

Telehealth Wound Applications: Barriers, Solutions, and Future Use by Nurse Practitioners

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Abstract

Telehealth applications are an emerging technology in a new era of health care system technologies. Although telehealth technologies, including a number of different applications, are used by various members of the health care team, nurse practitioners (NPs) utilize them for a variety of patient issues across healthcare settings. The Indiana University-Purdue University Fort Wayne Computer Science Department has recently developed a wound scanning application, *WoundView* for nurse practitioners to utilize in different healthcare settings. Such telehealth mobile applications are used in clinics, home health, rural, and remote settings where a physician may not be readily available. However, there are obstacles with the current practice of using telehealth technologies such as a dire need for evidence-based research that supports attainable solutions for these barriers. Extensive, ongoing research will allow NPs to anticipate an immense mainstream implementation of telehealth applications in the very near future.

Introduction

Telehealth applications are an emerging technology in a new era of health care system technologies. Many advancements have been made in recent years in telemedicine technologies including mobile stroke units, wireless wearable sensors, leadless pacemakers, and wound scanning devices. The World Health Organization (WHO) defined telemedicine as “delivering health care services from a distance by interactive, visual, and data communications for the diagnosis, treatment, and prevention of disease and injuries” (2010, p.10).

Although telehealth technologies, including applications, are utilized by various members of the health care team, Nurse Practitioners (NPs) utilize telehealth technology for a variety of issues and in various settings such as clinics, home health, rural, and remote settings. Wound applications have been introduced to accurately assess a wound in remote locations. The use of these various applications and technologies bring common barriers including issues with current practice, financial considerations, compliance factors, and user willingness to implement and

utilize these technologies. Evidence-based research suggests potential solutions for these barriers. Such solutions include telemedicine initiatives like state legislators leading to an increase in reimbursement rates from the Centers for Medicare and Medicaid (CMS), encouraging telemedicine applications to become 'mainstream' in the health care system, and efficient technical support and telehealth champions that supports improved compliance among staff and patients throughout the process of incorporating telemedicine. Additionally, research allows NPs to prepare for the implementation of telehealth applications within hospitals and other settings that will lead to increased efficiency, decreased health care costs, and enhanced patient outcomes. With new and innovative ways to deliver efficient patient care, cost analysis and patient outcomes are observed and measured in telehealth technology studies (Foster & Sethares, 2014). This paper presents an examination of research in the literature to ascertain how telemedicine should be incorporated into mainstream healthcare delivery systems to benefit patient care.

Current Practice in Wound Care Management Post-Discharge

It is estimated that there are approximately 6.5 million patients in the United States that currently receive wound treatment. Approximately \$25 billion is spent annually on acute and chronic wound care management (Shah, Wollack, & Shah, 2015). Many of these patients require post-discharge wound care either at home by a registered nurse or in a wound clinic by a NP. Wound care management is defined as a clinician assessing a wound, classifying the wound type, determining wound stage, and formulating the appropriate action plan to promote wound healing in a timely manner. An acceptable wound healing timeframe is approximately forty percent wound improvement within the first three weeks of wound management (King, 2014).

Current Wound Management Procedures

Wound Assessment. Nurses are typically the clinicians who provide routine follow up wound care for patients discharged from the hospital. Nurses assess the wound's dimensions, color, odor, exudate, drainage, amount, consistency, staging, and evidence of potential infection such as increased temperature, etc. Other important factors nurses assess include wound classification, etiology, position, degree of pain, and characteristics of surrounding skin. Assessment findings are communicated by the nurse with the appropriate physician or NP for further recommendation and treatment. Wound assessment documentation is also important when managing the healing process and the effectiveness of wound healing (Santamaria & Kapp, 2013).

Common Wound Measurement Procedures. The most commonly used method of measuring a wound is the 'ruler and Q-tip method.' This method involves nurses simply using a paper or plastic ruler to measure the length and width of the wound and then using a cotton-tip applicator to estimate the depth of the wound. Other forms of wound measurement include acetate tracing by which the nurse or NP places a thin, translucent graph paper over the wound to map its 2D measurements (Shah et al, 2015). Although common practices of wound care management have enhanced wound healing, current innovations using telehealth applications are designed to provide state-of-the-art care that will further enhance wound care across the healthcare spectrum.

Current Telemedicine Advancements in Wounds Care. Evidence-based, efficient wound care telemedicine systems, particularly in the home health care setting, have continued to expand over the last 15 years or so. In general, telemedicine can be subdivided into three categories: teleassistance (remote wound assessment), teleconsultation (wound care in the patient's presence), or teleexpertise (multiple wound care clinicians assessing a particular case without the patient's presence) based upon authorization (Teot, 2014). There are two primary types of wound care telemedicine systems: store-and-forward (SAF) systems and video-conference programs. There are also hybrid systems that have both capabilities. Current research suggests that wound care telemedicine has significantly shown benefits for both patients and clinicians; however, there continues to be a lack of integration of these programs within current health care systems and electronic health records (EHRs) (Santamaria & Kapp, 2013).

The primary goal of wound care telemedicine is to provide clinically efficient and effective wound care post-surgery or post-hospital discharge by preventing infections, unnecessary emergency room visits, and hospital readmissions. A study by the American College of Surgeons National Surgical Quality Improvement Project (ACS NSQIP) discovered that 42% of surgical site infections (SSI) developed post-discharge from the hospital. Patients who developed SSIs post-discharge, were found to have an increased likelihood of needing reoperation and their mortality rates increased significantly (Tevis, 2014). Telemedicine applications have successfully shown effective management of wound and SSI complications post-discharge by offering more precise daily assessment surveillance and intervention for NPs (Semple, Sharpe, Murnaghan, Theodoropoulos, and Metcalfe, 2015).

The Indiana University-Purdue University Computer Science Department has just introduced a mobile application and scanning device for the advancement of remote wound care. *WoundView* has the capability to scan, photograph, and calculate the exact dimensions of a wound. It then transmits the data to a dashboard for the NP to assess, diagnose, and implement appropriate interventions. Technologies such as *WoundView* create an improved standardized process for wound measurement, healing trends, and provide accurate documentation for healing prediction (Shah et al, 2013). *WoundView* and similar technologies show far greater predictive accuracy than traditional methods such as 2D planimetry, acetate grid tracing, and the ruler method as denoted in Table 1.

Table 1

Benchmarked Variances of Wound Measurement Methods

Method	Variance
Ruler Method	75%
Acetate Grid Tracing	41%
2D Planimetry Volumetric Method	52%
3D Scanner with Volumetric Method	11%

Note. There has been found to be less of a variance in wound measurement with 3D scanners with volumetric capabilities versus the traditional ruler method, acetate grid tracing, or 2D planimetry volumetric methods. Adapted from Shah, A., Wollak, C., and Shah, J. (2013). Wound measurement techniques: comparing the use of ruler method, 2d imaging and 3d scanner. *Journal of the American College of Clinical Wound Specialists*, 5(3), 523-533.

Benefits Versus Issues When Using Wound Telemedicine Technologies

According to the literature, one benefit of telemedicine technology is enhancement of patient quality of life and access to wound care (Teot, 2014). Other benefits include time efficiency, reduction in patient expenses, more communication and feedback from providers, as well as increased patient satisfaction (Foster & Sethares, 2014). Of major importance is patient quality of life and access to wound care that has immensely improved with telemedicine technologies (Teot, 2014).

It is well documented that telehealth applications and telemedicine technologies have many beneficial patient outcomes; however, there are some limitations and issues that should be considered. It should be noted that patients should ideally first meet face-to-face with a wound management expert prior to the use of any telehealth wound applications. Nevertheless, establishing meetings is not always a feasible option for patients due to remote locations, disabilities, or transportation issues. A controversial issue of whether telehealth applications are truly affordable and cost-efficient must also be taken into consideration.

As well, smartphone applications may be difficult for technology-naïve patients, patients may not own a smartphone, and elderly patients may have difficulty navigating the smart phone or application interface. Elderly patients may also become anxious or annoyed while attempting to adjust their lifestyle to include the use of telehealth technology (Foster & Sethares, 2014).

Barriers to Implementation of Telemedicine in the Healthcare Industry

Telemedicine, including telehealth applications, have multiple limitations that restrict the widespread adoption of these technology programs. Some issues that were identified in one

study suggested that the following factors influenced successful implementation of telemedicine: Sufficient clinician education and training, efficient technical support for troubleshooting, and level of involvement of a local champion during the initial planning phase (Angel et al, 2015). Cost-benefit analyses may also vary dependent upon the facility, stakeholder interest, patient population, and geographic location for telemedicine use. Reimbursement for telemedicine is also variable and provides its own limitations in the utilization of telemedicine technologies. Historically, the Center for Medicare and Medicaid Services (CMS) generally only reimbursed telemedicine services if the patient is located outside of a metropolitan area, if patients live in rural locations, or in an area with a health care provider shortage. Reimbursement stipulations also vary from state to state (HCPro, 2015). The misconception of how and why telehealth should be used based upon geographic location hinders its adoption into the mainstream health system. Telemedicine, including mobile applications, should be viewed as a virtual modality instead of a separate service requiring its own unique billing codes (Dinesen et al., 2016).

Solutions to Barriers of the Integration of Telemedicine in Healthcare

One of the first steps in determining feasible solutions to some of the obstacles that telemedicine faces is encouraging state regulators to define telemedicine and determine how to renegotiate payment and reimbursement conditions from a state level. Telemedicine technologies offer a new frontier level of care; so, it is expected to receive some resistance until clarifications of its definition, purpose, and outcome are detailed by state regulators (HCPro, 2015). Interestingly, a 2015 study found that the average hospital inpatient stay cost \$820 per day, long term care facility stay cost \$100 per day, and home health visits averaged \$74 per day. In contrast, telemedicine (specifically "virtual visits") only cost \$30 per day (Baig, Gholam Hosseini, and Connolly, 2015).

It is feasible that telemedicine is not something that should simply be added to the mainstream health care delivery system, but incorporated as an innovation at the system level. The incorporation of telemedicine involves assessing the patient subpopulation flow, altering the general approach to care, assimilating telemedicine technologies, and altering existing care delivery approaches (Dinesen et al, 2016). Current and future telehealth initiatives are needed to facilitate the integration of telemedicine into contemporary EHR systems.

The Future of Telemedicine in Healthcare

Telemedicine and mobile apps are gaining more attention with new applications and devices that have been recently introduced to the market. As Dinesen et al (2016) outlined, there are eight key elements that will soon be driving the future of telemedicine:

1. Personalization of the delivery of health care
2. Matching certain patients with corresponding technologies
3. Efficient use of data; including a secure interface between the patient and provider
4. More opportunities for patient education

5. New communities of clinical practice
6. Care models and business models adapted for sustainability of telemedicine initiatives
7. Increased scientific research converged with evidence-based practice
8. Forward-thinking research approaches within telemedicine (Dinesen et al, 2016)

The clear majority of today's telehealth technologies only focus on one issue or disease process. The Centers for Disease Control and Prevention (CDC, 2016) estimated that 25% of Americans have multiple chronic diseases with statistics rising to 75% in the geriatric population over age 65. Because of the commonality for patients to have multiple diagnoses, future telehealth applications will need to be versatile in addressing multiple acute and chronic patient problems. In other words, there needs to be increased patient personalization that is tailored to their specific comorbidities.

Discussion

There have been many great advancements in telehealth wound applications and other telemedicine technologies. However, there have been barriers such as conflicts in cost efficacy, reimbursement, standardization, integration into current practice, and skepticism by stakeholders. The primary solution to the increased utilization of telemedicine wound applications will be supported by strong research-based evidence that telehealth applications are both sustainable and scalable. Nevertheless, it is clear that the future of telehealth technology is on the rise and will eventually be embraced by the current health care system in order to ensure advancement of enhanced patient outcomes, cost, and quality of life (Dinesen et al, 2016).

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Alyssa Shelton, RN, BSN is a graduating Adult-Gerontological Nurse Practitioner student from Indiana University-Purdue University Fort Wayne (IPFW). In 2017, she served as the Medical Advisory role in IPFW's Computer Science Department's telemedicine project. She also presented at the 2017 Xi Nu Research Symposium about Telemedicine and its future implications for nurses.

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