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# The Bridge: A mobile application for burn patients

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## ABSTRACT

Global use of the internet has become commonplace, and smart phones have paved the way for technological mobility. Incorporation of smart phone technology has the potential to positively affect health outcomes through use of health-directed applications (apps), particularly for those patients living in medically underserved areas. The Bridge Mobile App for Burn Patients (fka: *HealthySteps*), is a pilot project that was developed to address the unique recovery needs of patients with major burn injuries who are being discharged from a regional burn center. App content was developed from three focus groups to explore and elucidate on stakeholders' understandings of the bio-psycho-social education and messages that they believed would improve short-term outcomes for newly discharged burn patients. The app will provide burn patients with accessible support 24h a day, seven days a week. Original recovery-stage appropriate bio-psycho-social content, instructional videos and links to burn-supportive web sites are delivered directly to patients' smart phones for the first 90 days following discharge. The primary goal for the Bridge App is to decrease unplanned hospital re-admissions, while supporting increased quality of life and resilience in short-term recovery. In addition, the Bridge Mobile App is designed to collect patient data reflecting pain, anxiety, mood, itching, medication compliance, social participation, self-efficacy and return to work on a password protected, HIPPA compliant, encrypted mainframe.

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## 1. Introduction

Global use of the internet has become commonplace, and smart phones have paved the way for technological mobility. Incorporation of smart phone technology has the potential to positively affect health outcomes through use of health-directed mobile applications (apps), particularly for those patients living in medically underserved areas. It is understood

that patients living in underserved areas such as rural communities and inner cities are found to have more chronic illnesses and shorter life expectancies than those who live in communities with higher socioeconomic levels and would, therefore, benefit from apps designed for specific health-related needs [1,2]. Burn patients are typically given extensive, specialized treatment and support while in the burn center and then are expected to continue that self-care upon returning home. Discharge instructions may be lost or forgotten in the excited anticipation of going home, furthermore, Home Health providers frequently lack experience in specialized burn care. This combination leaves patients and family caregivers in a vulnerable state and inadequate access

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to care may result in complications and unplanned hospital readmissions. In a study conducted by Weiss et al., 19.1% of patients who had required burn wound debridement/excision experienced unplanned hospital readmissions [3]. An app that educates, provides support, and collects data relative to patient recovery has the potential to provide additional guidance to post-discharge care, as well as decrease unplanned hospital readmissions [4].

The Bridge Mobile Application (App) for Burn Patients (fka: *HealthySteps*) is the first mobile app of its kind that is tailored specifically toward the early recuperative needs of post-discharge burn patients. App content was designed using qualitative data from three stakeholder focus groups and is intended to provide bio-psycho-social education and support for the first 90 days following discharge from a burn center. Our primary goal for this mobile app is to decrease complications that lead to unplanned hospital readmissions, as well as to improve patient quality of life and support resilience following discharge from a burn center. The burn app has the capacity to deliver instructional videos, bio-psycho-social information and positive cognitive-behavioral text messaging to burn patients' smart phones as they transition from hospital to home and their social/vocational roles. Because burn centers typically serve large catchment areas that include medically underserved communities, the mobile app provides a way to bridge specialized burn care between hospital and home.

### 1.1. Background

Based on a review of current literature, this type of mobile app has never, to our knowledge, been used with discharged burn patients. However, there are a number of apps for a variety of other medical conditions which have been shown to be effective. Researchers have found that app usage provides positive outcomes in behavior change for patients with diabetes, asthma, pregnancy, and smoking cessation [5–10]. In another study, researchers of a randomized controlled trial found that use of health-based messages through smart phones supported behavioral change, particularly while the intervention was in use [11]. In a recent systematic review, investigators found that within the 70 apps related to burns available in the Google Play and Apple App stores, only 12 were designed for individuals without medical backgrounds and none were designed for newly discharged burn patients [12].

The American Burn Association reports that more than 40,000 individuals are admitted to hospitals for burn injuries annually [13]. Discharge and follow-up can be difficult for patients returning to underserved and rural communities. While each patient who is discharged from a burn center has distinct needs, many discharge plans are similar and can be supplemented through the burn app. In addition, it is not feasible for burn team members to provide around-the-clock, extended support for the bio-psycho-social needs of discharged burn patients. There is a recognizable need for a post-discharge intervention that will support patients as they transition from burn center to home.

The Bridge Mobile App for Burn Patients is a pilot study that was developed to address the unique recovery needs of

patients with major burn injuries who are being discharged from a regional burn center and will be provide accessible support for patients 24h a day, seven days a week. The app delivers original, recovery-stage appropriate bio-psycho-social content to patients' smart phones for the first 90 days following discharge. The Bridge Mobile App is a digital platform on which patients have access to instructional videos for behavioral reinforcement that will facilitate healing. These videos include demonstrations of hand hygiene, wound care, dressing changes, and range of motion exercises for all regions of the body. Additionally, the Bridge App delivers educational messages that support wound care and rehabilitation, as well as positive cognitive-behavioral messages that promote the emotional and social well-being of patients during the burn recovery process. A patient who was just discharged from the hospital has needs that are different than a patient who has been home for 2 months. The Bridge App is designed to deliver messages that meet the expected stage of bio-psycho-social healing based on time since discharge as well as phone numbers and web links to additional burn supportive resources and crisis hotlines.

In addition to delivery of content to patients, the Bridge Mobile App was designed to collect patient data through online "surveys" that inquire about pain, anxiety, mood, itching, medication compliance, social participation, self-efficacy and return to work (Figs. 1 and 2). At the end of the 90-day period of the intervention, surveys will be delivered including The Burn Specific Health Scale-B, The Connor-Davidson Resilience Scale and the CAGE-AID scale for substance abuse [14–16].

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## 2. Methodology

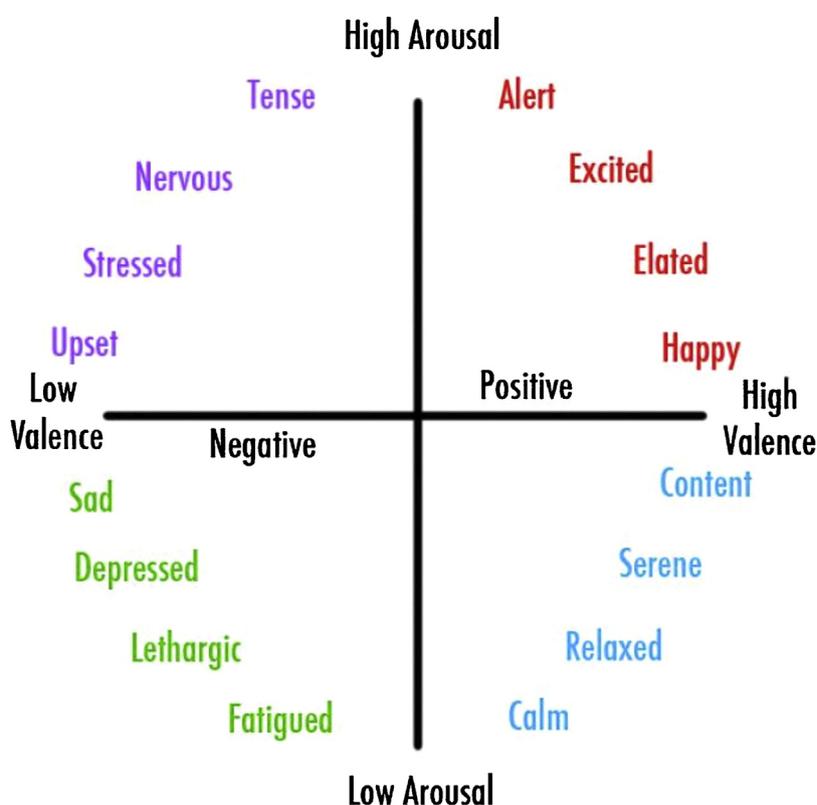
This study utilized qualitative inquiry to explore and elucidate on stakeholders' understandings of the bio-psycho-social education and messages that would be important for newly discharged burn patients to improve short-term outcomes. Research approval for the initial phase of mobile app development was granted by the primary investigator's Institutional Review Board. Funding for the mobile app prototype was provided by the Regional Burn Center's Hospital Foundation and additional funding for the Bridge Mobile App was awarded through the primary investigators' institution and research foundation.

### 2.1. Study setting

Focus groups were conducted in the conference rooms adjacent to the regional burn center and the Department of Plastic Surgery. The institution's burn center serves a primarily rural, medically underserved catchment area.

### 2.2. Participant sampling

Historically, focus groups were used as a marketing tool to gather information about customers' likes and dislikes. More recently, focus groups have been used in public health program development and evaluation to identify group-specific characteristics believed to influence population health and to discover the means to communicate health information with recipients more effectively. Focus groups



**Fig. 1 – App participants will be asked to complete daily inquiries pertaining to mood, in addition to other data points.**

have been used successfully when programming is aimed to change current health-behaviors and to identify unique needs of target populations that are influenced by factors such as culture, resource availability, goals, fears, and other psychosocial characteristics that may influence learning, motivation and behavior [17]. There are four essential phases in qualitative research design when using focus groups: formatting the group interview, observation, analysis and reporting [18]. Each group typically consists of between six and eight participants and continues until the group feels they have satisfactorily answered the interview questions [19]. Prompts are routinely used to elicit greater depth of dialog or to stimulate participant conversations.

### 2.3. Participant recruitment

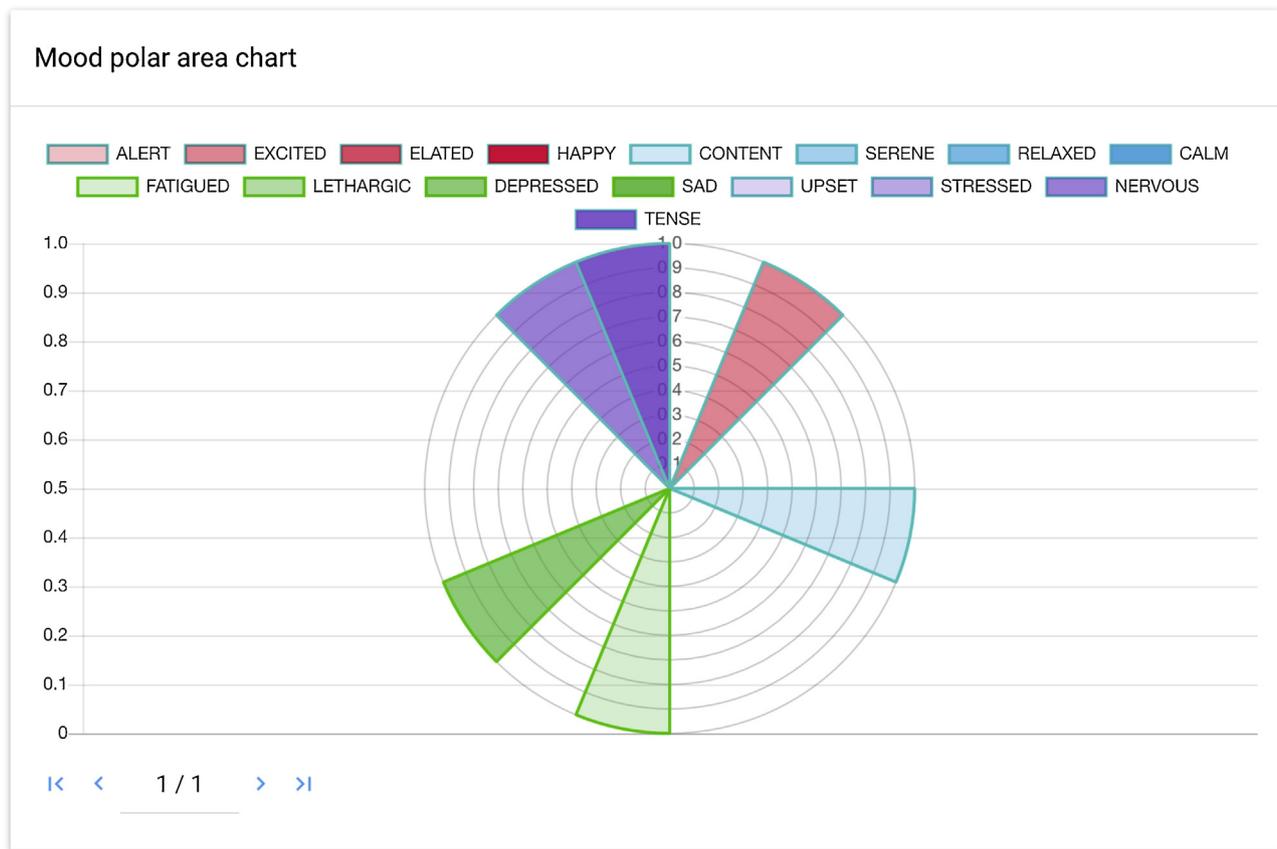
Purposive sampling was employed to identify and recruit key informants based on their meeting study criteria, availability and consent for participation [20]. Sign-up sheets explaining the purpose of the research were posted on plastic surgery attending physicians and surgical residents' office doors and another on the Burn Center Break Room in August of 2014. An informational sheet was distributed during the October 2014 burn survivors' group meeting inviting attendees to participate in the study by coming to the November 2014 support group meeting 90min early. Participants were offered a one-time compensation payment of \$25 for their time spent in the focus groups.

Each of the three homogenous focus group audio recorded sessions consisted of five to eight adult

participants as recommended for focus group discussions [21]. Focus group #1 consisted of five burn nurses; focus group #2 consisted of two attending plastic surgeons and six plastic surgery residents; focus group #3 consisted of eight, adult burn survivors from the burn center's support group. Each semi-structured focus group met one time between September and November of 2014. Focus groups were facilitated by the primary investigator and each session ran between 60 and 90min. Participants in all three focus groups were asked:

1. Are there any events or scenarios with newly discharged burn patients, during the first three months, that you believe could be avoided or diminished if patients had a form of support when returning home.
2. What types of strength based messages do you believe would be helpful during the initial phase of recovery/adaptation?
3. What types of videos do you think would be helpful to support wound healing and psychosocial recovery during the first three months following discharge.
4. What information would you like to deliver to discharged burn patients who live long distances from our burn clinic.
5. What type of information would you like to receive from discharged burn patients (i.e. Scales for mood, anxiety, compliance with exercise regime, appetite).

Minimal prompts were utilized to encourage participants' conversational dialog. Audio recordings were transcribed verbatim and narratives were analyzed for themes that



**Fig. 2 – App tracks patients’ daily mood log and displays chart to patient indicate progress. Data is time stamped for multiple daily mood scores.**

participants believed to be important for early burn patient recovery. Hand-written notes were taken by the interviewer to document contextual data reflecting group social processes.

### 3. Results

#### 3.1. Data analysis

Content analysis of qualitative data was conducted to identify problem areas and potentials for distance support that would benefit burn patients in the first 90 days following discharge from a regional burn center. Practise theory was utilized to guide data analysis, recognizing the interconnectedness between bodily movement, mental activities, and background knowledge that took the form of understanding, emotional states and motivational knowledge [22].

Data reflected multiple themes believed to impact short-term patient outcomes, including: hand hygiene, wound care; exercise to improve range of motion; proper nutrition; medication management; self-image; self-efficacy; goal setting/attainment; social re-integration; return to work/productive activity. App content was organized to reinforce these aspects of recovery through use of videos, educational and positive cognitive behavioral texts, prompts for goal setting and links to other burn-supportive organizations.

#### 3.2. App content

Access to the burn app will begin when user downloads the app prior to discharge and will continue for 90-days after discharge or when the app is deleted from patient’s smart phone. The primary goal of the burn app is to decrease unplanned hospital readmissions, with secondary goals of improved quality of life and resilience. Text messages and original educational videos are designed to encourage appropriate medication management, recommended wound care, improved range of motion, positive coping strategies, improved self-efficacy, prompt individual goal setting, proper nutrition, encouragement for social reintegration and steps leading to return to work. The Bridge App will be available for both Apple and Android smart phone devices.

The Bridge App is a health-based communication platform that was designed to deliver detailed post-discharge instructions right to the mobile phones of patients in English and non-English text messages. The burn app has been evaluated by the FDA and found to be an educational tool and does not qualify as a medical device. The app is password protected with access restricted by individual user names and passwords. The app is HIPPA compliant by using 256-bit SSL encryption to protect patient data. Each day, users receive a prompt that is delivered to their smart phones stating, “Hello. You have a message waiting for you on the Bridge, please log in.” The introductory text increases users’ privacy.

The Bridge burn app delivers positive bio-psycho-social text messages to increase knowledge about burn recovery and support psycho-social functioning following discharge from a burn center. Tailored text messages are serially timed to address changing health needs based on users' level of burn recuperation. Digital messages will be date and time stamped to reflect participant exposure to the intervention. Each time users log in, they will be asked to rate their pain, mood, itch, and anxiety (Figs. 1 and 2). Data will be collected and scrubbed for future use. The burn resource library features original 30 second to three minute videos depicting proper wound care, hand hygiene, dressing applications for each zone of the body, and exercises that promote full-body range of motion.

#### 4. Discussion

Mobile/smart phone applications have the ability to connect underserved community residents with outreach and health information through a powerful mechanism, regardless of geographical location [4]. The Food and Drug Administration (FDA) predicted that over the next several years, there will be over 500 million users of mobile medical applications [23]. Since more than 80% of Americans have mobile phones and up to half of American adults have at least one chronic medical condition "mHealth" technology, or the use of mobile devices has potential to improve outcomes in medical care [24].

Mobile technology is currently being utilized by the Veterans Administration (VA) to provide e-health linkages that increase availability and accessibility of services for consumers [9]. In a recent initiative, the VA demonstrated the practicability of using text messaging to monitor home exercise adherence in physically inactive older adults [25]. The Bridge App will be a valuable tool for burned soldiers, veterans and patients living in medically underserved, isolated communities or "priority populations" (briefing for U.S. Department of Health and Human Services by the University of Chicago) [5]. Priority populations have documented health disparities and are at increased risk as they return to their communities.

There are potential barriers to successful use of the Bridge Mobile App. One barrier could be lack of access to a smart phone, however there are currently supportive services available to secure a mobile phone device for consumers with demonstration of need (<https://www.safelinkwireless.com/Enrollment/Safelink/en/NewPublic/index.html>). Another potential barrier is that users must have access to phone service and/or data packages in order to fully utilize the burn app. Coverage can be inconsistent in rural and mountainous areas, especially on mobile networks. Most hospitals provide free internet access for patients and visitors so that the app can be installed and ready for use when used in internet accessible locations. Further research on amplification of cell service would be warranted.

There is tremendous room for growth with the Bridge Mobile App. One area for future research would be to institute an interactive component to the technology to create a bi-directional mode of communication or a more personal coaching approach [26]. These exchanges could then be integrated with the burn center's electronic medical records

(EMR's). Another area for potential expansion of the app is in smart watches that track vital signs, such as heart rate, calories and steps with text reminders that could be integrated with smart phone monitoring capabilities.

Limitations to this mobile app content are directly related to participants who volunteered to contribute to the focus groups in that we did not have Nutrition or PT/OT professionals volunteer for the focus groups. Nor did we have volunteers from any of the other medical services who also provide care for burn patients. We have supplemented the next phase of the Bridge App by including nutrition information and range of motion exercise videos will be performed under the guidance of our institution's PT/OT specialist.

#### 5. Conclusion

To survive initial launch into the "marketplace," mobile health products must show strong evidence of intervention exposure, clinical outcomes, usability/workflow, security, scalability, and economic value (<https://www.mddionline.com/how-develop-mobile-health-apps-built-last>). Phase 2 of the Bridge Mobile App for Burn Patients is in its developmental stage and is expected to be field tested and piloted in summer of 2018. Given that improved outcomes have been demonstrated for patients with diabetes, hypertension, asthma, pregnancy, and smoking, the Bridge Mobile App is expected to become a typical adjunct to discharge plans for these patients [27,28,5-11].

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