

NURSES' PERCEPTIONS, BARRIERS, AND PERCEIVED NEED FOR A
SMARTPHONE APPLICATION GUIDING WOUND CARE

by

Nicole Lorraine Cottom

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ABSTRACT

Living and working in a rural community has many advantages and disadvantages. One disadvantage is lack of resources and specialty in the medical field. One of these specialty fields lacking in countless rural areas is wound care. In the United States, approximately 6.5 million people develop chronic wounds annually. Economically, rural health care facilities are unable to send people for training and the limited number of people in rural areas with wounds would make it difficult for a wound expert to stay current in a rapidly changing field. However, inappropriate diagnosis and treatment of these wounds can be detrimental to the patient's life and be very expensive for the healthcare system.

The development of a smartphone application guiding wound management using telehealth is in progress. This easy to use software application on a smartphone would enable rural facilities to have immediate, secure access to wound experts for help with diagnosis, treatment, management, appropriate dressings, and suggestion for the need to perform additional physiologic testing.

This smartphone application will only be useful if healthcare staff are willing to use it. This research evaluated nurses' perceptions, barriers, and perceived need for this advancing technology. If these barriers and perceptions can be overcome, staff may be more willing to use this tool to provide the best quality wound care to their patients.

CHAPTER 1

RESEARCH PROBLEM

Introduction

Wounds are a burden medically and economically to both the healthcare system and to the individual who develops one (Harding, Morris, & Patel, 2002). Due to the high cost of training and the low number of patients living in rural areas with wounds, it is not economically feasible for health care facilities to send staff to receive formal wound care training. This leads to a disparity in wound management between urban and rural areas. Lack of trained wound care providers makes evidence based wound care difficult in rural areas. A wound that is inappropriately diagnosed and therefore inappropriately treated can be detrimental to not only the patient's health, but to their life. It can also cause increased expense to the patient and the healthcare system. In order to receive appropriate care, many patients living in rural areas who develop a wound will have to frequently travel or temporarily be moved to an urban location for wound care (Zulkowski, 2012).

An easy to use, smartphone application would enable rural healthcare providers to have immediate access to evidence based wound care guidelines, to wound experts, and reference for suggestion on the need for additional physiologic testing. A smartphone application would also provide a mechanism for documentation of each wound's characteristics. This would lead to a broader spectrum of expert services available to rural patients in their local town or facility (Zulkowski, 2012). The development of such

smartphone application was recently placed on the market (K. Zulkowski, personal communication, February 13, 2014).

Problem

Patients living in rural areas requiring wound care often are required to frequently travel long distances or temporarily relocate to be treated appropriately by a wound care specialist. Traveling is an inconvenience for the patient and adds to the overall cost of wound care in gas, lodging, food, and lost wages. The smartphone application would bring evidence based wound care to the patient's rural hometown clinic or hospital. With any new technological advancement, there is bound to be resistance. The smartphone application will only be useful and benefit rural patients if nurses are willing to overcome their perceived barriers and be open to using it.

Purpose

The purpose of this study was to examine nurses' perceptions, barriers, and perceived need for a smartphone application to guide wound care treatment in rural healthcare settings. The study focused on areas where this technology is perceived to be most useful and what barriers may stand in the way of it being used.

Research Questions

Four primary research questions were asked in this study: "What are nurses' experiences with the use of smartphone technology?". "What are nurses' experiences in providing wound care?". "What are nurses' perceived barriers to using a smartphone

application to guide wound care?”. Lastly, “In what areas of patient care do nurses see a need for a smartphone application to guide wound care?”.

Background

Rural Access to Care

There are many ways in which patients and the healthcare system suffer from improper wound care. These are often related to living in rural areas, lack of wound care education, and lack of resources. According to the 2010 census, 19.3% of the United States population lives in rural areas, yet these areas contain only 10% of the medical doctors in the country. In the state being studied, 44% of the population lives in rural areas (“2010 census”, 2013).

In most rural areas, specialized health care providers, such as wound care specialists, are not available. This results in the patient receiving improper wound care or having to travel to an urban area to receive appropriate care. In the state being studied, 54% of residents travel more than five miles to get to their doctor’s office, 13% travel more than 30 miles, and 7% travel more than 50 miles (“State & county”, 2012). To make patient’s lives more difficult, this state has minimal public transportation accessible to people in rural communities (Zulkowski, 2012). A smartphone application guiding wound care would allow rural patients to receive appropriate care without having to travel these long distances.

Prevalence of Wounds

In the United States, approximately 6.5 million people develop chronic wounds annually. In acute care, 72% of the patients found to have pressure ulcers were over the age of 65. Of hospitalized patients with pressure ulcers, over 50% go to a nursing home for further care. This is three times more than any other condition. Patients that develop pressure ulcers during a hospital stay have higher mortality (11.6%) compared to other conditions (2.6%). Appropriate care is also required for acute wounds such as surgical incisions, traumatic wounds, abrasions, and superficial burns. Among injury-related hospitalizations, up to 96.9% of patients had some form of open wound. The likelihood of having an acute wound that required home health care referral was significantly increased with age, diabetes, and obesity demonstrating that a significant number of acute wounds do not go on to resolve uneventfully and require skilled wound care (Sen, Gordillo, & Roy, 2009).

Cost of Wound Care

In the United States alone, wound care treatment costs approximately \$25 billion annually. In 2006, three-quarters of hospitalizations with pressure ulcer care were billed to Medicare compared to half of hospitalizations for all other conditions. Medicaid patients account for an additional 12.5% of hospitalizations with a pressure ulcer. This makes the government the biggest payer for pressure ulcer care. Pressure ulcers, diabetic foot ulcers, and vascular ulcers either venous or arterial, also add a significant cost to the health care system. In 2007, foot ulcer treatment cost between \$7,439 and \$20,622 per wound. There are 25.9 million Americans with diabetes. The direct and indirect cost of

complications associated with wound care is an astonishing \$174 billion each year. Many patients with diabetic related foot ulcers eventually undergo extremity amputations. Each amputation procedure costs approximately \$38,077. (Russo, Steiner, & Spector, 2008).

Wound care costs the healthcare system a great deal of money each year and patient costs for out of pocket expenses continues to rise. When there are long travel distances for care, this cost may become prohibitive.

Wound Care Education

Nurses and physicians, especially in rural areas, receive very little wound care education. Studies have been done to determine nurses' and physicians wound care knowledge. One study demonstrated physicians mean knowledge score on the Peiper Pressure Ulcer Knowledge Test was 69%, well below the score of the nurses' 76% on the same test. This study showed that physicians had great difficulty identifying suspected deep tissue injury and unstageable ulcers (Levine, Ayello, Zulkowski, & Fogel, 2005).

Registered nurses' knowledge has also been tested using the Pieper Pressure Ulcer Knowledge Test. When urban versus rural nurses' knowledge was examined, all scored at a "C" level. Certified wound care nurses scored 93%. Due to nurses' low scores, baccalaureate nursing programs content was examined. Multiple deficiencies in wound content were identified including types of dressing, peripheral vascular testing, and documentation (Zulkowski & Ayello, 2005). These findings support that the average nurse or physician may not accurately be able to identify and assess wounds, or then plan appropriate treatment.

Lack of Providers

Five million United States rural residents live in designated provider shortage areas. Few specialists are available in rural areas with rural areas having half the number of surgeons and other specialists compared to urban areas per capita. There are only 18 American Academy of Wound Management certified wound care specialists in this western rural state and all but one are located in the larger cities. The small number of wounds and rapidly changing treatment and dressing market would make it difficult for a small rural facility to keep current (Rosenblatt & Hart, 2000).

Effectiveness of Telehealth

Telehealth is an up-and-coming healthcare technology, especially in rural areas. Use of telehealth technology has been extensively researched and found to be effective in multiple forms. Original telehealth applications used remote live broadcasting from a studio to another location. This allowed patients to access providers remotely but meant they had to travel to the equipment's location. The next generation used home computers for remote monitoring of health status, education and consultation and was also effective. Wound care patients using this technology had fewer emergency department visits, fewer hospitalizations, and shorter length of stay. Overall the patients experienced lower costs. Handheld "smartphone" photography was found to be effective for flap monitoring or wounds at 97.4% accuracy between in person and photograph evaluation. Digital imaging for pressure ulcer assessment was found to be accurate and reliable (Rees & Bashshur, 2007).

Conclusion

The intense economic and social impact of wounds on patients and society calls for allocation of a higher level of attention and increased development of resources to guide wound management. The cost of wound care is a financial burden to the patient and to the healthcare system. Given the high prevalence of wounds, chances are that every RN will have to provide wound care at some point in their career. As demonstrated above, medical provider's wound management knowledge is lacking and there are a limited number of wound care specialists, particularly in rural communities. A smartphone application guiding wound management would be an invaluable resource at their fingertips. A team of researchers recently released this very piece of technology. This smartphone application uses telehealth to allow medical personnel to have access to point of care diagnosis and treatment options from a wound expert, remotely, using HIPPA compliant encrypted software. However, this resource will not benefit nurses or patients if nurses are not willing to overcome perceived barriers and use the tool created to improve patient wound management. This study was conducted to evaluate nurses' perceptions, barriers, and perceived need for a smartphone application guiding wound care.

CHAPTER 2

LITERATURE REVIEW

Introduction

Although very few research studies have been conducted on this topic, there are studies that have been done to evaluate nurses' acceptance and adoption of the use of telehealth and smartphones in the nursing profession. A review of literature was conducted to identify previous studies evaluating nurses' adaptation of smartphone applications in the medical field and the use of telehealth. A literature review was also conducted to determine gaps in research and literature pertaining to these topics. Rozzano Locsin's conceptual framework focusing on technological advances in healthcare as well as the Technology Acceptance Model and Telemedicine Technology Acceptance Model were found to be common themes and tools in previous research. Conceptual and operational definitions will also be discussed in this chapter.

Review of Literature

Search Methods

Databases. The search for pertinent literature entailed using several different databases. Common databases of nursing, medical, and allied health literature were selected. The databases used for this review were the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Library, MEDLINE (Pubmed), Global

Health. Google Scholar was also used in an attempt to broaden the literature being searched.

Search Terms. The search terms were drawn from the research question and conceptual framework. The keywords *telehealth, nurses, views, perspectives, attitude, acceptance, use, pressure ulcer, smartphone application, and Rozzano Locsin* were all used in various combinations to search CINAHL, MEDLINE, Global Health, and Google Scholar (Table 1). Titles, abstracts, and text, were reviewed to assess fit with this study.

Date	Database	Search Term	Number of References Found	Comments	Number of References Used
10/5/12	CINAHL	Telehealth Nurses	232	None of the articles discuss nurses' views on using telehealth. Most of the articles discuss the role of telehealth in the nursing profession.	0
10/5/12	Cochrane Library	Telehealth Nurses	24	None of the articles apply to nurses' views of the use of telehealth.	0
10/5/12	Medline	Telehealth Nurses	1,483	Too many articles, need to narrow search.	0
10/5/12	Global Health	Telehealth Nurses	7	None of the articles pertained to nurses views of using telehealth prior to using it.	0

Table 1 Continued <i>Literature Review Database Searches</i>					
10/5/12	CINAHL	Telehealth Nurses Views	3	One article discussed the ease of use of telehealth. Another article discusses the manager's role in implementing telehealth. The third article is a political perspective of the use of telehealth.	0
10/5/12	Cochrane Library	Telehealth Nurses Views	18	The articles either discussed telehealth for specific diseases or the use of telephones in health care.	0
10/5/12	Medline	Telehealth Nurses Views	67	Many of the articles discuss nurses' views after using telehealth. Two articles were found that study nurses' knowledge about telehealth prior to using it. These two articles will be used for this literature review (Richards et al., 2005) and ("eHealth survey," 2010).	2
10/5/12	Global Health	Telehealth Nurses Views	0		0
10/5/12	CINAHL	Telehealth Nurses Perspectives	5	The articles discussed family's perspectives on telehealth, international perspectives on telehealth, ambulatory care perspectives, school health telehealth, and home care telehealth.	0

Table 1 Continued <i>Literature Review Database Searches</i>					
10/5/12	Cochrane Library	Telehealth Nurses Perspectives	0		0
10/5/12	Medline	Telehealth Nurses Perspectives	44	Most of the articles focused on nurses' perspective of telehealth after using it.	0
10/5/12	Global Health	Telehealth Nurses Perspectives	0		0
10/5/12	CINAHL	Telehealth Pressure ulcer	4	None of the articles discussed nurses' perspectives.	0
10/5/12	CINAHL	Telehealth Pressure ulcer Nurses	1	The article discussed the nurses' role in wound healing and technology but does not relate to telehealth.	0
10/5/12	Medline	Telehealth Pressure ulcer Nurses	12	These articles did not discuss nurses' view of telehealth in the use of pressure ulcer treatment.	0
10/5/12	CINAHL	Smartphone application Nurses	0		0
10/5/12	Cochrane Library	Smartphone Application Nurses	1	The article discussed a computer program to aid in weight loss.	0
10/5/12	Medline	Smartphone Application Nurses	3	None of the articles applied to nurses' use of smartphone applications.	0
10/5/12	Global Health	Smartphone Application Nurses	0		0
10/5/12	CINAHL	Smartphone application Nurses Views	0		0

Table 1 Continued <i>Literature Review Database Searches</i>					
10/5/12	Medline	Smartphone application Nurses Views	1	This article was about smartphones in nursing education.	0
10/5/12	Medline	Telehealth Nurses Attitude	204	Again, many articles talked about nurses' attitudes after using telehealth.	0
10/5/12	Medline	Telehealth Nurses Acceptance	75	Many of these articles discussed patient's acceptance of using telehealth for their own care, not nurses' acceptance.	0
10/5/12	CINAHL	Rozzano Locsin	0		0
10/5/12	Cochrane Library	Rozzano Locsin	0		0
10/5/12	Medline	Rozzano Locsin	0		0
10/5/12	Global Health	Nurses Telehealth Acceptance	0		0
10/5/12	Google Scholar	Nurses Smartphone Acceptance	1,150	The search needs to be narrowed down and more specific. However two articles were found that will be used for this literature review (Park & Chen, 2007) and (Putzer & Park, 2010).	2
10/5/12	Google Scholar	Nurses acceptance of smart phone applications	698	The articles did not specifically discuss nurses' acceptance of smart phone applications.	0
10/5/12	Google Scholar	Smartphone application Pressure ulcer	175	The articles did not discuss nursing acceptance of smartphone applications.	0

Table 1 Continued <i>Literature Review Database Searches</i>					
10/5/12	Google Scholar	Nurse Views Smartphone application Appropriate	1,180	There were too many articles.	0
10/5/12	Google Scholar	Nurses use telemedicine	16,500	There were a large number of articles found. The search needs to be more specific to lower the number of results. One of the articles found will be used for this literature review (Kowitlawakul, 2011).	1

Findings

Using the above discussed databases and terms, only five articles were found that would sufficiently relate to nurses' acceptance and adoption of telehealth or a smartphone application in the clinical setting. Many articles identified did not discuss or evaluate nurses' perceptions, barriers, or perceived need for telehealth or smartphone application prior to their use. Nurses' experiences were evaluated after using these tools.

The article *The Technology Acceptance Model: Predicting Nurses' Intention to Use Telemedicine Technology (eICU)* used Davis's Technology Acceptance Model (TAM) to examine nurses' intention to use telemedicine technology in healthcare settings. The TAM has five foci: the perceived usefulness (PU), perceived ease of use (PEOU), attitude toward using, intention to use (ITU), and actual system use (Figure 1). Kowitlawakul revised the TAM and renamed it the Telemedicine TAM (TTAM) (Figure 2). The TTAM utilizes PU, PEUO, attitude toward using, and ITU from the TAM and

adds three previously identified external variables (years working in the hospital, support from administrators, and support from physicians). Kowitlawakul found that PU was the most influential factor influencing nurses' intention to use telemedicine technology and that PEOU significantly impacted PU (Kowitlawakul, 2011).

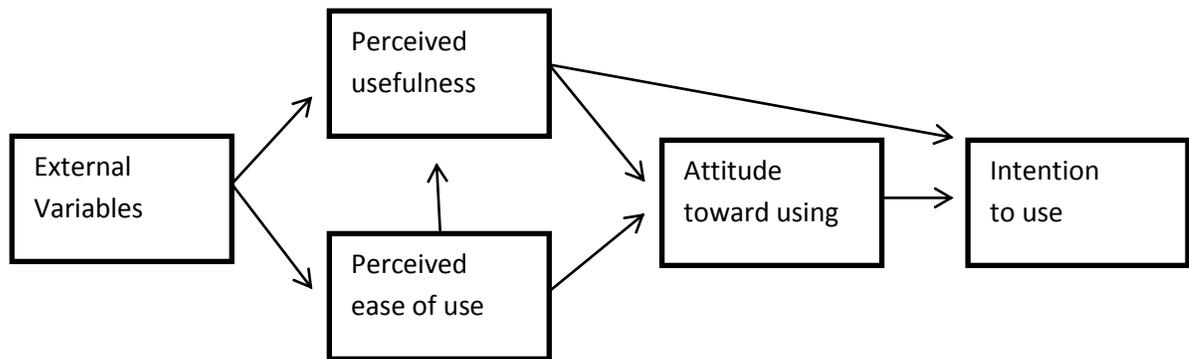


Figure 1. Technology Acceptance Model (Davis et al, 1989)

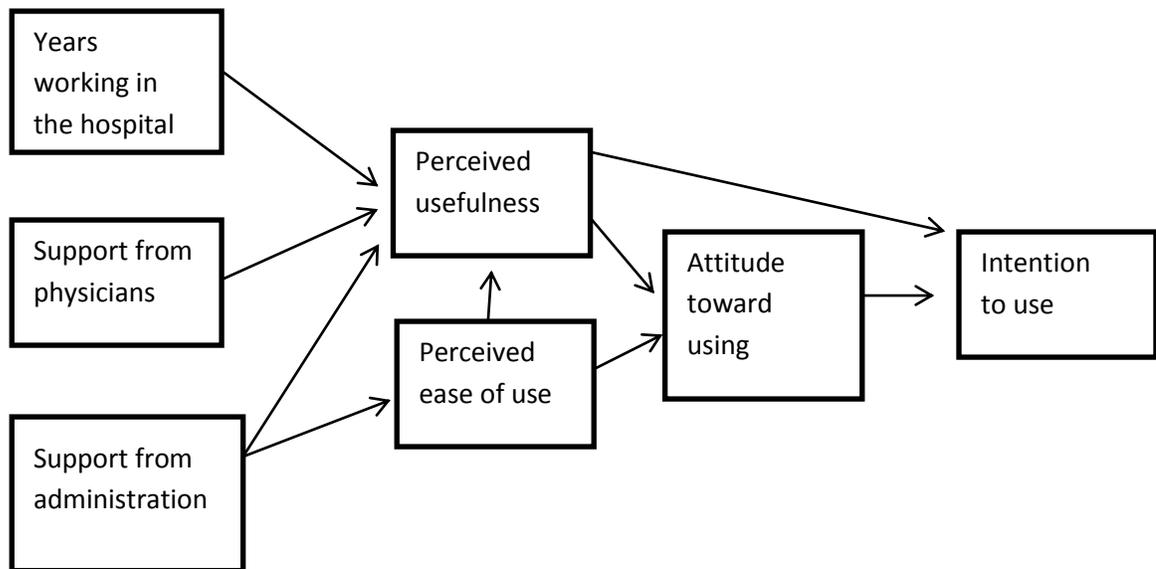


Figure 2. Telemedicine Technology Acceptance Model (TTAM) (Kowitlawakul, 2011)

The article *The Effects of Innovation Factors on Smartphone Adoption Among Nurses in Community Hospitals* used Roger's Diffusion of Innovations (DOI) theory as the basis of the study to investigate human motivations affecting an adoption decision for smartphone among doctors and nurses based on individual and organizational perceptions. The DOI theory focused on factors including observability, compatibility, trialability, task, individual features, organizational characteristics, and environmental factors to determine one's adoption of technology. This study found that the innovation characteristics of observability, compatibility, job relevance, internal environment, and external environment all influence nurses' attitudes toward use of a smartphone. Observability, prior observation of a healthcare professional using a smartphone, and compatibility with other technologies in the hospital, had a significant positive effect on nurses' attitude and decision to adopt the use of a smartphone into their daily workflow (Putzer & Park, 2010).

The article *Acceptance and Adoption of the Innovative use of Smartphone* combined the use of Davis's TAM and Roger's DOI theory to investigate human motivations affecting an adoption decision for smartphones among doctors and nurses. This study found that intent to use a smartphone was largely influenced by PU and attitude toward using. It also found that PU and PEOU positively determine attitude toward using a smartphone for medical purposes. Additionally, the impact of PU on attitude was stronger than that of PEOU (Putzer & Park, 2010).

The article *Remote working: survey of attitudes to eHealth of doctors and nurses in rural general practices in the United Kingdom* conducted a survey to elicit current use of, and attitudes toward eHealth of professionals in primary care. This study found that

aspects of experience that were rated positively were clinical usefulness, functioning of equipment, and ease of use of equipment. The most important barriers identified were lack of suitable training, high cost of buying telemedicine equipment, and increased workload. This study concluded that although health professionals recognize the general benefits of eHealth, uptake is low and by acknowledging barriers to uptake, implementation may improve (Richards, King, Reid, Selvaraj, McNicol, Brebner, & Godden, 2005).

The *eHealth Survey 2010 Report* was commissioned to explore knowledge and understanding of eHealth, electronic patient records, telehealth, and use of social networking sites among nursing staff. In relation to telehealth, this survey concluded that nurses' knowledge and awareness of telehealth was less advanced than other topics such as electronic patient records and that low levels of experience in using telehealth was reflected by a large amount of uncertainty regarding its benefits. However, many of the respondents were open to telehealth's introduction and were interested in learning more about it ("eHealth survey", 2010).

Gaps in Literature

By performing this literature review, it became evident that very little has been researched regarding nurses' acceptance and adoption of the use of telehealth and smartphones in a clinical setting. The most evident gap identified was the lack of research pertaining to nurses' attitudes and perceptions toward adopting telehealth and smartphone use into their work. Another gap identified by this literature review was that there were no studies found that include nursing theorist Rozzano Locsin's theories of technological

advancements in the healthcare field. These findings show that there is much still to be studied in the field of nursing and technology, specifically smartphone usage.

Theoretical Framework

Theorist

Nursing theorist Rozzano Locsin's model of "technological competency as caring in nursing" (2005) was used to guide this study. This model illustrates that intention to care and to nurture the other as caring is actualized through direct knowing, technological competence, and the medium of technologically-produced data. Locsin recognizes caring in nursing, human beings as persons, and technological competence as three spheres that interface, and through which, nurses know their patients (2005). This model specifically integrates nurses with the modern technology they encounter in the workplace.

Understanding how nursing and technology intersect is important to give nurses a frame of reference for the incorporation of new technologies into their workflow. Locsin (2012) states:

Inigorating my philosophical views of human beings are conceptualizations of wholeness of persons, particularly as influenced by technologies in nursing practice, competency, and the caring of/for persons dependent on mechanical devices, and the prospect of futuristic appreciations of humans as being demanding and expecting nursing congruence in a post-human world.

As technology advancements continue to be introduced to healthcare, technology will continue to play an important role in nurses' daily routine. Nurses need to be able to adapt to new technology or they will fall behind and patient care will begin to lack.

Locsin believes that technological competence defines contemporary nursing practice (2012).

The use of a smartphone application would allow nurses to provide care for patients with wounds at their local hospital if the nurse is willing to develop technological competence for the smartphone application. Caring, which is central to the philosophy of nursing (Locsin, 2005) need not be lost in becoming technologically proficient at this new skill.

Conceptual Model

Another conceptual model that will be used is the Technology Acceptance Model (TAM) developed by Fred Davis in 1986 (Kowitlawakul, 2011) (figure 1). The TAM provides a framework for understanding and determining technology acceptance and explains user behavior in a variety of end-stage user populations. The theoretical framework has the potential to identify, explain, and predict the factors, such as internal beliefs and attitudes, which have an effect on the intentions of technology end users. The TAM contains five components: PU, PEOU, attitude toward using, ITU, and the actual system use (Kowitlawakul, 2011). Kowitlawakul took the TAM and revised it; renaming it the Telemedicine TAM (TTAM) (2011) (figure 2). The TTAM utilizes PU, PEOU, attitude toward using, and ITU and adds three previously identified external variables including years working in the hospital, support from administrators, and support from physicians (Kowitlawakul, 2011). The TTAM will be very useful in this research as it was developed to understand external variables affecting nurses' acceptance of the use specifically of telemedicine, such as a smartphone application.

Definitions

Conceptual

The key terms to be discussed include perception, barrier, need, smartphone, smartphone application, guide, wound, and care. A perception is “the way you think about or understand someone or something” (“Perception”, 2013). A barrier is “something that prevents or blocks movement from one place to another” or “a problem that makes something difficult or impossible” (“Barrier”, 2013). A need is “a situation or something in which someone or something must have or do in order to live, succeed, or be happy” (“Need”, 2013). A smartphone is a “mobile phone built on a mobile operating system with advanced capabilities beyond a typical mobile phone” (“Smartphone,” 2012). “Smartphones run complete operating system software that provides a standardized interface and platform for application developers and contain portable media players, digital cameras, video cameras, global positioning system (GPS) navigation, and web browsers (“Smartphone,” 2012). A smartphone application is “a software program used on a smartphone or mobile device pertaining to business, productivity, entertainment, references, gaming and media” (Smith, 2012). A guide is “a person or something that leads or directs a person’s behavior” (“Guide, 2013). A wound is “an injury to the body that typically involves laceration or breaking of a membrane, such as the skin, and usually damage to underlying tissues” (“Wound”, 2013). Care is “things that are done to keep someone healthy, safe, or in good condition” (“Care”, 2013).

Operational

For this study, perception was related specifically to nurses' views regarding usage of a smartphone application. Barrier is defined as something that nurses believe will inhibit their use of a smartphone application. Need is in relation to nurses' perceived benefit from the use of a smartphone application. Guide, in this study, relates to offering assistance and evidence-based suggestion for appropriate wound care. Last, wound care is the act of treating a wound.

Conclusion

This literature review made it apparent that very few research studies have been done to evaluate nurses' acceptance and adoption of the use of telehealth and smartphones in a clinical setting. This review also identified that no research, that could be located, has been done to determine nurses' acceptance of the use of a smartphone application to guide wound care. No studies were located that included Rozzano Locsin's theories of technological advancements in the healthcare field. These findings show that there is much still to be studied in the field of nursing and technology, specifically smartphone usage.

CHAPTER 3

METHODS

Introduction

The purpose of this study was to examine nurses' perceptions, barriers, and perceived need for a smartphone application to guide wound care treatment in rural healthcare settings. Most rural health care facilities do not have staff that are trained or experienced in wound and pressure ulcer care. Inappropriate diagnosis and treatment of a pressure ulcer can be detrimental to the patient's life and be very expensive for the health care system. There is a great economic and social burden associated with wounds. This burden calls for a new level of attention and resources to guide wound care.

Design

This research was a non-experimental quantitative study. Data collection was through use of an electronic survey. This study was guided by Rozzano Locsin's mid-range theory Technological Competency as Caring in Nursing (Parcells & Locsin, 2011). In this theory, "the intention to care and to nurture the other as caring is actualized through direct knowing, technological competence, and the medium of technology produced data" (Purnell, 2010, p. 407). This research used guidance from Locsin's theory, the Technology Acceptance Model (Davis et al, 1989), and the Telemedicine Technology Acceptance Model (Kowitlawakul, 2011) to gain insight into nurses' views on the use of technology, specifically a smartphone application, in aiding them to care for

their patients. Understanding how nursing and technology intersect is important to give nurses a frame of reference for the incorporation of smartphone applications into their practice.

Sample

Eligibility Criteria

The overall population of focus was all registered nurses (RNs) in the United States. The target population consists of all RNs in one rural western state. The sample population being used for this study was RNs licensed to practice in and currently working in ten critical access hospitals in this state. This population was chosen for convenience and because these hospitals are all rural, critical access hospitals with limited specialty providers.

Location of Data Collection

For convenience, and to get samples from multiple critical access hospitals, data collection was done through the internet using surveymonkey.com as the survey distribution website. The survey was developed, distributed, and results were received all through the researcher's account on this website.

Tools for Data Collection

A 25-question survey titled "Smartphone Application Guiding Wound Care" was developed by the researcher. This survey consisted of four sections: demographics,

cellphone usage, wound care, and smartphone application for wound care. See appendix D for a copy of the survey.

Steps of Data Collection

The researcher contacted the Chief Clinical Officer (CCO), Chief Nursing Officer (CNO) or department managers at ten critical access hospitals to discuss surveying the nurses employed at their hospital for this study. If the CCO, CNO, or manager agreed, an internet link to the survey and an introduction letter from the researcher describing the reason for the study was emailed to the CCO, CNO, or manager who then sent out an email to their nursing staff. The RNs voluntarily and anonymously completed the survey on-line. A three week deadline was set for RNs to complete the survey.

Protection of Human Rights

An application for approval of the study was submitted to the Montana State University-Bozeman Institutional Review Board prior to starting the collection of data. Before starting the survey, the participants were asked to read the introduction letter. The letter emphasized that the participant could withdraw from the study at any time and that there would be no pressure to resume or continue the survey. Participants were informed that confidentiality would be maintained throughout the entire study. No identifiable data was used. The researcher's account with surveymonkey.com was destroyed after completion of the study. Completion of the survey was considered consent to participate.

The potential benefit to the participants from this study was the opportunity to contribute to the research knowledge base of nursing. They also gained knowledge about

the current development of a smartphone application for wound evaluation and treatment and the use of telehealth in rural hospitals. The participants may have experienced stress or anxiety when completing the survey.

Planned Statistical Analysis

Analysis tools within the SPSS statistical analysis software were used to analyze each item in the survey separately and then totals were calculated. Each participant's responses were analyzed individually. The overall survey responses were then analyzed.

Descriptive statistics were used to report the sample's demographics. Percentages of responses for each item were calculated.

Assumptions

There were multiple assumptions that the researcher expected to find pertaining to nurses' perceptions, barriers, and perceived need for a smartphone application to guide wound care. One assumption was that as technology advancements continue to be introduced to healthcare, technology will continue to play an important role in nurses' daily routine. It was assumed that nurses would be aware of the advancing medical technology and believe that it will continue to play a large role in their profession. Nurses need to be able to adapt to new technology or they will fall behind in their field and patient care will begin to suffer. It is assumed that nurses recognize that they need to be receptive to new technological advances in healthcare and be willing to gain competency for these advances. Another assumption was that years of working in the hospital will have an indirect correlation with receptiveness to use the application. It was also assumed

that owning or previously having used a smartphone will have a positive correlation with intent to use a smartphone to provide wound care. It was assumed that older nurses will be less receptive to using a smartphone application as part of their nursing routine than younger nurses. Another assumption was that nurses' would be willing to adopt technological advances if it is for the best interest of their patients. Lastly, it was assumed that perceived ease of use and perceived usefulness would be strong barriers to using a new piece of technology.

Consistent with Locsin's (2005) assumption, the researcher thought that the purpose of technology is to enhance nurses' understanding of patients as a whole and to improve nurses' practice. In addition, the researcher believed that technology is not meant to make nurses' work harder or to interfere with what nurses strive to do. It is assumed that if the smartphone application is not perceived to be beneficial, nurses will be open to learning what action is necessary to make these new systems work to their and the patient's advantage.

Conclusion

This non-experimental quantitative study was conducted to evaluate nurses' cell phone usage, wound care experience, education and resources, and perceived barriers and usefulness of a smartphone application to guide wound care. It was also conducted to better understand how one's demographics play a role in nurses' perceptions toward using a smartphone application for guidance. It was the hope of the researcher that by completing this survey nurses would become aware of the need for new tools to assist them with appropriate wound management and that the results could be analyzed to help

hospitals in the future make implementation of this smartphone application an easier transition for their staff.

CHAPTER 4

RESULTS

Survey Results

Data was collected in the fall of 2013 from nurses working in critical access hospitals in a rural western state via an online survey. The survey contained questions pertaining to demographics and work history, cell phone usage, wound care, and the use of a smartphone application for wound care. Questions were in the form of multiple choice, check all that apply, and Likert scale. All responses were voluntary and anonymous. There were a total of 28 responses; all which were used for data analysis.

When hospital CCO, CNO, or managers were contacted to determine how many nurses the survey was sent to, no responses were received.

Demographics

Of the total respondents, 26 were registered nurses and 2 were licensed practical nurses. All 28 respondents were female. The age of respondents ranged from 20-79. The largest response group was age 40-49 (32.1%). There were 2 respondents age 20-29 (7.1%), 4 respondents age 30-39 (14.3%), 7 respondents age 50-59 (25%), 5 respondents age 60-69 (17.9%), and 1 respondent age 70-79 (3.6%).

All of the respondents have worked greater than one year as a nurse and many of them have worked 10 years or greater (78.5%). There were 4 respondents (14.3%) who have worked 1-5 years as a nurse. There were 2 respondents (7.1%) who have worked 5-

10 years as a nurse. There were 5 respondents (17.9%) who have worked 10-20 years as a nurse. There were 9 respondents (32.1%) who have worked 20-30 years. There were 7 respondents (25%) who have worked 30-40 years and 1 respondent who worked over 40 years as a nurse.

The current area of specialty varied greatly. Nurses were able to choose multiple areas of specialty. The medical-surgical floor was the most common area of specialty with 40% (n=12) of respondents working on that floor. Other areas of specialty included emergency department (n=9, 33.3%), labor and delivery (n=6, 22.2%), operating room (n=5, 18.5%), management (n=5, 18.5%), outpatient infusion or treatment (n=4, 14.2%), home health and hospice (n=2, 7.4%), and float pool (n=1, 3.7%).

Cell Phone Usage

The majority of the nurses (n=26, 92.9%) own a cell phone, with only 2 of them not owning one (7.1%). Almost equal amounts of respondents own a smartphone (n=14, 51.9%) as those who do not own a smartphone (n=13, 48.1%). For those who do not own a smartphone, 72.2% (n=13) of them have never even used a smartphone. Of those who do not own a smartphone, only 41.2% (n=7) would prefer to have one. Those who do own a smartphone use a variety of their functions including making phone calls (n=14, 100%), texting (n=14, 100%), taking pictures (n=14, 100%), sending emails (n=13, 92.9%), checking the weather (n=12, 85.7%), social networking (n=11, 78.6%), and playing games (n=10, 71.4%).

The majority of respondents reported that they were very comfortable using a smartphone to make a phone call (n=14, 58.3%), send a text message (n=15, 62.5%),

reading and responding to an email (n=13, 54.2%), taking a photo (n=14, 58.3%), emailing or texting a photo (n=12, 50%), using the internet (n=12, 50%), using an application (n=10, 41.7%), playing games (n=11, 45.8%), and social networking (n=10, 43.5%). However, it should be noted that a significant number of respondents were not at all comfortable performing the following tasks on a smartphone: making a phone call (n=4, 16.7%), sending a text message (n=5, 20.8%), reading and responding to emails (n=7, 29.2%), taking a photo (n=4, 16.7%), emailing or texting a photo (n=6, 25%), using the internet (n=7, 29.2%), using an application (n=7, 29.2%), playing games (n=9, 37.5%), or social networking (n=9, 39.1%).

Wound Care

The majority of the respondents (n=24, 85.7%) dress and treat wounds in their current nursing position. However, many of them (n=21, 75%) have never received any wound management education through their facility teaching proper wound care. Only 17.9% (n=5) of the respondents have a certified wound care specialist at their facility. The average number of wounds treated each month by the responding nurses was 0-4 (n=21, 75%). 17.9% (n=5) of nurses treat 5-9 wounds monthly and 7.1% (n=2) treat 10 or greater wounds monthly. The responses were similar for the number of dressings applied or changed monthly. 67.9% (n=19) performing 0-4 dressing changes monthly, 21.4% (n=6) performing 5-9 dressing changes monthly, 3.6% (n=1) performing 10-14 dressing changes monthly, and 7.1% (n=2) performing 15 or greater dressing changes each month.

Other nurses were by far the greatest resource (n=27, 96.4%) used to assist with wound dressings. Physicians were also a frequently used resource (n=24, 85.7%). Other resources to assist with wound dressings included a wound care specialist (n=7, 25%), the internet (n=13, 46.4%), a nursing procedure book (n=13, 46.4%), their facility's policy and procedure for wound care (n=13, 46.4%), and a wound care manual (n=4, 14.3%).

None of the responding nurses reported feeling 'very confident' in their wound management skills. The majority of the respondents (n=15, 53.6%) reported feeling 'somewhat confident' in their wound management skills with 32.1% (n=9) feeling 'slightly confident' and 14.3% (n=4) feeling 'not at all confident'.

Smartphone Application for Wound Care

In regards to providing patient care, many of the respondents had *never* previously used a smartphone at work to perform a variety of tasks. 71.1% (n=20) have never used a smartphone at work to listen to lectures. 96.3% (n=26) have never used one for work-related conference calls. 66.7% (n=18) have never used one for reading medical articles. 55.6% (n=15) have never used a smartphone to look up medical information. Lastly, 63% (n=17) have never used a smartphone at work to look up medications.

In the future, nurses thought that it was 'fairly likely' that a smartphone application would play a role in remote consultation between primary care providers and specialists (n=16, 59.3%), radiology (n=13, 48.2%), pathology (n=15, 55.6%), dermatology (n=15, 57.7%), wound care (n=19, 70.4%), and follow up (n=15, 55.6%).

Nurses were then asked how beneficial they thought the use of a smartphone application would be to guide wound care for patients in a variety of setting. The

following results are the combined percentage of nurses who thought a smartphone application would be ‘fairly beneficial’ and ‘very beneficial’ in each setting. Patients living in rural areas of the county were thought to benefit most (n=24, 88.9%) from this smartphone application. 85.2% (n=23) thought it would be beneficial for patients presenting to their primary care provider for wound management. 85.2% (n=23) of nurses thought it would be beneficial when treating nursing home residents with wounds. 81.5% (n=22) of nurses thought it would be beneficial when treating hospitalized patients with complicated wounds. 81.5% (n=22) thought it would be beneficial for patients without resources to travel to a wound care specialist. 77.8% (n=21) thought it would be beneficial for disabled patients with wounds. 74.1% (n=20) of nurses thought it would be beneficial when treating prisoners. 74.1% (n=20) thought it would be beneficial when treating battlefield wounds.

The nurse respondents were fairly receptive to a smartphone application guiding wound management with 37% (n=10) of respondents reporting that they would be ‘very likely’ to use it, 37% (n=10) stating they would be ‘fairly likely’, 22.2% (n=6) would be ‘somewhat likely’. Only 3.7% (n=1) would be ‘fairly unlikely’, and 0% being not at all likely to use it.

There were many barriers affecting nurses’ likelihood to use a smartphone application to guide wound care treatment. In regards to lack of knowledge in smartphone 14.8% (n=4) stated it was a ‘very strong barrier’, 33.3% (n=9) stated it was a ‘fairly strong barrier’, 18.5% (n=5) stated it was a ‘moderately strong barrier’, 7.4% (n=2) stated it was a ‘fairly weak barrier’, and 25.9% (n=7) stated it was a ‘very weak barrier’.

Lack of confidence in smartphone usage had similar results. 14.8% (n=4) reporting it being a 'very strong barrier', 29.6% (n=8) felt it would be a 'fairly strong barrier', 25.9% (n=7) felt it would be a 'moderately strong barrier', 3.7% (n=1) felt it would be a 'fairly weak barrier', and 25.9% (n=7) felt it would be a 'very weak barrier'.

Lack of time to use the application did not seem to be as strong of a perceived barrier with only 7.4% (n=2) reporting it being a 'very strong barrier', 25.9% (n=7) felt it would be a 'fairly strong barrier', and 22.2% (n=6) felt it would be a 'moderately strong barrier', 22.2% (n=6) felt it would be a 'fairly weak barrier', and 22.2% (n=6) felt it would be a 'very weak barrier'.

Lack of knowledge on how to use the application was a fairly strong barrier with over half of the respondents (n=15, 55.6%) reporting it being either a 'very strong barrier' or a 'fairly strong barrier'. Lack of frequency treating wounds to become proficient in the use of the application was also perceived as a notable barrier with 22.2% (n=6) reporting it was a 'very strong barrier', 22.2% (n=6) reporting it was a 'fairly strong barrier', 37% (n=10) reporting it as being a 'moderately strong barrier', 14.8% (n=4) reporting it being a 'fairly weak barrier', and 3.7% (n=1) reporting it being a 'very weak barrier'.

Lack of understanding of basic wound care was perceived to be a weak barrier with only 18.5% (n=5) of respondents feeling it was a 'very strong' or 'fairly strong barrier'. 25.9% (n=7) thought it would be a 'moderately strong barrier', 29.6% (n=8) thought it would be a 'fairly weak barrier' and 25.9% (n=7) thought it would be a 'very weak barrier'.

Lack of necessity for a smartphone application to guide wound care had mixed responses. 7.4% (n=2) of nurses believing it would be 'very strong barrier', 18.5% (n=5)

believed it would be a 'fairly strong barrier', 29.6% (n=8) believed it would be a 'moderately strong barrier', 22.2% (n=6) believed it would be a 'fairly weak barrier', and 22.2% (n=6) believed it would be a 'very weak barrier'.

Lastly, nurse respondents were asked which of the following, perceived usefulness, perceived ease of use, and perceived benefit to the patient, would guide their intention to use a smartphone application for wound care. They were asked to check all that would apply. Perceived usefulness was reported by 77.8% (n=21) of nurses, perceived ease of use was reported by 88.9% (n=24) of nurses, and perceived benefit to the patient was reported by 81.5% (n=22) of nurse respondents.

Conclusion

Of the nurses working in critical access hospitals in this rural western state, the majority of them own a cellphone but just over half own a smartphone. However, over half of them feel fairly confident or very confident operating a smartphone. Many of the nurses dress and treat wounds, although very few a month, in their current positions without ever receiving any formal wound management education through their facility. Less than a quarter of respondents had a wound care specialist at their facility or used a wound care specialist as a resource. Physicians and other nurses were the most used resources for questions and guidance regarding wound care treatment. Many nurses were aware of their limited resources and believed that in the future a smartphone application guiding wound care would likely be used and be quite beneficial in a variety of settings.

Barriers such as lack of knowledge in smartphone or specific application usage, lack of confidence in smartphone usage, lack of time to use the application, and infrequency of treating wounds to become proficient in the usage of the application were perceived by nurses and will need to be addressed. Perceived ease of use was the most influential factor affecting nurses' intent to use the application followed by perceived benefit to the patient then perceived usefulness.

CHAPTER 5

DISCUSSION

Introduction

This study showed that although a large majority of nurses working in critical access hospitals provide wound care, very few of them have ever had formal wound care education through their facility. Wound care specialists are not on staff or available at most critical access hospitals leaving nurses to turn to other resources such as physicians, the internet, nursing procedure books, facility policy/procedures, and other nurses to guide them in wound management. These nurses believed that in the future smartphone applications will be used to provide a variety of patient services to patients living in rural areas. They also believed that a smartphone application guiding wound care would be beneficial in a range of settings. For this application to benefit patients and nurses there are a number of perceived barriers that will need to be addressed and overcome by individual nurses and their facility.

Implications for Nursing

Education

Education regarding wound care can begin in nurses' undergraduate training. Educating nursing students on the basics of wound pathophysiology, assessment, and management will better prepare them for providing appropriate wound care to patients after graduation. However, wound care is only part of this equation. Student nurses

should also be introduced to a variety of ways to communicate with specialists remotely. This involves using a variety of technology mechanisms such as phone, internet, video, and telemedicine. Introducing students to these forms of communication will hopefully start to make them familiar and comfortable with the variety of technological resources that are available in health care.

Clinical Practice

As demonstrated in this study, very few nurses receive formal wound care education from their facility. Yet, these same nurses treat wounds on a monthly basis. If facilities expect their nurses to provide wound care, they should provide them with the education and resources necessary to do so. Since there are limited wound care resources available on site at critical access hospitals, these facilities should explore other methods to offer their staff the tools needed to provide best practice wound care. One of these methods could be the newly developed smartphone application guiding wound care. The hospital would then need to provide staff with education on application usage and adapt or develop a new policy to allow for the usage of a smartphone when providing patient care. This process would be beneficial if it enhanced nurses confidence and offered resources to provide best practice wound care.

Future Research

Health care organizations will likely continue to implement telemedicine and the use of smartphone applications for methods of providing patient care and communicating with other members of the health care community remotely. One of the areas where telemedicine can play a role is in wound management. Further research studies should be

conducted to determine other barriers perceived by nurses influencing their use of telemedicine and smartphone applications. In doing this, these barriers can be addressed increasing nurses intent to use these resources. Future studies should also include nurses' attitudes on the use of specific smartphone applications, such as the one guiding wound care, after having used them for a period of time. By doing this, programs or processes can be changed to improve user satisfaction and in turn patient care.

Limitations

This research was time-limited due to the time constraints of the nursing program. The researcher identified a time line to assure that all components of the study were conducted in a timely manner. The researcher also set a completion date well ahead of the defense date to allow for unforeseen circumstances that would affect the completion date.

Another limitation was cost. There was no external funding for this research. The researcher performed the research using as little finances as possible. The researcher used resources provided by the college of nursing for costs such as printing and data analysis.

The number of participants available in a rural area to participate in the research was another limitation. There was limited number of people to pool from, as well as willing to volunteer to participate in the research. All participants were female, leaving out the views and perceptions of the male nurse population. All participants were also currently working in the same western rural state at critical access hospitals eliminating the views and perceptions of nurses working in urban areas.

Bias is a variable that, although measures were taken for this to be avoided, is inherent in any study. The selection of studies for the literature review, the way the

survey questions were worded, and the way the data was interpreted may have been influenced by the researcher's personal bias. To reduce bias as much as possible, the author acknowledged self-identified preconceived beliefs and opinions about the subject matter. By objectifying personal assumptions, and keeping these in mind through every step of the literature review, personal bias was reduced.

Conclusion

Lack of knowledge in use of a smartphone application and perceived ease of use were two of the biggest barriers affecting nurses' intention to use a smartphone application to guide wound care. If these barriers could be addressed improving nurses' confidence and competence in using the application, it is hoped that better wound care would be provided to patients. Implementing the use of a smartphone application when providing wound care to a patient would be an adjustment that would require education, adaptation, and perseverance. But if it improved patient outcomes, then nurses' goal of providing the best patient care would be accomplished. One of the survey respondents said it best: 'With adequate training anything can be accomplished. This applied to nurses, caregivers, and patients.'

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APPENDIX A

SURVEY QUESTIONS & RESULTS

Demographics

1. What is your current position?		
	N	%
Registered Nurse	26	92.86%
Licensed Practical Nurse	2	7.14%

2. What is your gender?		
	N	%
Female	27	100%
Male	0	0%

3. What is your age?		
	N	%
20-29	2	7.14%
30-39	4	14.29%
40-49	9	32.14%
50-59	7	25%
60-69	5	17.86%
70-79	1	3.57%

4. How long have you been an RN/LPN?		
	N	%
0-1 year	0	0%
1-5 years	4	14.29%
5-10 years	2	7.14%
10-20 years	5	17.86%
20-30 years	9	32.14%
30-40 years	7	25%
Greater than 40 years	1	3.57%

5. What is your current area of specialty?		
	N	%
Medical-Surgical	11	40.74%
Labor & Delivery	6	22.22%
Operating Room	5	18.52%
Emergency Department	9	33.33%
Outpatient Infusion/Treatment	4	14.81%
Home Health/Hospice	2	7.41%

Management	5	18.52%
Float	1	3.7%

Cell Phone Usage

6. Do you own a cell phone?		
	N	%
Yes	26	92.86%
No	2	7.14%

7. If you own a cell phone, is it a smartphone?		
	N	%
Yes	14	51.85%
No	13	48.15%

8. If you do not own a smartphone, have you ever used one?		
	N	%
Yes	5	27.78%
No	13	72.22%

9. If you do not own a smartphone, would you prefer to have one?		
	N	%
Yes	7	41.18%
No	10	58.82%

10. If you own a smartphone, which functions do you use (check all that apply)?		
	N	%
Phone Calls	14	100%
Texting	14	100%
Email	13	92.86%
Camera	14	100%
Games	10	71.43%
Social Networking	11	78.57%
Weather	12	85.71%

11. On a scale of 1-5 how comfortable are you with using a smartphone for the following tasks? (1, not at all comfortable. 5, very comfortable)					
	1	2	3	4	5

Making a phone call	4 16.67%	1 4.17%	3 12.50%	2 8.33%	14 58.33%
Sending a text message	5 20.83%	1 4.17%	2 8.33%	1 4.17%	16 62.50%
Reading & responding to email	7 29.17%	1 4.17%	1 4.17%	2 8.33%	13 54.17%
Taking a photo	4 16.67%	2 8.33%	3 12.5%	1 4.17%	14 58.33%
Emailing or texting a photo	6 25%	1 4.17%	3 12.5%	2 8.33%	12 50%
Using the internet	7 29.17%	1 4.17%	2 8.33%	2 8.33%	12 50%
Using an application	7 29.17%	2 8.33%	2 8.33%	3 12.5%	10 41.67%
Playing games	9 37.5%	1 4.17%	2 8.33%	1 4.17%	11 45.83%
Social Networking	9 39.13%	1 4.35%	1 4.25%	2 8.7%	10 43.48%

Wound Care

12. Do you dress/treat wounds in your current position		
	N	%
Yes	24	85.71%
No	4	14.29%

13. Have you received education through your facility on proper wound care?		
	N	%
Yes	7	25%
No	21	75%

14. Do you have a certified wound care specialist at your facility?		
	N	%
Yes	5	17.86%
No	23	82.14%

15. How many wounds do you see each month?		
	N	%

0-4	21	75%
5-9	5	17.86%
10-14	1	3.57%
15 or greater	1	3.57%

16. How many dressings do you apply/change each month?		
	N	%
0-4	19	67.86%
5-9	6	21.43%
10-14	1	3.57%
15 or greater	2	7.14%

17. What resources do you have available to assist you with wound dressings? (choose all that apply)		
	N	%
Wound care specialist	7	25%
Physician	24	85.71%
Internet	13	46.43%
Nursing procedure book	13	46.43%
Policy/Procedure	13	46.43%
Wound care manual	4	14.29%
Other nurses	27	96.43%
None	0	0%

18. How confident are you in your wound management skills?		
	N	%
Very Confident	0	0%
Somewhat Confident	15	53.57%
Slightly Confident	9	32.14%
Not at all Confident	4	14.29%

Smartphone application for wound care

19. Have you previously used a smartphone in the following areas at work?				
	Yes		No	
	N	%	N	%
Providing patient care	7	25.93%	20	74.07%
Listening to	1	3.7%	26	96.30%

lectures/conferences/meetings				
Reading medical articles	9	33.33%	18	66.67%
Looking up medical information	12	44.44%	15	55.56%
Looking up medications	10	37.04%	17	62.96%

20. On a scale of 1-5, in the future, how likely is it that a smartphone application will play a role in the following areas of medical decision making? (1, not likely. 5, very likely)					
	1	2	3	4	5
Remote consultation between primary care providers & specialists	0	0	3 11.11%	16 59.26%	8 29.62%
Radiology (i.e. image transmission to radiologist)	1 3.7%	1 3.7%	1 3.7%	13 48.15%	11 40.74%
Pathology (i.e. specialist looking at a slide via smartphone)	1 3.7%	2 7.41%	3 11.11%	15 57.69%	6 22.22%
Dermatology (i.e. specialist looking at a skin lesion via smartphone)	0	0	3 11.54%	15 57.69%	8 30.77%
Wound Care (i.e. specialist looking at a pressure ulcer via smartphone)	0	0	0	19 70.37%	8 29.63%
Follow Up (i.e. a patient at home using electronic home visits via smartphone)	0	3 11.11%	3 11.11%	15 55.56%	6 22.22%
Psychiatry (i.e. electronic home visits via smartphone)	2 7.41%	5 18.52%	7 25.93%	8 29.63%	5 18.52%

21. On a scale of 1-5, how beneficial would the use of a smartphone application be in guiding wound care management in the following scenarios? (1, not at all beneficial. 5, very beneficial)					
	1	2	3	4	5
Patients in	0	0	3 11.11%	16 59.26%	8 29.62%
Radiology (i.e. image	1	1	1	13	11

transmission to radiologist)	3.7%	3.7%	3.7%	48.15%	40.74%
Pathology (i.e. specialist looking at a slide via smartphone)	1 3.7%	2 7.41%	3 11.11%	15 57.69%	6 22.22%
Dermatology (i.e. specialist looking at a skin lesion via smartphone)	0	0	3 11.54%	15 57.69%	8 30.77%
Wound Care (i.e. specialist looking at a pressure ulcer via smartphone)	0	0	0	19 70.37%	8 29.63%
Follow Up (i.e. a patient at home using electronic home visits via smartphone)	0	3 11.11%	3 11.11%	15 55.56%	6 22.22%
Psychiatry (i.e. electronic home visits via smartphone)	2 7.41%	5 18.52%	7 25.93%	8 29.63%	5 18.52%

22. How likely would you be to use a smartphone application to guide you in wound management? (1, not at all likely. 5, very likely)		
	N	%
1, not at all likely	0	0
2, not very likely	1	3.7%
3, somewhat likely	6	22.22%
4, fairly likely	10	37.04%
5, very likely	10	37.04%

23. On a scale of 1-5, how strong of a barrier would the following items be affecting your use of a smartphone application to guide wound care? (1, weak barrier. 5, strong barrier)					
	1	2	3	4	5
Lack of knowledge in smartphone usage	7 25.93%	2 7.41%	5 18.52%	9 33.33%	4 14.81%
Lack of confidence in smartphone usage	7 25.93%	1 3.70%	7 25.93%	8 29.63%	4 14.81%
Lack of time/too busy to use the application	6 22.22%	6 22.22%	6 22.22%	7 25.93%	2 7.41%

Lack of knowledge on how to use the application	4 14.81%	5 18.52%	3 11.11%	10 37.04%	5 18.52
Lack of frequency treating wounds to become proficient in the usage of the application	1 3.70%	4 14.81%	10 37.04%	6 22.22%	6 22.22%
Lack of understanding of basic wound care	7 25.93%	8 29.63%	7 25.93%	4 14.81%	1 3.70%
Lack of necessity for a smartphone application to guide wound care	6 22.22%	6 22.22%	8 29.63%	5 18.52%	2 7.41%

24. Which of the following would guide your intentions to use a smartphone application to guide wound care? (check all that apply)		
	N	%
Perceived usefulness	21	77.78%
Perceived ease of use	24	88.89%
Perceived benefit to the patient	22	81.48%

25. Please indicate any other barriers you perceive regarding the use of a smartphone application to guide wound care.
How up to date the application is & approved use of the application by the facility.
Facility approval cost of buy-in, policies to support its use.
The biggest barrier is lack of knowledge in use of a smartphone. With adequate training, anything can be accomplished. This applied to nurses, caregivers, and patients.
No transmission (cell service) – ok for use at the clinic or hospital, but not for home health.
Getting a good enough picture of large sites so that it could be adequately assessed and treated.

