Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

Conceptualizing smartphone use in outpatient wound assessment: patients' and caregivers' willingness to use technology

*Jason T. Wiseman, MD, Sara Fernandes-Taylor, PhD, Maggie L. Barnes, BA, Adela Tomsejova, R. Scott Saunders, MD, and K. Craig Kent, MD**

Wisconsin Surgical Outcomes Research Program (WiSOR), Department of Surgery, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin

ARTICLE INFO

Article history:
Received 11 February 2015
Received in revised form
5 May 2015
Accepted 7 May 2015
Available online 14 May 2015

Keywords:
Telehealth
Telemedicine
Remote technology
mHealth
Transitions in care
Wound care

ABSTRACT

Background: Information technology is transforming health care communication. Using smartphones to remotely monitor incisional wounds via digital photos as well as collect postoperative symptom information has the potential to improve patient outcomes and transitional care. We surveyed a vulnerable patient population to evaluate smartphone capability and willingness to adopt this technology.

Methods: We surveyed 53 patients over a 9-mo period on the vascular surgery service at a tertiary care institution. Descriptive statistics were calculated to describe survey item response.

Results: A total of 94% of recruited patients (50 of 53) participated. The cohort was 50% female, and the mean age was age 70 y (range: 41–87). The majority of patients owned cell phones (80%) and 23% of these cell phones were smartphones. Ninety percent of patients had a friend or family member that could help take and send photos with a smartphone. Ninety-two percent of patients reported they would be willing to take a digital photo of their wound via a smartphone (68% daily, 22% every other day, 2% less than every other day, and 8% not at all). All patients reported they would be willing to answer questions related to their health via a smartphone. Patients identified several potential difficulties with regard to adopting a smartphone wound-monitoring protocol including logistics related to taking photos, health-related questions, and coordination with caretakers.

Conclusions: Our survey demonstrates that an older patient cohort with significant co-morbidity is able and willing to adopt a smartphone-based postoperative monitoring program. Patient training and caregiver participation will be essential to the success of this intervention.

* *Corresponding author*. Department of Surgery, University of Wisconsin School of Medicine and Public Health, 600 Highland Avenue, Madison, WI 53792 7375. Tel.: +1 608 265 8854; fax: +1 608 265 5963.
E-mail address: Kent@surgery.wisc.edu (K.C. Kent).

0022-4804/$ – see front matter © 2015 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jss.2015.05.011

1. Introduction

The use of telemedicine applications for remote diagnosis and treatment of various health problems is expanding, but implementation of these techniques for transitional care remains relatively limited owing to (1) system and organizational barriers as well as (2) human factors, including patient and doctor engagement [1]. Notwithstanding, interest in telemedicine is growing, primarily because of its potential to address longstanding issues within the health care system including facilitation of patient-provider communication, patient self-management, and the coordination of care across settings [1].

Postdischarge surveillance of surgical site infection (SSI) and other wound complications is an area of surgical care that stands to benefit from the potential of telemedicine. SSI is the most common nosocomial infection in surgical patients and accounts for 38% of postoperative complications [2,3]. SSI can lead to reoperation, limb loss, or death [4,5], dramatically increasing health care costs [6,7]. Furthermore, these complications are the leading cause of unplanned, potentially preventable hospital readmissions for surgical patients [2,4,8,9].

A large proportion of severe wound complications develop after hospital discharge [2]. This is in part due to shorter lengths of hospitalization but also because patients rarely recognize the early stages of a wound infection [10,11]. This absence in clinician monitoring after hospital discharge reveals the potential for a transitional care photo-based telemedicine application. The information contained within a digital wound image may allow diagnose at an early stage, when an SSI can be treated in the outpatient setting with oral antibiotics and wound care, potentially precluding the need for readmission, intravenous antibiotics, and reintervention.

Technologies for wound analysis in the inpatient setting have proven feasible and reliable; interpretation of digital images taken by a photographer of postoperative wounds have been shown to be equivalent to physical examination for determining wound complications [12–15]. However, in contrast to clinician-based inpatient protocols, patient- and caregiver-based outpatient digital wound monitoring protocols for SSI is still an unexplored area and thus patients' understanding and willingness to use relevant technologies in the postoperative period is poorly understood. This is particularly true for the older surgical patient with multiple comorbidities.

In this study, we explore human factors in the context of system and organizational barriers to determine the feasibility of a mobile health (mHealth [16]) smartphone-based intervention for wound monitoring to promote early recognition of wound complications after discharge (Fig. 1). We surveyed vascular surgery inpatients at a tertiary care center and evaluated smartphone ownership, technological capability, and willingness to adopt new technology in a high-risk, elderly vascular population, for which barriers to adoption might be substantial and the role of caregivers is variable. We focus on vascular surgery because this population has the highest readmission rate among surgical specialties (i.e., approximately 24% in 30 d) [17], and the majority of these readmissions are for treatment of SSI [5,8].

2. Methods

A preliminary draft of the survey was developed and informed by a community-based research advisory focus group: Community Advisors on Research Design and Strategies (CARDS) [18]. CARDS are trained focus groups that advise researchers; they reflect the views of racial, ethnic, and socioeconomic groups rarely represented in research planning or activities. The CARDS input and feedback provided a "patient's perspective" that informed survey development. The preliminary set of survey questions were then reviewed by a multidisciplinary team of vascular surgery faculty, surgery residents, and health services researchers who provided a "professional perspective" (Fig. 2).

The University of Wisconsin Madison Health Sciences Institutional Review Board approved the finalized survey and associated protocol. The study was conducted from September 2013–May 2014 at the University of Wisconsin Hospitals and Clinics. The population of interest was vascular surgery in patients aged >18 y and not in the intensive care unit. Vascular surgery nurse practitioners identified and recruited eligible participants. The survey was administered to each participant in a private hospital room to ensure that

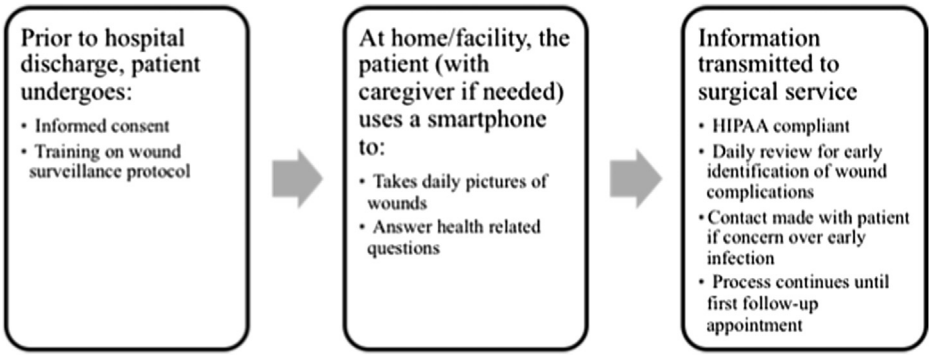

Fig. 1 – Conceptual model of mHealth smartphone-based intervention protocol for wound monitoring to promote early recognition of wound complications after discharge.