highlight those young people in greatest need for immediate care, and develop a new clinical pathway that seamlessly incorporates the new technology.

Methods: An electronic holistic psychosocial assessment tool (EhHAT) was developed in collaboration with young people and service providers, with service providers specifying "critical" items they considered most indicative of risk. Center managers were also interviewed to determine current and potential pathways of care and technological requirements. The EhHAT was then administered to 151 young people attending a headspace center to determine the "critical items" most likely to identify the top 10%-20% of young people at greatest risk of harm.

Results: The critical items considered most indicative of risk included but were not limited to a suicide screen score ≥10, current homelessness, self-harming behaviors in the previous month, psychotic experiences in the previous month, daily use of drugs, and an extreme K10 score. After administering the ehHAT to young people, it was found that the suicide screen would positively identify the top 11.9% of young people most at risk. In addition to those already identified via the suicide screen, a further 13.24% would be identified as "at risk" by endorsing 3 or more "critical" items or a further 5.29% identified by endorsing 4 or more items. Interestingly, while 23.07% of participants who endorsed 3 or more critical items also had a suicide screen of ≥10, 72.72% of those who endorsed 4 or more items also had a suicide screen of ≥10. In order to ensure seamless integration into clinical pathways, technological requirements included the ability to complete the assessment via mobile, tablet or computer, automated risk alerts to clinicians via text, clear highlighting of risks to clinicians via a summary, and the ability to integrate this assessment into current client data management tools.

Conclusions: With appropriate considerations and adaptations, technology can be integrated into clinical pathways to assess young people before they see a clinician. Such assessment ensures young people at the greatest risk of harm receive care quickly. Furthermore, the early identification of those with milder symptoms allows young people to be re-directed to alternative treatment

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options. Utilizing this stepped care approach will reduce wait times for those with more severe symptomology and those at greatest risk of harm.

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KEYWORDS

youth mental health; technology; risk assessment

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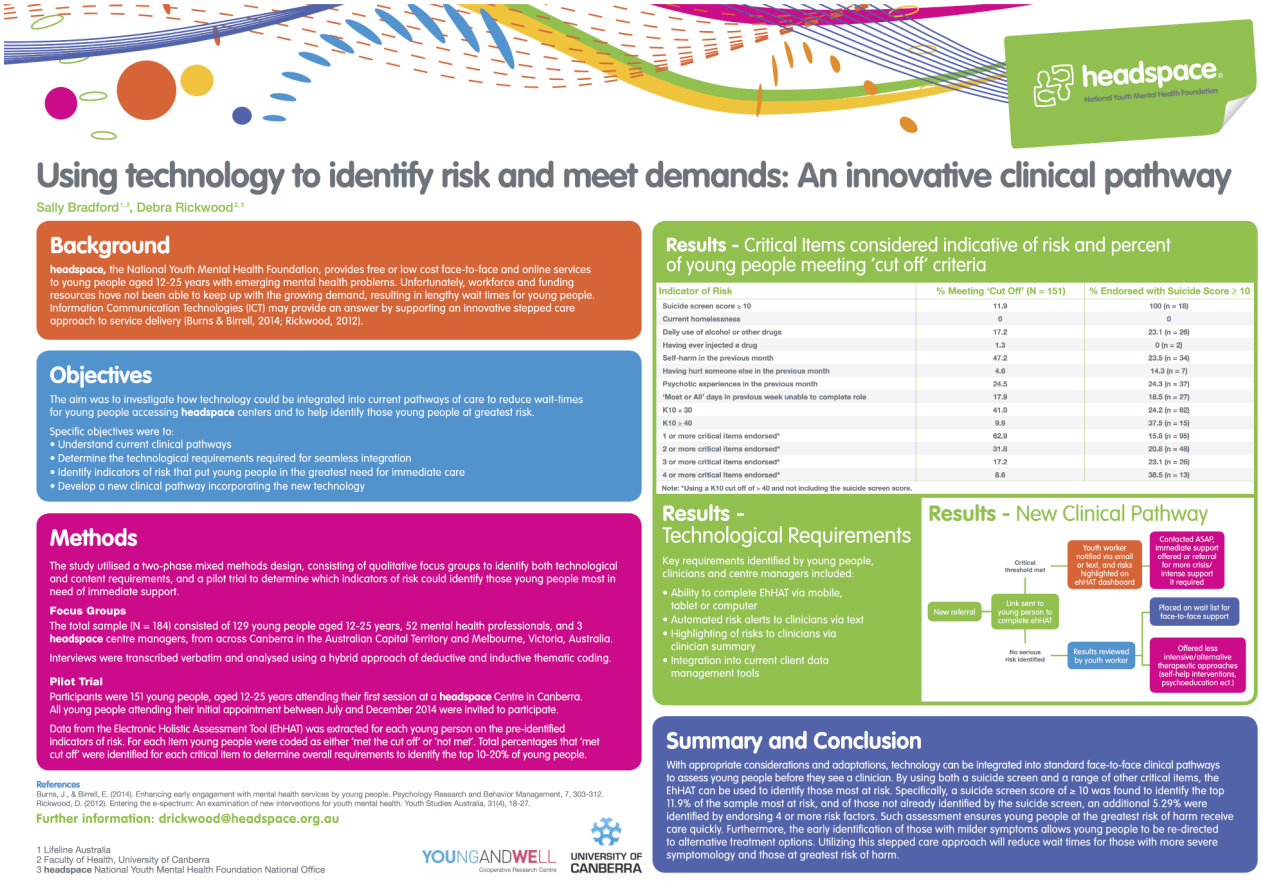
Figure 1. Poster.



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Poster

Connecting With the Audience: Testing the Use of the Entertainment Education Strategy and Narrative in an SMS Intervention

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Abstract

Background: Short message service (SMS) interventions can influence knowledge, attitudes, and behaviors related to health. While SMS for health promotion has grown in popularity, there is a paucity of research that examines specific characteristics of text message interventions to determine what may make them effective. Previous research in health communication has identified strategies that can effectively lead to positive health outcomes, such as the use of entertainment education (EE). EE is the practice of embedding educational content in an entertaining format. One component of EE is the use of narrative, which allows for audience members to identify with characters, reduce counter-arguing of a message, and engage with the information presented.

Objective: To determine the potential for the use of narratives and the entertainment education strategy in a text message intervention. In particular, we focused on a topic relevant on college campuses in the United States, alcohol and hookups, with young adult females.

Methods: In spring 2015, we conducted a 3X1 posttest only experiment with 137 college females. We developed two sets of text messages about alcohol and hookups based on formative research with the target audience. The first set used narrative to convey information about Sara (a fictitious student) and her experiences. The second set used no story to present the same information. Messages were pretested prior to the experiment, and participants identified the information presented to be similar with differences in format. A third set of messages served as a control, focusing on campus events. We recruited participants from a communication college participant pool. Participants signed up to come to the lab to complete the experiment. Participants were given a mini tablet on which to view the messages that included an iMessage conversation featuring the messages for their condition. After viewing the messages, participants clicked on a link that took them to a questionnaire.

Results: Transportation, which is whether the viewer felt engrossed in the story, differed by condition $F(2, 133)=6.368$, $P<.01$. Only the control condition differed significantly from the narrative condition, however, with those in the narrative condition experiencing greater transportation than those in the control condition. Counter-arguing differed by condition $F(2, 132)=14.680$, $P<.001$, with greater counter-arguing in the narrative condition than the non-narrative ($P<.001$). Identification did not differ by condition.

Conclusions: Transportation may occur via text message; however, counter-arguing worked in reverse of what would typically be hypothesized, and identification did not significantly differ by condition. The finding of transportation being greater for the narrative condition is promising, as it highlights that even through a series of six 160-character messages, young adult females who view narrative messages can feel somewhat more transported than participants who view messages about general campus events. However, it appears that narrative is difficult in such a small space, as identification did not occur, and identification is often important for people to feel connected to the characters, which can then influence attitudes and behaviors. Future work should examine other elements associated with narrative to assess potential effects.

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KEYWORDS

short message service (SMS); text message; intervention; cell phone; entertainment education

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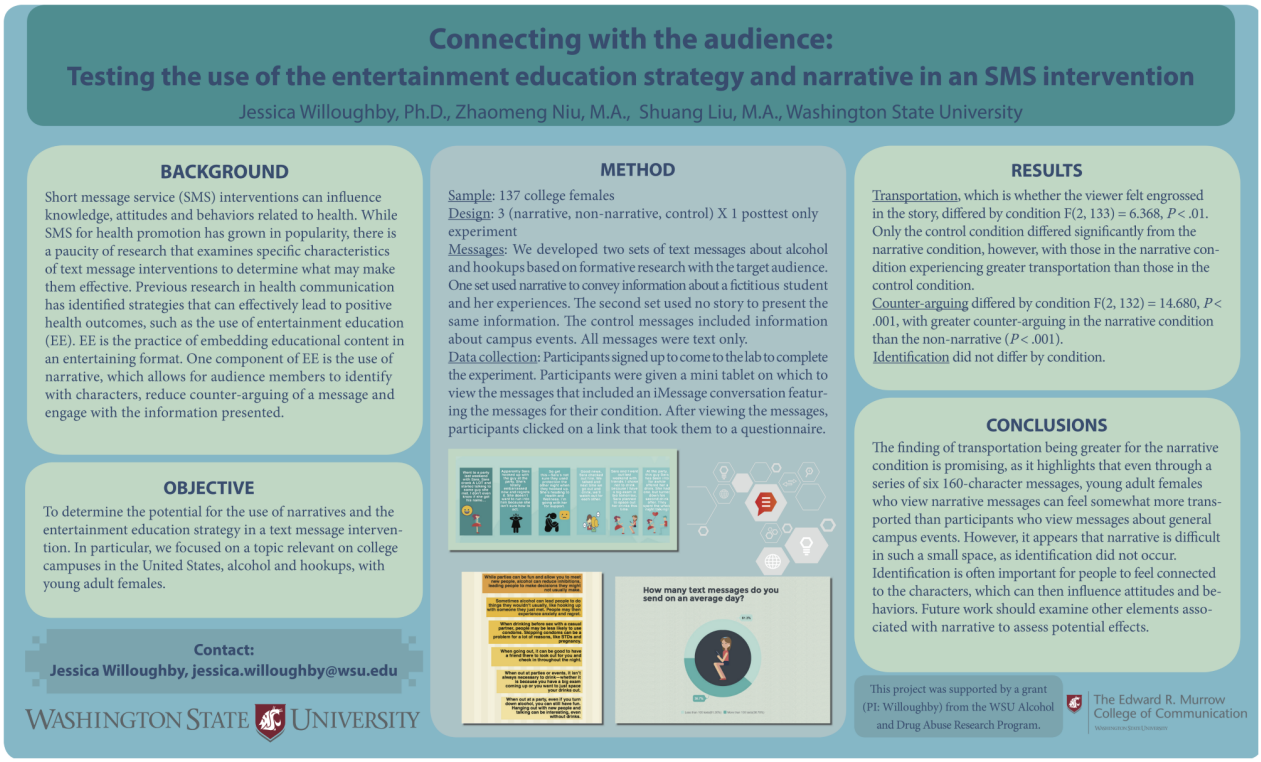
Figure 1. Poster.



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Poster

Using High-Tech and High-Touch Methods for Effective Population Health Management

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Abstract

Background: Healthcare consumers today are more engaged and empowered than ever before. Social, mobile, and in-home self-monitoring tools now enable health consumers to manage their health conditions and receive advice, support, and care without leaving home. Consumers are increasingly buying biometric devices such the Fitbit and Apple Watch to monitor their health. Many payers and employers are providing fitness devices to encourage consumers to be healthy, often offering discounts to their healthcare premiums. These devices create a sense of euphoria initially, but they do not yield sustainable health results and necessary behavioral changes in consumers to sustain it in the long-term. According to BJ Fogg, Stanford professor, sustainable behavior change (B) is a function of the motivation of the individual (M) × ability of the individual to do the task (A) × Trigger (T); B=MAT.

Objective: Our hypothesis was that self-managed digital triggers alone would not yield sustainable change, but a combination of digital biometrics devices that automatically monitor health supplemented by weekly contact with a health coach would deliver sustainable changes to consumer behavior.

Methods: During the 6-month pilot in 2014 and 12-month program in 2015, Cognizant wanted to test this hypothesis by providing appropriate triggers to motivate individuals to achieve their goals and ensure sustainable change in behavior. We provided Fitbit devices to participants and shared their digital information with our health coach. The coach worked with the individuals in setting individual goals, reviewed their progress, and helped with better food and exercise choices. The coach also used gamification to motivate the group into friendly competitions.

Results: At the end of the pilot, participants averaged 70,000 steps per week. This was well above the average US baseline of 36,000 steps and Fitbit average of 42,000 steps. Pilot participants also lost over an average of 10 pounds each. However, during the pilot we determined coaching needed more focus on incremental, sustainable goals to lead toward long-term behavior changes. During a 6 month period between the pilot ending and the 2015 program initiation where pilot participants did not have access to a coach, participants' activity level decreased, and weight lost during the pilot was gained back. During the 2015 program, participants sustained on average 66,000 steps per week (well above both the US and Fitbit average). Obese 1 participants normalized steps at 70,000 per week and increased activity from baseline almost 30%. This group started at the very bottom of "Somewhat Active" and transitioned into the "Active" category. Obese 2 participants normalized steps at 60,000 per week and increased activity from baseline almost 33%, which transitioned them from "Low Active" to "Somewhat Active." This was the largest increase by any group from baseline. Our control group, who did not have access to coaches, averaged only 43,000 steps per week.

Conclusions: Coach influence and participant change is most effective in the first 6 months. After that, coaches concentrate on incrementally increasing activity in a sustainable manner. Effective population health management and high value personalized services can be achieved by weight loss from increasing physical activity and better food choices brought about by direct consumer engagement that combines "high tech" with "high touch."

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KEYWORDS

population health management; fitness apps; self-monitoring

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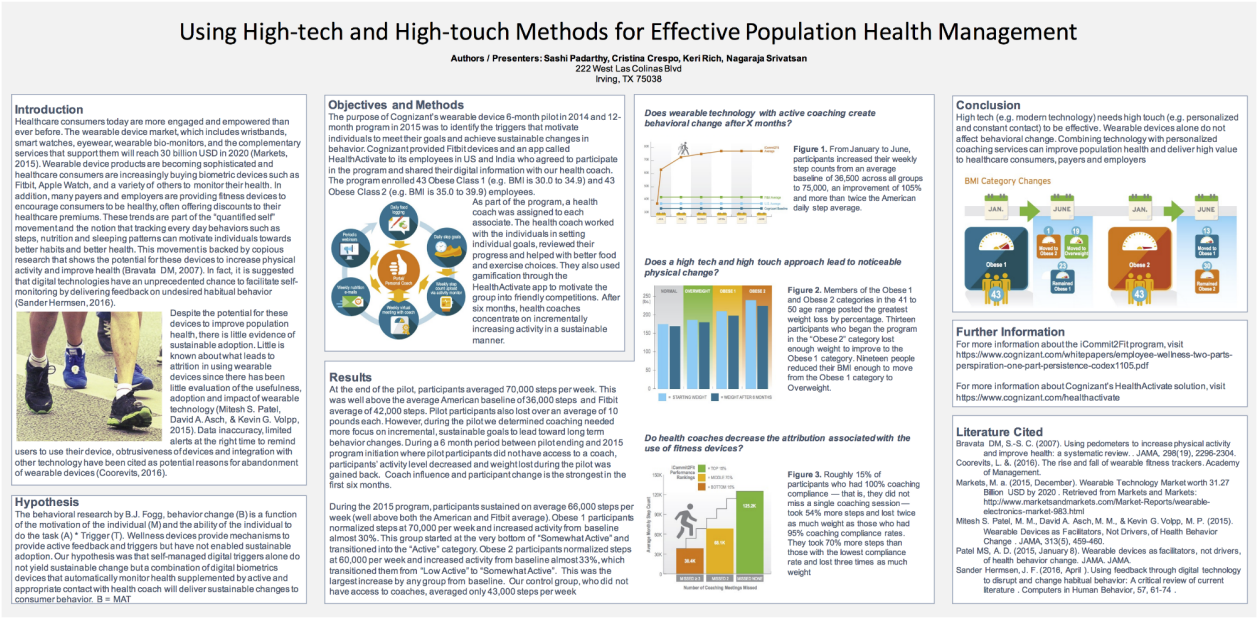
Figure 1. Poster.



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Poster

Visual Food Diary for Social Support, Dietary Changes and Weight Loss

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Abstract

Background: To find out to what degree health-improving dietary behavior (eg, increasing consumption of vegetables and fruits) can be furthered in virtual peer support groups moderated by a nutrition professional using a mobile app.

Objective: To find out, to what degree health improving dietary behaviour, for example increasing the use of vegetables and fruits can be furthered in virtual peer support groups moderated by a nutrition professional using a mobile application.

Methods: In this feasibility study, volunteering adult men and women (body mass index [BMI]>25 kg/m²) were recruited both from a diabetes outpatient clinic and from an occupational health care unit. Participants were divided into 3 groups. All participants used a smartphone app that allowed them to keep a visual food journal, share their meals and activity with group members, and receive virtual coaching from a nutrition professional. Outcomes were assessed via surveys at baseline, after the intervention, and 4 weeks later using a food frequency questionnaire (FFQ). Frequency of app use, weight, and waist circumference were estimated at baseline and after the intervention.

Results: Mean weight loss (n=25) after intervention was 1.5 kg (95% CI 0.79 to 2.29), or 1.7% (95% CI 0.89 to 2.5) in all subjects together, and 1.5% in group 1 (95% CI –0.02 to 2.9), 1.9% in group 2 (95% CI 0.56 to 3.25), and 1.7% in group 3 (95% CI –0.20 to 3.61), respectively. Mean waist circumference (n=22) reduced 2.4% (95 % CI 1.3 to 3.4). At the end of the 4-week intervention, the consumption of vegetables and fruits (n=26) had increased by 55%, while the consumption of sweets and chocolate had decreased by 39% as compared to baseline. Almost all participants (84%) strongly agreed (40%) or agreed (44%) that they got support and encouragement from other group members. Similarly, altogether 92% of participants strongly agreed (67%) or agreed (25%) that they felt like they belonged to the group. The engagement level was high, with the average user uploading 5.2 meals a day and recording a total of 9.3 sessions a day. There was some variation between the 3 groups. On average, users in groups 1, 2, and 3 uploaded 3.8 (n=8, 862 meals), 5.8 (n=8, 1315 meals) and 5.7 (n=11, 1774 meals) meals a day, respectively, within the 4 week period. In total, the participants uploaded 3951 meals and recorded 7066 sessions.

Conclusions: Smartphone-based virtual peer support can be used as a tool to promote healthy eating both in outpatient clinic and occupational health settings.

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KEYWORDS

mHealth; nutrition; food journal; peer support; obesity

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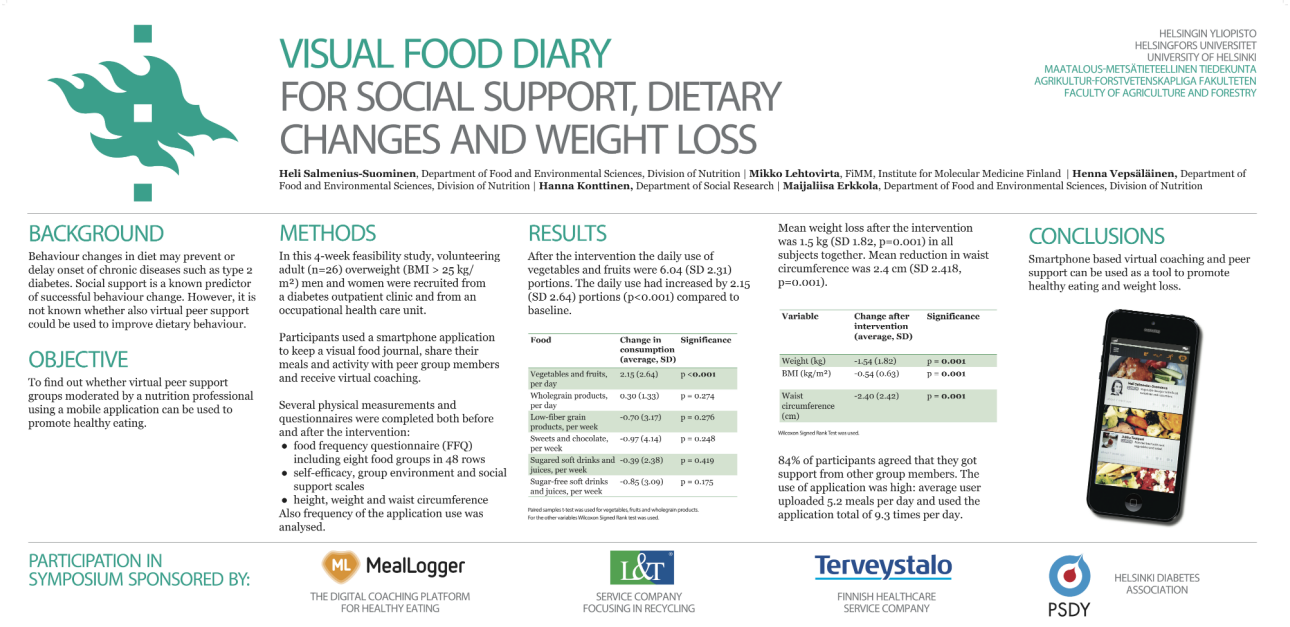
Figure 1. Poster.



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Poster

A Comprehensive Survey of Managed Care Organization (MCO) Medication Adherence Intervention Programs

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Abstract

Background: Medication adherence is defined as the extent to which patients takes their medications as prescribed by their healthcare providers. Medication non-adherence is understood to be a costly and dangerous problem. In the United States alone, non-adherence is estimated to incur US $290 billion in avoidable healthcare expenditures each year. On an individual basis, annual spending for non-adherent patients with hypertension and diabetes is approximately US $4000 greater than for patients who are adherent to their medications. In addition, non-adherent patients suffering from heart failure are hospitalized 2.5 times more frequently than those who adhere to their medication regimens, resulting in a profoundly diminished quality of life, while driving up health care costs. This problem will continue to get worse as more patients will continue to take multiple medications to treat chronic conditions. While medication non-adherence is a serious problem, its origins are complex and not fully elucidated. Some of the more commonly accepted causes include complex treatment regimens, adverse drug reactions, forgetfulness, socioeconomic issues, health literacy, and personal beliefs.

Objective: The purpose of this study is map the current landscape of managed care organization (MCO) medication adherence programs, review the common medication adherence interventions that are used by MCOs, and identify the need for more enhanced intervention targeting such as predictive analytics platforms and other non-predictive methodologies.

Methods: This research survey was conducted in the spring of 2014 and involved 30 MCOs. Each MCO was asked about their current medication adherence intervention programs. Each MCO was represented by an employee who manages medication adherence programs within the organization. Each employee was interviewed during a 10-week long period by virtue of a detailed questionnaire that involved open-ended and multiple-choice questions. Questions addressed information about each MCO's existing medication adherence programs and interventions. Information and insight into the effectiveness of existing interventions, the criteria by which patients are selected for interventions, and the processes by which adherence is measured by each MCO were summarized for this survey. The questionnaire was divided into three basic components: general questions regarding existing medication adherence programs, types of interventions used and their individual effectiveness, and how patients are selected to receive interventions. Respondents also discussed any unique services their programs provide and any future plans of expansion. All data was recorded by 5 interviewers and then reanalyzed by the authors. All 30 MCOs interviewed have medication adherence intervention programs that target their patient population. The MCOs vary in size and coverage demographics. A total of 19 of the organizations are classified as small MCOs (enrollment <200,000), while 11 are classified as large MCOs (enrollment >200,000). The surveyed MCO populations encompass most of the continental United States as well as Puerto Rico. The coverage demographics of these MCOs include commercial, Medicare, and/or Medicaid. Overall, 53% of MCOs cover a commercial

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population, 80% cover a Medicare population, and 27% cover a Medicaid population. The highest coverage combinations are commercial and Medicare and Medicare and Medicaid, which account for 23% of the population and 17% of the population, respectively.

Results: Most MCO medication adherence program interventions are directed at patients with chronic cardiovascular disease states (diabetes, hypertension, hyperlipidemia, and heart failure). Cardiovascular diseases are a primary concern for MCOs because of the chronic use of medications/therapies that are associated with the management of such disease states. Furthermore, there is a strong association with medication non-adherence and increased hospitalization rates. Most MCOs use triggers and retrospective adherence measures to select patients for interventions. MCOs seem to follow a rule-based approach (using specific demographic profiles and predefined events to trigger interventions) rather than treating each patient individually. One way to implement a more personalized approach is through predictive analytics. While only 7% of MCOs currently use predictive analytics, over half of the surveyed MCOs plan on incorporating some type of analytics platform. Many are interested in adopting a platform that identifies interventions most likely to engage patients and influence their behavior, avoiding wasteful spending on interventions with patients who will not need them. These enhanced programs are dynamic and self-learning and can rapidly adapt to new intervention techniques. MCOs focus on four intervention channels to improve patient adherence: telephone outreach, direct mail, provider-centric, and face-to-face visits. These interventions are conducted through a combination of in-house and outsourced techniques. MCOs perceive current approaches as only moderately effective because of a failure to intervene before patients are non-adherent and a failure to personalize interventions. This relative ineffectiveness of current interventions has been implicated in previous studies.

Conclusions: The study results suggest that most MCO medication adherence programs target chronic, comorbid cardiovascular disease patients through a system of triggers and retrospective adherence measures. Most MCOs intervene using telephone outreach, direct mail, provider-centric, and face-to-face visits through a combination of in-house and outsourced methods. This approach is seen as only moderately effective as it fails to personalize interventions and intervene before a patient becomes non-adherent. In light of these findings, predictive analytics platforms can play an increasing role in addressing the needs and shortcomings of existing MCO medication adherence programs.

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KEYWORDS

predictive analytics; managed care; medication non-adherence; adherence; intervention; managed care organizations; health outcomes

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

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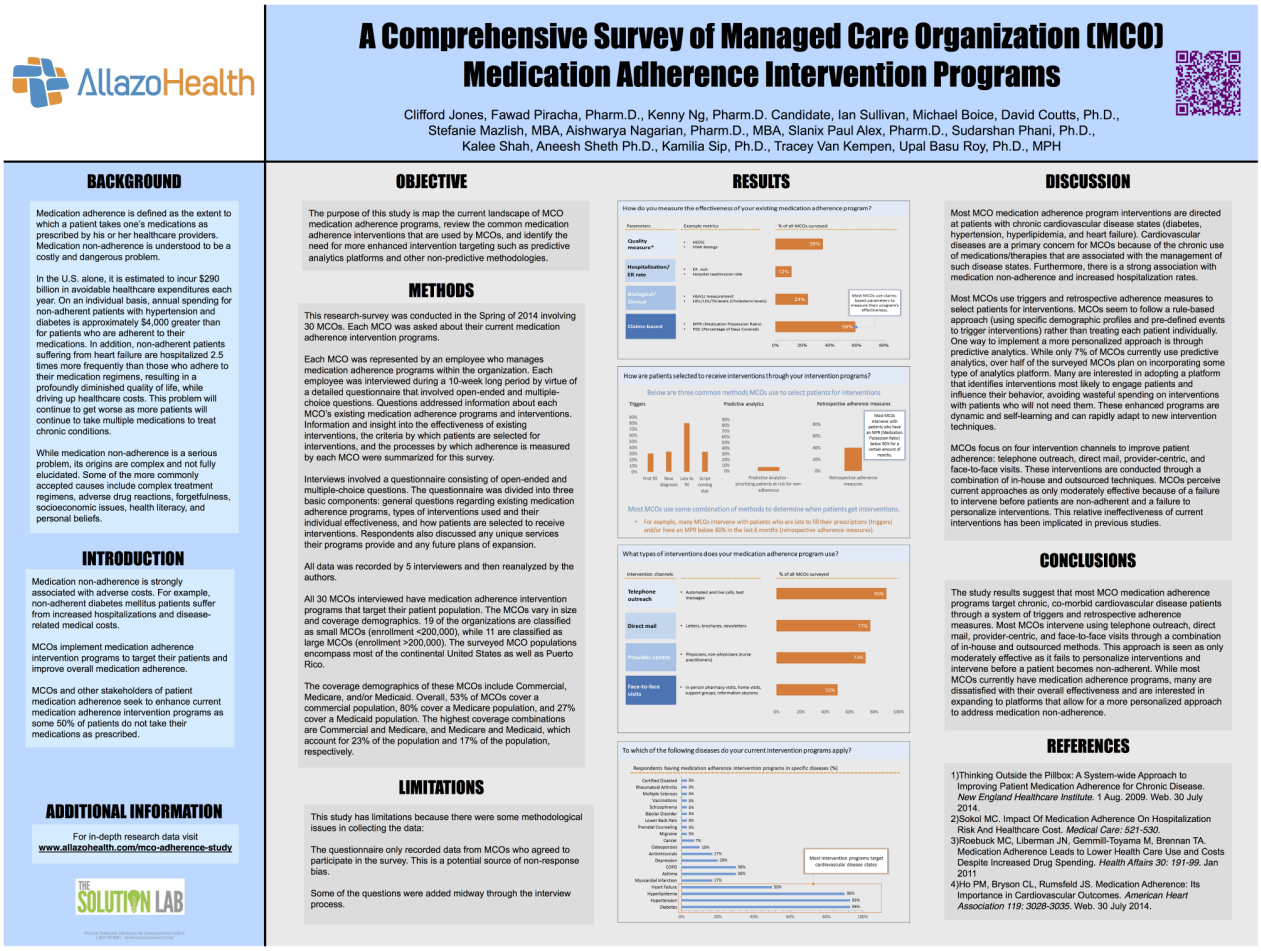
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Feasibility of Using a Game-Based Cognitive Assessment for Older Adults in Emergency Care

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Abstract

Background: Developed nations are currently facing a demographic shift towards a higher proportion of elderly people and increasing age-related health concerns. Elderly adults often enter into the health care system through emergency services. As a result, emergency departments (EDs) are an opportune environment for cognitive screening to improve patient outcomes. Existing methods are not designed for use in EDs and require administration by a trained test administrator. As an alternative, we suggest serious games as screening tools that can be self-administered or used with minimal assistance in emergency care. The use of validated and reliable serious games can encourage more efficient and engaging cognitive screening.

Objective: Our objective was to investigate the feasibility and usability issues identified in the process of evaluating the validity and reliability of a game-based cognitive screening tool administered on an interactive tablet, for use by elderly adults in emergency care.

Methods: We carried out a study in a hospital ED to evaluate the validity of the serious game with elderly adults over the age of 70 years (N=146). Validity was assessed in terms of the correlation of game performance with outcomes of current assessment methods. Comparative assessments included the Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), and the Confusion Assessment Method (CAM). We also assessed the reliability of our game-based assessment tool in a hospital ED for a large subset of the patients who underwent a revised protocol involving follow-up sessions at a minimum of every 8 hours (n=127). In both studies, research personnel (RP) administered the standard cognitive assessments and then asked the patients to play the serious game. Recruitment for the reliability study overlapped with our validation study, with 56 potential overlap cases.

Results: In our validation group, 141 of 146 patients consented to play the serious game. Performance on the serious game correlated significantly with the MoCA (r=–0.339, P<.001), MMSE (r=–0.558, P<.001), CAM (r=0.565, P<.001), and other cognitive assessments. In our reliability study of 127 adults, we obtained data from 126 people. We observed good test-retest reliability with Pearson correlation r values between 0.5 and 0.7. These results supplement findings from our validation study that the assessment was correlated with MMSE, MoCA, and CAM scores. Usability feedback suggested that the game was too easy and the need to use a stylus for users with dry skin. All patients were able to play the serious game administered on a tablet

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either independently or with minimal assistance from RP. In the latter case, RP would assist by holding the tablet as some patients found it heavy.

Conclusions: This research demonstrates the feasibility, validity, and reliability of using a game-based cognitive assessment in a clinical setting. Elderly users in an ED can use our screening tool by improving on the usability of the system by incorporating their feedback in our design process. This research shows that appropriately designed serious games can be self-administered or used with minimal assistance in a clinical setting repeatedly for each person.

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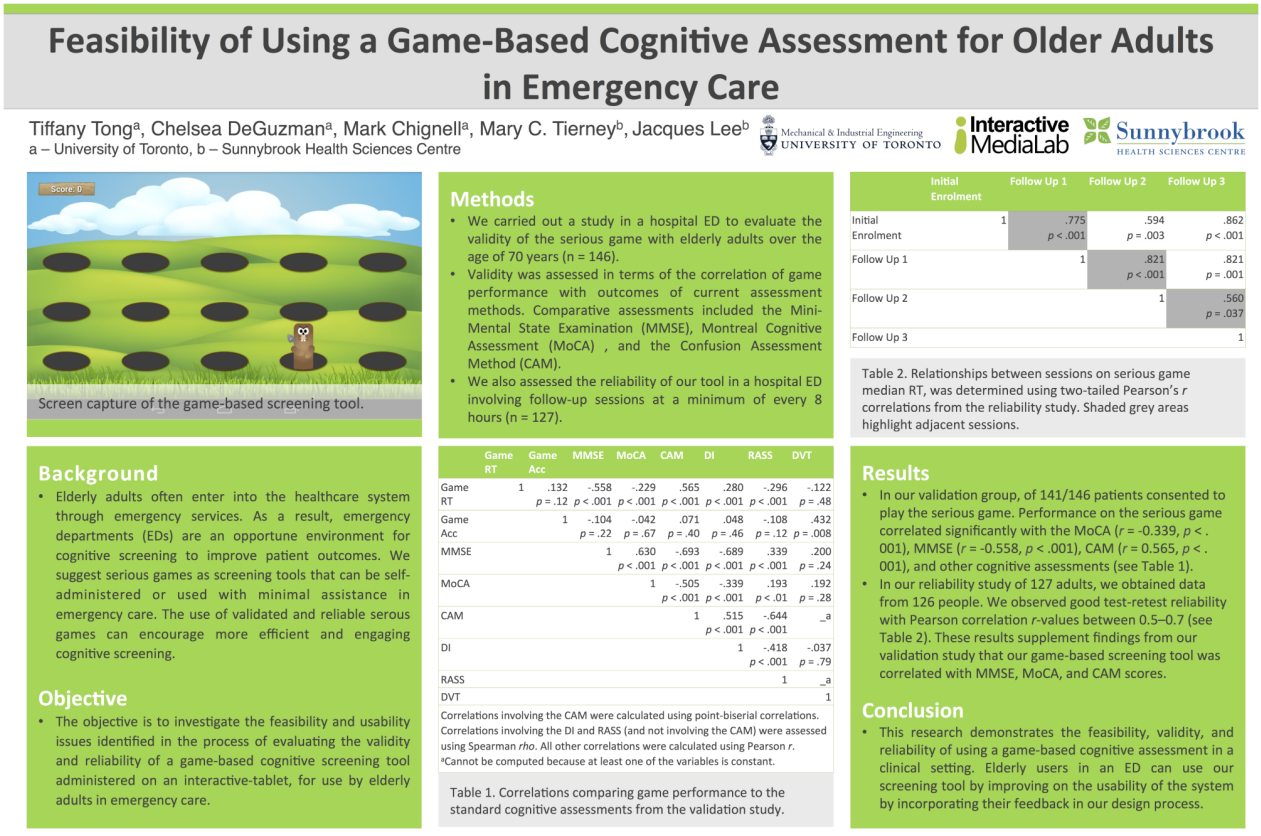
KEYWORDS

cognitive assessments; cognitive screening tools; computerized assessments; games; human computer interaction; human factors; neuropsychological tests; screening; serious games; tablet computers; technology assessment; usability; validation studies; video games

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. A photo of the poster is displayed as an image in Figure 1 and as a higher resolution image in Multimedia Appendix 1.

Figure 1. Poster.



	Game RT	Game Acc	MMSE	MoCA	CAM	DI	RASS	DVT
Game RT	1	.132 p = .12	-.558 p < .001	-.229 p < .001	.565 p < .001	.280 p < .001	-.296 p < .001	-.122 p = .48
Game Acc		1	-.104 p = .22	-.042 p = .67	.071 p = .40	.048 p = .46	-.108 p = .12	.432 p = .008
MMSE			1	.630 p < .001	-.693 p < .001	-.689 p < .001	.339 p < .001	.200 p = .24
MoCA				1	-.505 p < .001	-.339 p < .001	.193 p < .01	.192 p = .28
CAM					1	.515 p < .001	-.644 p < .001	_a
DI						1	-.418 p < .001	-.037 p = .79
RASS							1	_a
DVT								1

Correlations involving the CAM were calculated using point-biserial correlations. Correlations involving the DI and RASS (and not involving the CAM) were assessed using Spearman *rho*. All other correlations were calculated using Pearson *r*.
[a]Cannot be computed because at least one of the variables is constant.

	Initial Enrolment	Follow Up 1	Follow Up 2	Follow Up 3
Initial Enrolment	1	.775 p < .001	.594 p = .003	.862 p < .001
Follow Up 1		1	.821 p < .001	.821 p = .001
Follow Up 2			1	.560 p = .037
Follow Up 3				1

Multimedia Appendix 1

Poster.

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Poster

The Impact of Electronic Administration of the MMSE on Error Rates and Data Quality

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Abstract

Background: The Mini-Mental State Examination (MMSE) is a widely used measure of cognition in clinical practice and is a frequently used screening and outcome measure for cognition-enhancing clinical drug trials for Alzheimer's Disease. Scoring and administration errors on the MMSE in a clinical drug trial can contribute to placebo response and unreliable data. Examples of such errors range from basic addition errors to failure to adhere to structured administration instructions. Prior research from independent clinical review of paper versions of the scale as part of a data quality monitoring program in worldwide studies has demonstrated that MMSE error rates among clinical trial raters tend to be upwards of 30% on initial administration. An enhanced tablet-based electronic (eCOA) version of the MMSE was developed for clinical trials by Bracket and has been utilized in worldwide clinical trials since 2013. The scale is administered in a system compliant with US Food and Drug Administration guidelines on the use of electronic medical records in trials and was designed to be equivalent to the paper MMSE. The eCOA version was augmented with internal logic, automated scoring and addition, standardized instructions, and enforcement of administration conventions. These enhancements were intended to decrease errors and increase the likelihood that the scale would be consistently administered and scored according to standard conventions.

Objective: Our objectives were to (1) determine if error rates using the eCOA MMSE were reduced when compared to standard paper administration and comparable to eCOA error rates from an analysis published in 2015 and (2) consider the impact of utilizing enhanced eCOA versions of scales like the MMSE in clinical practice.

Methods: All data from this analysis and comparative analyses were from multinational studies that trained and certified raters on the MMSE and included an in-study data monitoring program of clinical reviews to detect scoring and administration errors. Error rates on the enhanced electronic versions of the scales used in a late-phase Alzheimer's study were compared to those previously seen in other studies when using paper versions and the enhanced eCOA MMSE. The dataset for this eCOA analysis was limited to English-speaking sites.

Results: A total of 66/626 (10.5%) of the enhanced eCOA MMSEs reviewed at the inclusion visits contained an error in scoring which required outreach to the rater. This represents a statistically significant reduction (P<.0001) in the error rates compared to paper administration of the MMSE (877/2889, 30.4%) and is consistent with the findings from a prior analysis of an eCOA MMSE dataset from another trial (107/990,10.8%).

Conclusions: Use of enhanced eCOA for the MMSE in clinical trials has significantly improved error rates and data quality compared to standard paper administration. Enhanced eCOA that is designed to minimize errors and enforce administration standards could be a useful tool to reduce common errors and increase the precision of the MMSE use in clinical practice.

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KEYWORDS

mental health technologies; Alzheimer's assessments; eCOA

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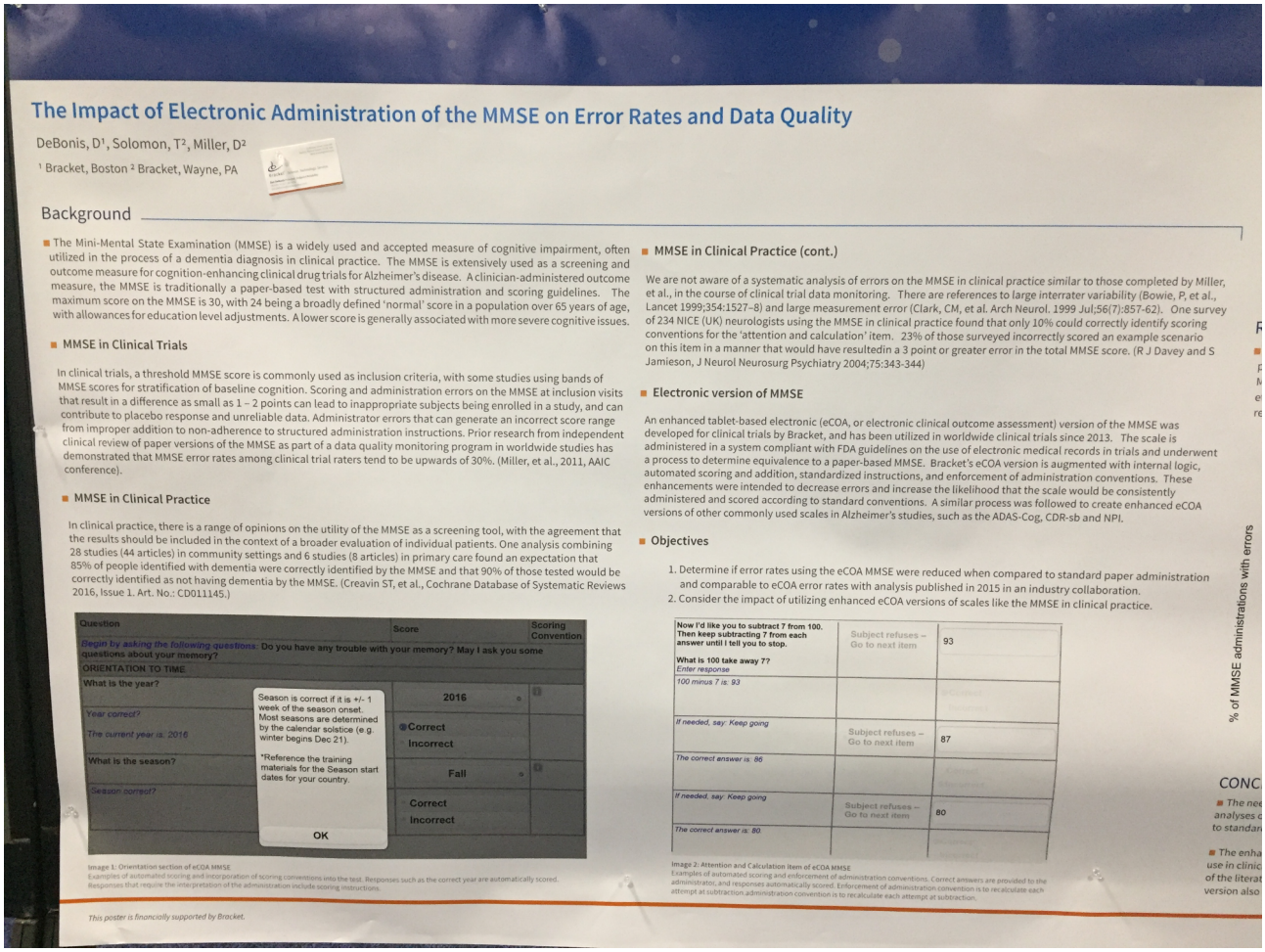
This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. The poster is displayed as an image in Figure 1 and as a PDF in Multimedia Appendix 1.

Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Patient Reported Value and Usability of a Digital Health Intervention for Asthma

Rajan Merchant[1], MD; Rubina Inamdar[2], MD; Kelly Henderson[3*], MPH; Meredith Barrett[3*], PhD; David Van Sickle[4*], PhD

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Abstract

Background: Digital health tools are increasingly recognized as effective in improving asthma clinical outcomes such as control and adherence; however, few studies have evaluated patient perspectives on the usability and value of these tools in supporting asthma self-management. Patient perceptions of digital health tools, including usability and satisfaction, will determine the success of these digital health interventions and the durability of their effects.

Objective: We aimed to assess patients' usability feedback and satisfaction with an asthma digital health platform after 12 months of use.

Methods: We administered surveys to participants of a randomized controlled clinical study designed to measure the clinical effectiveness of the Propeller Health Asthma Platform. The electronic surveys evaluated patients' feedback on the usability of the sensor and the perceived value of the platform and information provided after 12 months of use. The clinical study had enrolled patients (N=495) in parallel arms from specialty and primary care clinics. Intervention group patients (n=250) used electronic inhaler sensors to track the date, time and geographic location of medication use. Patients received access to a digital health platform including smartphone and Web-based applications that provided information about their asthma medication use trends, real-time asthma control, guidelines-based education, and personalized support for 12 months. Physicians could monitor the status of their patients and receive notifications about short-acting beta agonist (SABA) overuse. Survey results reported here represent adult participants from the intervention group who completed the exit survey at 12 months.

Results: Respondents (n=89) reported being very satisfied (79%) or somewhat satisfied (20%) with the inhaler sensor, stating that the sensor was "small," "unobtrusive," and "easy to use" and carry. A total of 90% of respondents found the information they received via the platform useful, with 93% expressing satisfaction with the information. In open-ended responses, participants cited valuing how the platform increased awareness about their asthma control status and medication use, provided "relevant" and "timely" information, and identified potential environmental triggers that exacerbated their symptoms, with 65% of respondents identifying 1-7 new triggers as result of the information. Respondents described improved communication with their doctors: 46% of the respondents had talked with their doctor about the information they received, and 22% stated that their doctor recommended or changed a specific aspect of their asthma management as a result of the information. Over 50% of respondents said that they felt their asthma was more controlled as a result of the information they received, which is supported by the clinical results demonstrating 63% of uncontrolled patients achieved control during the program.

Conclusions: Patients reported positive usability of a digital health platform for asthma self-management, citing that it was easy to use and fit into their lives unobtrusively. Almost all patients perceived value from the digital health platform in contributing

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to their self-management, finding value in increasing self-awareness, identifying asthma triggers, offering actionable information, and improving communication with their doctors.

ClinicalTrial: Clinicaltrials.gov NCT01509183; https://clinicaltrials.gov/ct2/show/NCT01509183 (Archived by WebCite at http://www.webcitation.org/6nIIEejW7).

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KEYWORDS

asthma; digital health; usability

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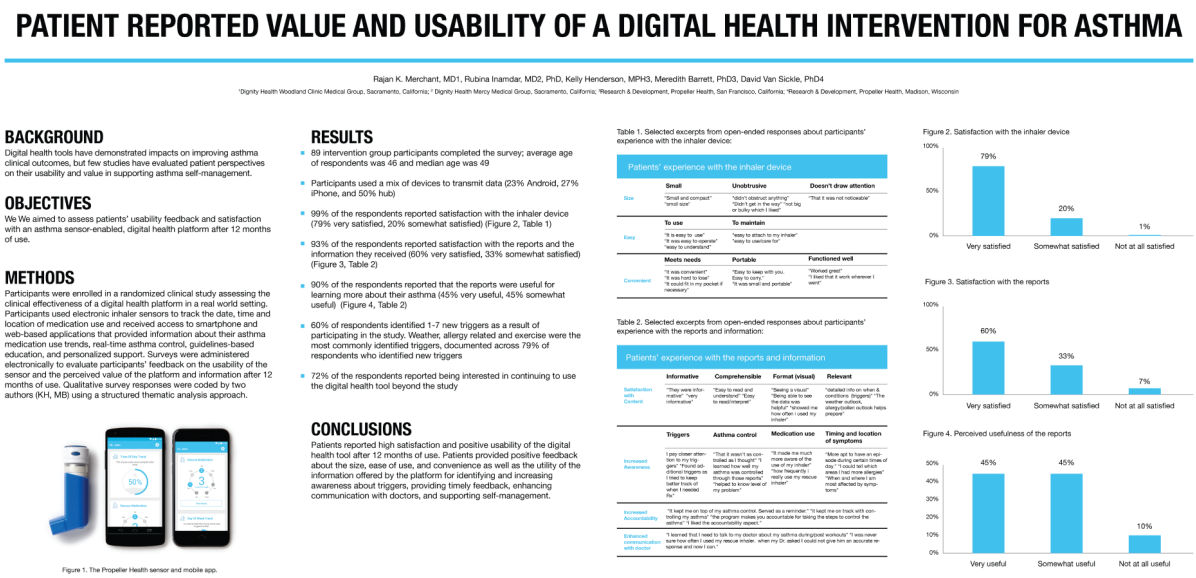
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Putting Young People at the Forefront of Their Mental Health Care Through Technology for Holistic Assessment and Routine Outcome Tracking

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Abstract

Background: Young people have the highest need for mental health support yet are least likely to seek it from professional services. Enabling access and engagement in mental health care is essential to intervening early to provide appropriate and effective care to prevent escalation of young people's mental health problems. In response, Australia initiated headspace: the National Youth Mental Health Foundation, which provides friend-to-friend (f2f) and online services to young people aged 12-25 with emerging mental health problems. Innovations in technology are being developed to better engage and put young people at the forefront of their mental health care.

Objective: The aim was to investigate how technology could be used to facilitate holistic psychosocial assessments for young people entering mental health services and routinely track meaningful outcomes across an episode of care. Objectives were to determine whether this use of technology would be engaging and acceptable to young people and how it would affect appropriateness and effectiveness of the care received.

Methods: An electronic holistic psychosocial assessment tool (EhHAT) and a brief routine mental health outcome measure (MyLifeTracker) were developed in collaboration with young people and their service providers. The EhHAT was piloted using a quasi-experimental 2-phase treatment-as-usual/intervention design with 339 youth and 13 clinicians. Engagement and rates of disclosure and risk across the psychosocial domains were compared in a mixed methods approach. MyLifeTracker was implemented with all clients, and quantitative data were available from 15,222 young people and used to compare MyLifeTracker with standardized mental health outcome measures. Qualitative data were collected from a small subsample to examine their experience of this routine monitoring approach.

Results: The EhHAT was shown to be highly engaging and acceptable to young people and resulted in disclosure of psychosocial risks that were 2.8 through 10.4 times higher compared with the non-intervention group. MyLifeTracker was shown to have concurrent validity against well-validated measures of psychological distress, functioning, and life satisfaction. It was highly sensitive to change with excellent stability. Young people valued the opportunity to report and track their progress. For both applications, the use of technology improved the experience for young people, making them feel more in control, and providing better information for clinicians.

Conclusions: The results show that technology is effective at engaging young people in their own mental health care. They are comfortable providing personal information via tablet applications and are more likely to disclose in this format. This yields better information for clinicians to provide more appropriate and tailored care. Young people appreciate the opportunity to routinely track their outcomes via technology and find this a helpful way to have conversations with their clinicians around the changes that are meaningful to them, leading to more appropriate and effective care. These holistic assessment and outcome

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tracking tools are essential ways forward harnessing technology to put young people at the forefront of their own mental health care.

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KEYWORDS

youth; mental health; assessment; outcomes

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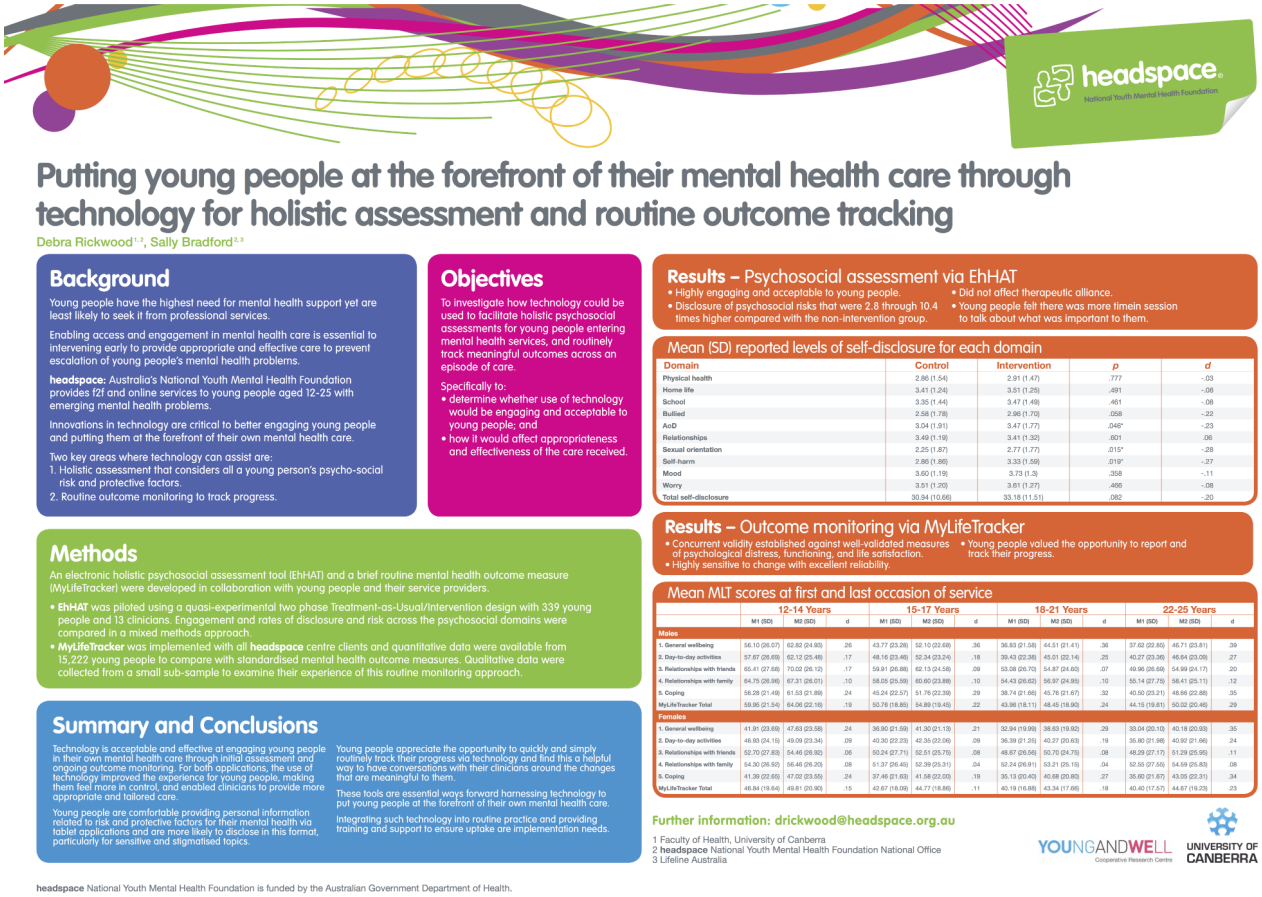
Figure 1. Poster.



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Poster

Mobile Apps for Behavioral Health: A Survey on User Engagement

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Abstract

Background: The number of mobile app interventions for behavioral health has grown exponentially over the last decade. A recent study by the IMS Institute for Healthcare Informatics found that health and wellness apps available to consumers more than doubled between 2013 and 2015, from 43,000 to over 90,000. Despite their availability, mobile app interventions are not yet offered or encouraged routinely in behavioral health treatment planning. One possible reason for minimal implementation is limited knowledge of patient preferences regarding use of these interventions.

Objective: The current study seeks to increase knowledge in three key areas related to mobile app interventions designed specifically to address a key area of behavioral health: depression and/or anxiety. Depression and/or anxiety were selected as the focus for this project given that these mental health disorders affect over a quarter of the US population and are highly comorbid. Key research questions include (1) What are the demographics of patients who are most interested in using mobile app interventions for depression and/or anxiety? and (2) What are the reasons patients endorse for disinterest in mobile app interventions for depression and/or anxiety?

Methods: Potential participants were identified at random from a list of veterans diagnosed with a mood and/or anxiety disorder (per the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition) who attended a primary care appointment during 2014 at a Veterans Affairs Medical Center located in a major metropolitan area of the northeastern United States. A total of 400 potential participants are being mailed a brief (15 minute) survey. A modified Dillman method is being used in which a prenotification letter is mailed out to participants, followed by the survey with an opt-out form, followed by up to two additional mailings for those potential participants who do not respond.

Results: Data collection is expected to be complete in late August of 2016. The poster proposed here will include findings from descriptive analyses on use of technology (smart phones, mobile apps in general, mobile apps for any behavioral health concern, and mobile apps for depression and/or anxiety) in different demographics. Additionally, descriptive data on reasons endorsed for low willingness to use mobile app interventions for depression and/or anxiety (when recommended by a health care provider as well as when accessed independently) will be presented. Finally, findings from analyses evaluating the relationship between demographic variables (race, gender, education, age, and symptom severity) and level of interest in mobile app interventions for depression and/or anxiety will be presented.

Conclusions: The target audience for mobile app interventions for depression and/or anxiety and reasons patients may choose not to use these interventions will be identified. Limitations include using a veteran-only sample and focusing exclusively on interventions for depression and anxiety rather than other areas of behavioral health. Future research should seek to build upon findings by broadening the scope of investigation to civilians and other areas of behavior change. Findings from this study can inform healthcare providers and app developers on patient preferences regarding mobile app interventions.

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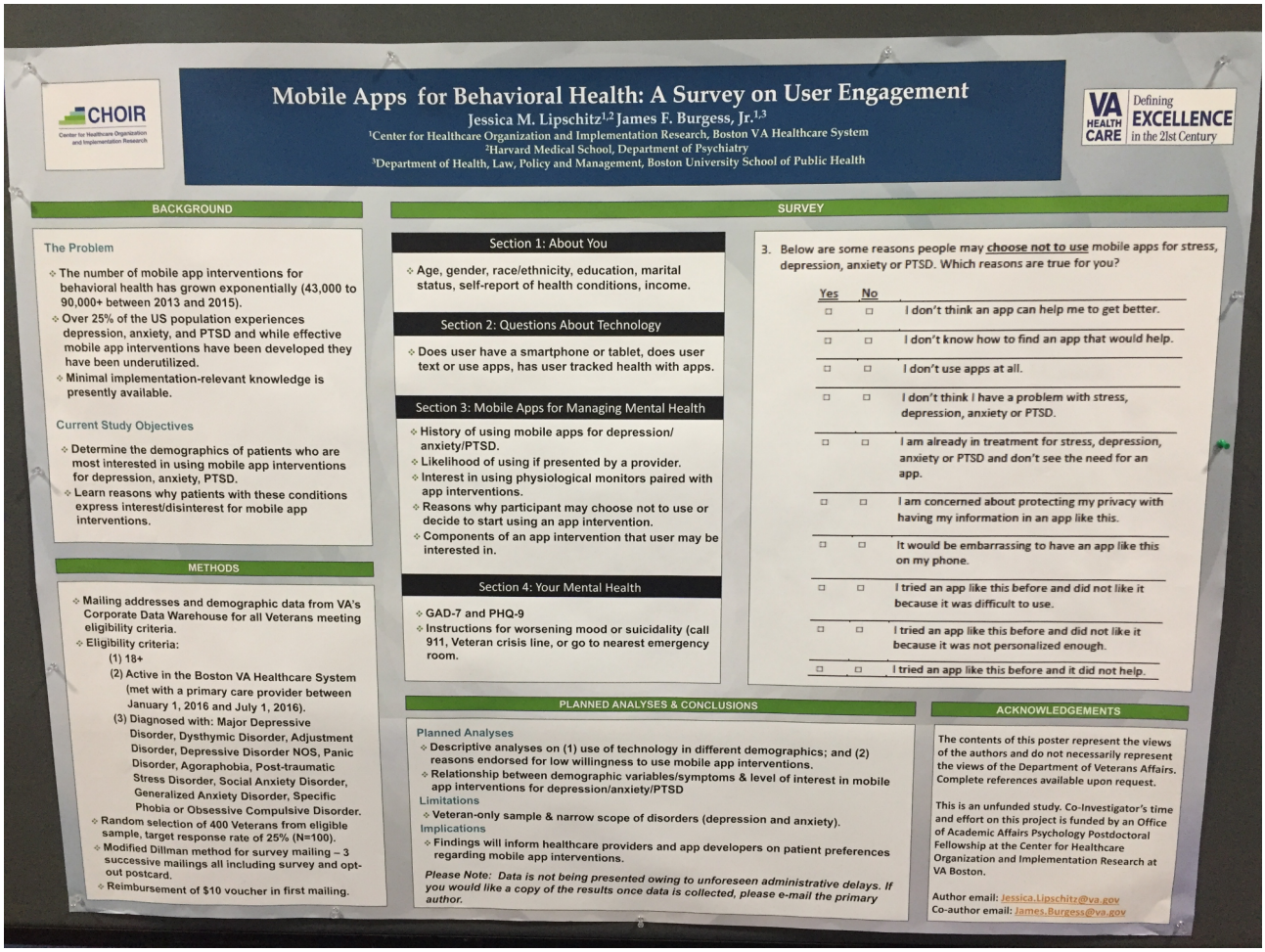
KEYWORDS

behavioral health; depression; anxiety; mobile apps; health interventions; mHealth

This poster was presented at the Connected Health Symposium 2016, October 20-21, Boston, MA, United States. A photo of the poster is displayed as an image in Figure 1 and as a higher resolution image in Multimedia Appendix 1.

Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Searching for Infertility Information Online: Differences Between Men and Women

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Abstract

Background: The Internet is an easily accessible source of medical information. People with stigmatized illnesses such as infertility often prefer to search for health-related information on the Internet; this is particularly true of men, who are in general less likely than women to seek help for medical problems and ask fewer questions and receive less information from health care providers. There has been limited research on the extent to which online resources are geared toward the information needs of men and women.

Objective: Differences between men and women in Internet searches about issues related to infertility and its treatment were examined, using data from an online survey of male and female fertility patients.

Methods: Patients seeking fertility care at four fertility clinics in Montreal and Toronto, Canada, were invited to participate in an anonymous online survey. Inclusion criteria included age 18 or over and the ability to answer survey questions in either English or French. Participants completed the survey either on an iPad at the time of recruitment or via a secure link, which was emailed to them. The survey included questions about whether the respondent had searched online for information about infertility, and which of a range of topics had been the subjects of an Internet search. Chi-square analysis was used to evaluate differences between male and female respondents.

Results: A total of 549 people, including 245 men (44.6%) and 304 women (55.4%), completed the survey. The average age of the participants was 36.5 years (SD=5.51). Time in treatment varied from first consultation to over 5 years of treatment. Most participants (87.9%) had searched the Internet for information about infertility, with women significantly more likely to report that they had done so (93.7% of women vs 80.3% of men, $P<.001$). Men and women were equally likely to search for information about causes of infertility, diagnostic tests, their own diagnosis, treatment options, and success rates. However, more women than men searched the scientific literature on infertility (88.4% vs 78.7%, $P=.005$), sought information about their own doctor (69.6% vs 49.2%, $P<.001$) as well as other fertility clinics (71.3% vs 56.5%, $P=.001$), and used the Internet to learn about the experience of other people with infertility concerns (70.7% vs 52.3%, $P<.001$).

Conclusions: The majority of fertility patients consulted the Internet for information. Previous research has indicated that women tend to see themselves as primarily responsible for obtaining information about infertility and its treatment. The results of the present study suggest that they use the Internet more than men to find such information, particularly as it pertains to treatment providers. Women may also be more inclined than men to seek social support via the Internet. Further study is required to determine whether male fertility patients have particular concerns and whether these are adequately addressed by available online resources.

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KEYWORDS

infertility; Internet search; gender differences

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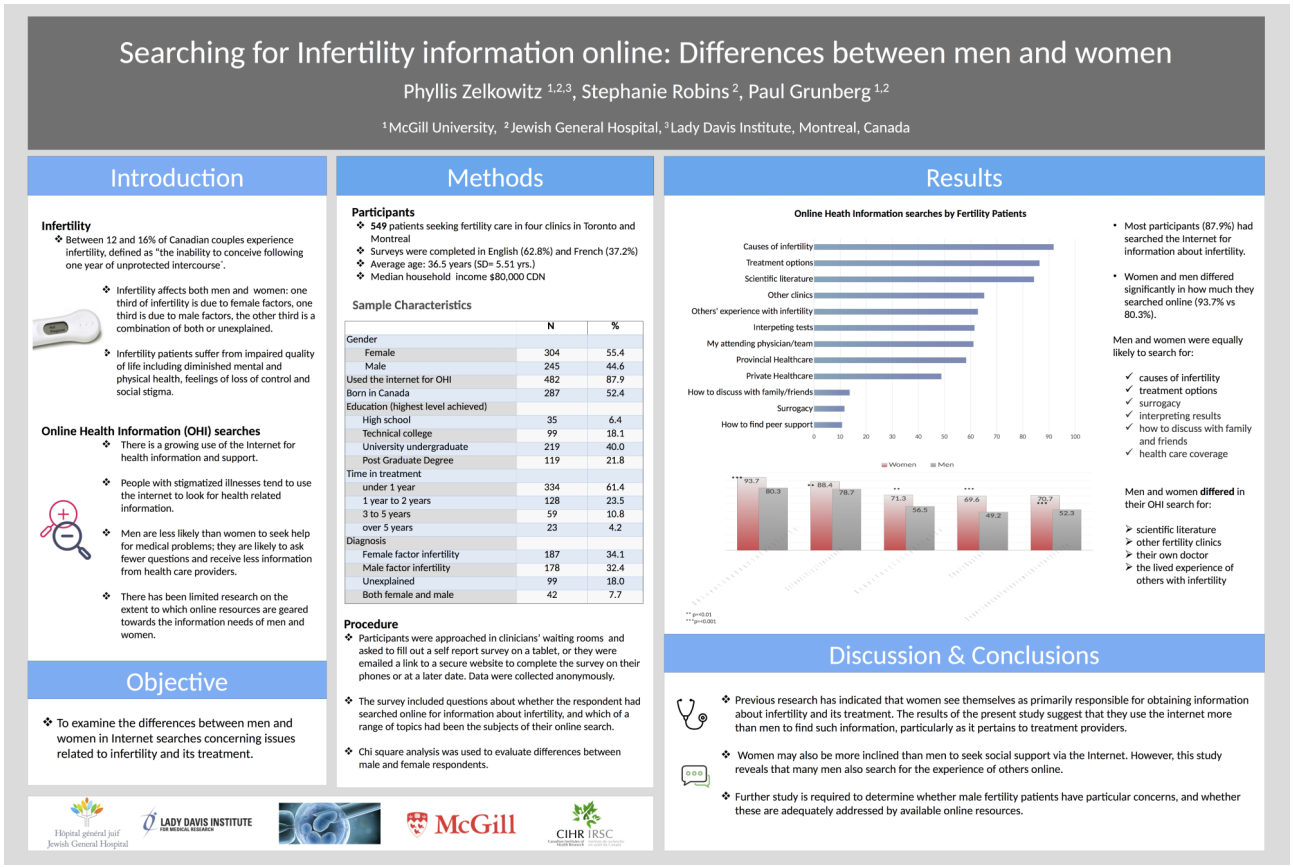
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Abstract

Developing and Implementing an Electronic Patient-Reported Outcomes Measurement Using REDCap in Usual Care Psychiatric Settings

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Abstract

Background: Finding ways to feasibly and cost-efficiently measure patient-reported outcomes in psychiatric routine care settings is critical to facilitate patient engagement in care, improve patient outcomes, and assess the performance of our treatment programs. McLean Hospital is a free-standing psychiatric hospital that is part of the Partners HealthCare network and offers a full continuum of psychiatric care (inpatient, residential, partial hospital, and outpatient services) located on multiple campuses. We began an electronic patient-reported outcomes measurement program, the Clinical Measurement Initiative (CMI), in November 2010.

Objective: To describe qualitatively and quantitatively the build and implementation experience of the McLean CMI program.

Methods: The CMI aims to inform individual patient care, assist with quality assessment of clinical programs, and facilitate clinical research. On admission, discharge, and interim points, patients complete computerized self-assessments of validated clinical measures. The CMI uses Research Electronic Database Capture (REDCap), a free (but not open-source) secure Web application for building and managing online surveys. We designed a custom reporting module for individual patient reports to be available immediately at the point of care and an online aggregate reporting tool for clinical teams to track survey completion rates and outcomes. Clinical teams work closely with the CMI team to develop their CMI program/survey tools but receive no additional resources to accomplish survey administrations. We calculated descriptive statistics of admission and discharge survey administration and developed qualitative information about implementation "lessons learned" based on discussions with clinical teams that have implemented the CMI as part of the ongoing evaluation and monitoring of the program.

Results: Over 20 programs representing 11 clinical psychiatric subpopulations have implemented the CMI to date; over 9000 episodes of care have been completed. Two programs (inpatient units) were unable to sustain the CMI in a way they found useful for clinical care and discontinued. Across active programs, 92% of admissions had admission assessments completed within 3 days of admission; 61% of discharges included a survey administration within 3 days of discharge. Clinical programs varied in the ability to successfully implement and sustain the CMI (eg, 69% of active CMI programs had >70% of admissions with admission surveys completed; over half accomplished >90% of admission surveys). Having at least one clinical champion at each program was a key driver for successful implementation. Champions served several needs: problem-solving successful new workflows, generating team enthusiasm, and setting team expectations for the importance of integrating the CMI information into clinical care. Teams that integrated the CMI into their clinical care with patients were also more successful in sustaining the CMI program.

Conclusions: Achieving electronic patient reported outcomes measurement in intensive treatment psychiatric settings using REDCap and custom reporting tools is feasible but more easily accomplished in residential and partial hospital levels of care (compared to inpatient), where patient acuity is high but less severe and lengths of stay are longer. Clinical champions play critical

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roles in successful implementation and maintenance of electronic patient reported outcomes measurement and can be successful independent of program level of care or patient acuity.

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KEYWORDS

medical informatics; electronic patient reported outcomes

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Poster

Technology and Dynamic Pathways: How to Improve Nursing Care, Documentation, and Efficiency

Yuri Ostrovsky[1*], AB, PhD; Terry Mahan Buttaro[2*], AGPCNP-BC, FAANP, DPNAP, PhD; Julie Diamond[1], BSc; John Hayes[1], BSEE

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Abstract

Background: Approximately 60% of adverse events in skilled nursing facilities are likely preventable. This provides an opportunity to improve care and decrease costs for ill, and especially aged, patients. The primary line of defense against adverse events in these facilities are the nurses caring for these patients each day. Nurses are responsible for recognizing early warning signs of illness and preventing falls and other complications. The care of patients with multiple comorbidities requires nurses to attend to an often overwhelming set of interacting details.

Objective: Our goal is to operationalize standards of care that can be implemented by nursing staff at skilled nursing and long-term care facilities in a manner complementing their natural workflow and facilitating patient interaction and shift documentation. To improve point of care patient management, nurses require a mobile solution that can guide their patient care unobtrusively.

Methods: Nurses at a Boston-area 100-bed skilled nursing/long-term care facility used our solution consisting of an app on a mobile device together with a Web-based administration and reporting system. Our custom software running on an iPod Touch device implements an adaptive methodology for succinctly guiding nurses through a systematic review of systems, a physical exam, a fall risk protocol, and other assessments suitable to their roles in the nursing facility. Dynamically created checklists that prescribe appropriate and immediate nursing interventions are automatically presented to the nurses following each assessment based on the data collected. The software utilizes behavioral “nudges” to nurse-users to minimize errors and improve speed of data entry. Additionally, a custom content creation system allows for high-level abstraction of protocol logic, enabling real-time improvement and customization of complex protocol algorithms without the need for error-prone software programming. These methods facilitate automated reporting that aids the structured thought processes of providers and caregivers.

Results: Pilot results were acquired using qualitative surveys and free-form interviews. Nurses reported a high facility after only an initial 15-minute training session. All nurses confirmed that having access to an efficient and mobile care facilitation device improved the likelihood of identifying patient complications. They also felt that a mobile documentation system lowered error rates by encouraging real-time documentation. Furthermore, systematic data gathering provided an improved level of documentation both in terms of comprehensiveness and clarity. Nurses claimed the system increased efficiency and lowered the overall time required for combined patient assessment and documentation. Most importantly, staff satisfaction was highly positive, encouraging continued usage of the intervention.

Conclusions: Technological interventions at skilled nursing facilities, when implemented to address the point-of-care needs of nursing personnel, can positively impact quality improvement goals, empower nursing staff, and improve patient care. The suite of tools developed here enables the operationalization of standards of care with sufficient comprehensiveness to address a sufficient portion of the complexity faced in daily nursing duties. We conclude that access to real-time protocols has a highly beneficial effect on nursing care.

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KEYWORDS

medical informatics; mHealth; nursing; standard of care

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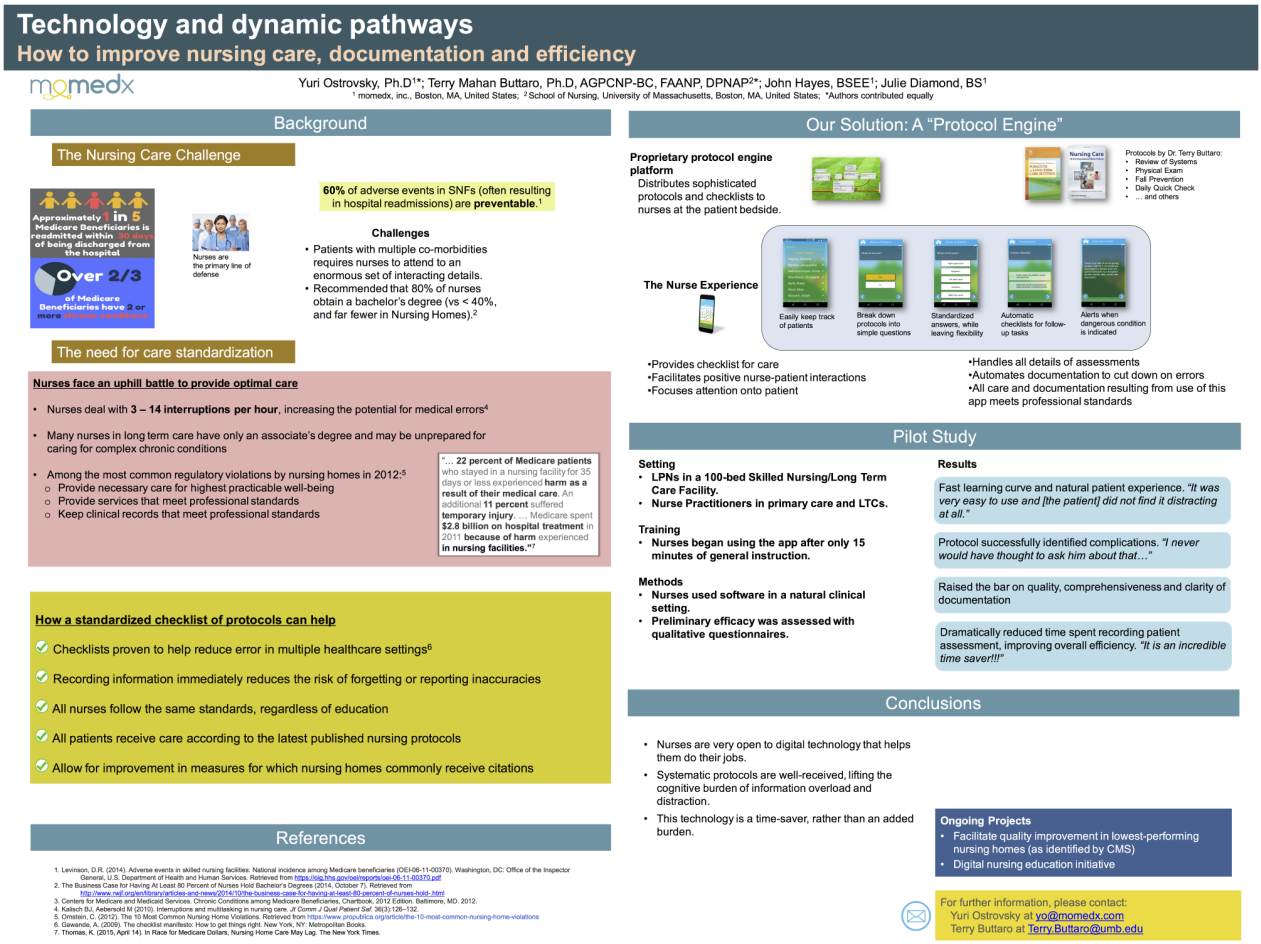
Figure 1. Poster.



Multimedia Appendix 1

Poster.

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Poster

Toward Expert Systems in Mental Health Assessment: A Computational Approach to the Face and Voice in Dyadic Patient-Doctor Interactions

Justin T Baker[1,2], MD, PhD; Luciana Pennant[1]; Tadas Baltrušaitis[3], PhD; Supriya Vijay[3]; Elizabeth S Liebson[1,2], MD; Dost Ongur[1,2], MD, PhD; Louis-Philippe Morency[3], PhD

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Abstract

Background: Computational approaches to measure naturalistic behavior in clinical settings could provide an objective backstop for mental health assessment and disease monitoring, both of which are costly and unreliable using traditional methods.

Objective: The objective of this pilot study was to determine which parts of the mental status exam could be reliably predicted by a combination of facial and vocal features extracted from a recorded interview using a combination of computer-assisted methods, in order to assess feasibility of our approach to quantify behavior for a longitudinal study of patients receiving psychiatric treatment.

Methods: A total of 18 patients carrying diagnoses of schizophrenia, bipolar disorder, and related conditions were recruited from an inpatient psychiatric unit and participated in a total of 24 semi-structured interviews lasting 5-15 minutes (modeled after clinical rounds). Synchronized audio and video data were acquired from both patient and doctor during each encounter using 1080p webcams focused on the face and upper torso and cardioid headset microphones. Standardized psychiatric symptom scales was obtained after each recorded interview. Behavioral features, including facial action units (AUs), gaze, and speech characteristics (eg, prosody, pitch, tone, texture) were computed automatically using in-house and publicly available software. To predict clinical scales we trained a linear kernel support vector regressor (SVR) using features from both the entire session (ie, global mean) and each experimental epoch (eg, means during time spent alone and each individual question), leading to 15 predictors for each clinical scale item and scale totals. We used leave-one-out validation on the training data (maximizing the Pearson correlation coefficient) to determine the C parameter for the SVR models; for testing, we used leave-one-subject-out cross-validation (ie, leaving 17 participants for training/validation in each fold).

Results: Providing evidence of our approach's ability to capture and quantify relevant signal that confirms or verifies clearly visible psychopathology, we found that parameters such as brow furrowing (AU4, R=0.744) and eye widening (AU5, R=–0.601) were correlated with depression measures on the BPRS. In many cases, these effects were specific to the question or experimental epoch. For instance, unusual thought content was most evident in increased frequency of brow flashes (AU2, R=0.752) and greater smile variability (R=0.656) that occurred while participants were alone in the room. Individuals with higher ratings of delusions also showed increased brow flashes in response to a question about their self confidence (R=0.739). Many relationships showed a “dose effect” with midrange scores corresponding with moderate psychopathology.

Conclusions: Our experiments show that automatically detected facial action units and speech properties can be used to predict and quantify a number of psychiatric symptoms from multiple domains of psychopathology, including both mood and psychosis. We demonstrate the importance of analyzing behaviors in the appropriate context (ie, while participants are alone or prompted

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with a specific question) in order to optimally extract clinically relevant information from objective indices of behavior. Thus, quantitative assessment of behavior in naturalistic settings is both feasible and informative as an adjunct to traditional methods of mental status assessment.

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KEYWORDS

human interaction; facial expression; voice; depression; bipolar disorder; schizophrenia; patient-physician relationship

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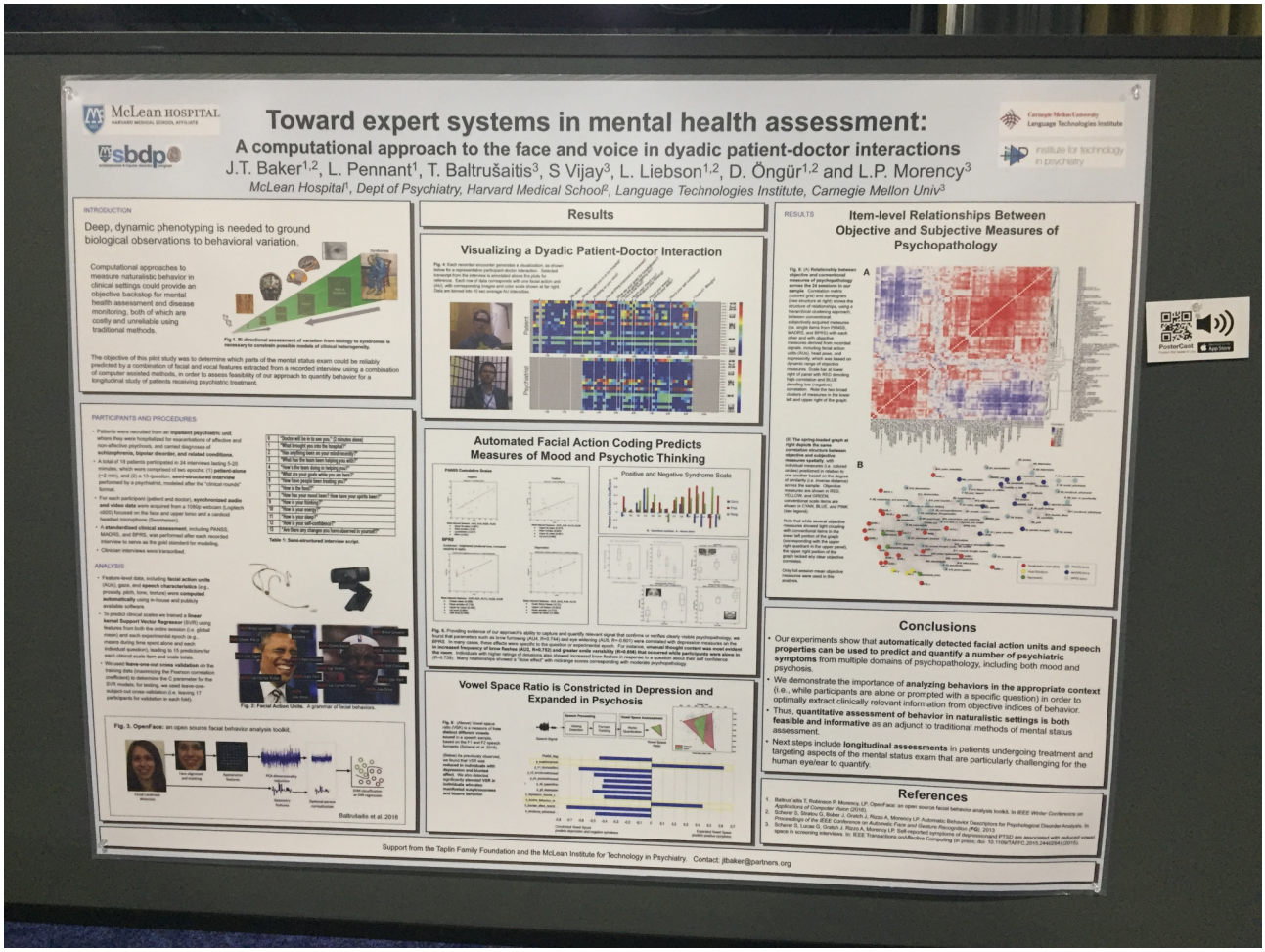
Figure 1. Poster.



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