Grant Final Report

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Telewound Care Network

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Abstract

Purpose: This study was to demonstrate the clinical effectiveness and cost-effectiveness of utilizing telehealth technology to reduce the days to heal for chronic wounds. Health information technology was utilized to improve access to knowledgeable caregivers, point of care processes, and dissemination of best practice information.

Scope: Fifty six patients from five rural and four metro counties in Oklahoma were enrolled.

Methods: The primary outcome measure was the time to heal. The unit for allocation was counties matched by characteristics, then allocating counties to receive either telehealth intervention or the community standard care. Pictures of the wound were taken at fixed intervals, and independently interpreted. The study incorporated a combination of broadband, analog, and web-based applications to patients in clinics, homes and long-term care facilities.

Results: Analysis had to be made within the telewound group for outcomes as too few were referred to the control group. The percentage of wounds that healed was 49.09% Early identification and intervention resulted in statistically significant decreased healing time, but the evidence was insufficient to prove utilizing an evidence based telewound approach leads to healing times that are superior to or different from those with standard treatment modalities.

Key Words: telemedicine, telehealth, wound care, diabetes

Final Report

Purpose

The specific purpose of this study was to evaluate the clinical effectiveness and cost-effectiveness of utilizing telehealth technology to reduce the time to heal for chronic wounds. The approach utilized health information technology to improve access to knowledgeable caregivers, point of care processes, and dissemination of best practice information.

Goal 1: Improve the Effectiveness, Quality and Efficiency of Health Care Delivered to Citizens of Oklahoma, No Matter Where They May Be Located

Objective 1.1: Expansion of Wound Care Network Results from Earlier Grants.

- Increase physician and case manager awareness of telemedicine services
- Strategic business planning for continuation after the study

Objective 1.2: Disease Management Documentation.

- Gather wound care and diabetes documentation
- Dissemination of information

Goal 2: Promote Wound Care Practices that Are Evidence-Based and Enhance Time to Wound Healing

Objective 2.1: Expand Current Evidence-Based Services Using Telehealth.

- Expand sites
- Demonstration and education on evidence-based practice

Objective 2.2: Improve Diabetes Management.

- Improve disease management utilizing videoconferencing and vital sign monitoring
- Increase compliance of evidence-based practice through increased and more timely interventions

Objective 2.3: Address Chronic Conditions in a Variety of Settings.

- Make services available to patients through home health, LTC facilities

Scope

Background

Chronic wounds are a national health problem. Chronic wounds, defined as wounds not healed in 30-days, have a high rate of occurrence and have significant clinical, cost, and social implications.[1] It is estimated that 5 million patients in the United States have chronic wounds, and that 1-2 million people develop new pressure ulcers each year. Costs to treat chronic wounds are high. Cost to treat a pressure ulcer, a common chronic wound, is estimated to range from $4,000 to $40,000 for a newly developed wound. [2] Hospital costs to treat chronic osteomyelitis of the pelvis resulting from truncal pressure ulcers average $115,635 per patient, excluding flap surgery that would add another $50,000 to $150,000 to the cost of care.[3] Chronic wounds are not only costly, they are painful, a source for infection and increase the risk of death. Chronic wounds impact other quality-of-life issues, including life satisfaction, mental health, productive use of time, and caregiver burden.[1]

- 5 million patients in the U.S. have chronic wounds
- In 1992- total charges for 34,000 inpatients with primary diagnosis of pressure ulcer was $836 million, not including secondary costs
- Diabetic foot ulcers and lower extremity amputations can be reduced by 44% - 85% through preventive care practices including appropriate wound management.[4]

There are challenges to delivering wound care services. Numerous healthcare providers and caregivers do not have the latest wound care guidelines. Wound care constitutes 48% of home health services provided in the nation according to the most recently available Centers for Medicare and Medicaid Services (CMS) Case Mix Report. Rural areas nationally have about half as many physicians per capita as urban areas[5] and there is a shortage of certified wound care nurses (CWCN) who are generally the primary clinician in specialty wound treatment centers and teams. Access to a CWCN can reduce time to healing for a wound and decrease related costs, yet there are only 3,930 of these specialists to serve the whole nation.[6] Additionally, wound care services are not reimbursed separately from home health, so there is a disincentive to utilize them. This gross disparity between patient need, reimbursement, and available practitioners is acutely felt in the rural communities.

Despite the high wound occurrence, few LTC facilities have the resources or ability to secure a wound specialist. If a facility is fortunate enough to get one, a CWCN can only handle five or six patients a day. With telemedicine, the CWCN can handle 15-20 patients a day.[7] Small studies where CWCN used telemedicine have shown positive results.

- 50% decrease in home visits for Medicare patients
- Decreased supply costs by 30-40%
- Reduced healing time by 30% (greater in more severe wounds)
- Reduced re-admissions [7,8]

A major contributing, but often overlooked, co-morbidity to chronic and non-healing wounds is diabetes. There are 25.9 million people in the United States (7.8%) with diabetes The complications from diabetes, including wounds and lower extremity amputations, cost the United States economy of $174 billion in direct and indirect costs.

About 40% of the patients entering the INTEGRIS Wound Care Center in Oklahoma City have diabetes. If blood sugars are too high, healing will not occur, and should be addressed as part of the wound treatment plan. Oklahoma has the second highest diabetes rate in the nation – and the second lowest in expenditure for diabetes services.[9,10] Many Oklahomans with diabetes remain undiagnosed since diabetes is generally without symptoms until complications develop. Evidence suggests that for every one person diagnosed with Type 2 (non-insulin dependent diabetes mellitus-NIDDM) there is another undiagnosed individual with diabetes. [11,12] Cultural diversity throughout the state contributes to the challenges of education, patient compliance, and cooperation with treatment regimens.[13]

Availability of the right knowledge at the right time has the potential to improve patients' quality of life, reinforce prevention, and improve diagnosis and treatment decisions. [14-18] Increased access to information through the Internet has increased patient knowledge and participation in their self care management. Recent reimbursement changes and easy connectivity have increased investment in and utilization of information systems both to influence patient behavior and for direct care.[19] Additionally, research has shown direct benefits when there is easy access to clinical and educational material.[20]

A study conducted in conjunction with Veterans Affairs evaluated the accuracy of a store-and-forward telemedicine system for assessing the status of chronic wounds. Study patients included inpatients and outpatients with pressure ulcers of stage II, III, or IV, plus outpatients with diabetic foot ulcers or venous stasis ulcers. A total of 70 patients were enrolled with up to six televisits per wound. Physician on-site evaluation correlated highly with telemedicine evaluations.[21]

Participants in Telewound Study

Fifty six participants from five rural and four metro counties of Oklahoma that had a chronic wound, defined as a wound that hadn't healed for 20 days, were included in this study.

Methods

Overview of Study Design

The study design was a controlled trial to evaluate outcomes utilizing a telehealth strategy incorporating evidence based practice guidelines as compared with outcomes utilizing the current standard of care in the community comparison to the current standard care provided in the community. The primary outcome measure was the time for the wound to heal. The unit for allocation was different counties in Oklahoma, but the unit of analysis was the individual patient. This strategy was used to avoid contamination of the standard care control group by the telehealth/evidence –based strategy, which would occur if the same providers in a county were delivering care in both the control and intervention groups. A true randomized allocation to the intervention or control groups was not possible due to logistic reasons, and to avoid withdrawal of telehealth services from counties in which telehealth was already been implemented. Bias was minimized by pairing selecting counties by their demographic and other characteristics, and then allocating counties within these pairs to receive either the experimental telehealth intervention or the community standard care (control group). Bias in the assessment of the outcome of wound healing was avoided by taking pictures of the wound, using a standardized method, at fixed intervals in all patients, and then having them confirmed at the study's end by an independent clinical expert, without knowledge of the patient or the patient's group assignment.

Patients: Criteria for Eligibility and Ineligibility

Patients included in the study had full or partial thickness wounds that hadn't healed for at least 20 days, and were referred by their primary care provider for specialized wound care services either to a wound center, home health agency or long-term care facility. Patients were ineligible if they had one or more of the following: 1) wound requiring surgical treatment (tissue around wound does not have adequate innervation or blood supply to heal), 2) patient will not get follow up care by a healthcare professional or trained caregiver, 3) no electrical or phone outlet is available for home telemedicine unit, or 4) severe expressive or receptive communication impairment. Patients under hospice or incarcerated were excluded. Patients with either Type 1 or Type 2 diabetes, if applicable, were eligible to participate.

Informed Consent

The legal department of one of the partners in the study, INTEGRIS Healthcare System, had developed a telemedicine services consent form for an earlier study. It included permission for telemedicine interventions and for data to be used for a study. This served as the template for the telemedicine consent form that was integrated into the telewound care study process and was signed by either the patient or their legal guardian before telemedicine services were supplied. The Informed Consent form was presented and approved by the Internal Review Board (IRB) prior to commencing the study.

Baseline Assessment

Baseline data was gathered from medical records and interview with each participant at entry into the study including demographics, medical history including previous wounds, current wound type and previous treatment. The baseline interview included a Quality of Life and, when appropriate, a diabetes questionnaire. An initial picture of the wound was taken and staged by the on-site provider. Staging was confirmed by a wound care expert at the study conclusion by de-identified picture and support information.

Intervention Allocation

The county of patient residence determined the patient's treatment group assignment into either "standard care" or the "telehealth" intervention group The "Standard" group was the group that received care as usual in their home community. The intervention group was the "Telehealth" group that received evidence-based services through the telemedicine technology. The wound care center at INTEGRIS Baptist Medical Center (IBMC) grouped their patients by home zip code to find major areas of referral in the state. Those regions were then paired with other regions based on demographics and population base. (Appendix C) Care was taken to separate the "standard" from the "telehealth" regions by distance as much as possible to help avoid contamination. Regions already served by the INTEGRIS Telehealth Services telewound care were assigned to the telehealth group.

Results

Information Dissemination

The first goal was to improve the effectiveness, quality and efficiency of health care delivered to citizens of Oklahoma, no matter where they may be located. This goal was achieved. Participants in the study often cited the educational component of the study as a major benefit to them. Initially, presentations were made on-site to physicians in both rural and metro settings on telemedicine and its potential applications. Additionally, telepresentations were used telemedicine were used to educate healthcare providers on best evidence-based practice for wound care and diabetes in group classes as well as through individualized coaching and/or sessions.

Group education was offered quarterly on diabetes care over broadband videoconferencing to rural sites, while metro participants attended on-site. Originally, full day classes were planned, but feedback from site directors was that two hours was the most at a time that they could free staff to attend. Educational materials were sent to the attending sites in advance, based on number attendees anticipated. The class was conducted by a Certified Diabetes Educator with time at the end of the session for question and answers. Wound care group education was offered twice over videoconferencing, and a few home health in-services were provided locally. The wound care class was conducted by a Certified Wound and Ostomy Care Nurse (CWOCN).

Both educational offerings were attended predominately by nurses and physical therapists, with attendance ranging ranged from four to eighteen at a time and two to four sites had providers attending Two rural home health directors followed an educational rotation, having different staff members attending the training each quarter. The providers voiced that not only were the materials and formal presentation of value, but that they now knew an expert they would feel comfortable contacting in the future. Providers from a site outside the study asked if they could attend a remote site presentation at a remote site, even though they were not in a county included in the study, further demonstrating that the providers who had attended the training sessions felt they were of value. Follow up contacts with the point of care providers were performed via email or conducted over analog videophone.

Part of the approach to encouraging participation in the study was to offer provider coaching/specialty consults individually with videophones. Few actually took advantage of this technology though it was easy to use and didn't require broadband connections. The few that did use this approach found it of great value. For example, one home health nurse was monitored by the CWOCN as she used a specific wound care tool utensil for the first time. Another example dealt with patient non-compliance. This was in a rural setting where and the patient had known the home health nurse since she was a baby, and was hard-pressed to accept that the nurse was competent in wound care. A videophone was used to connect the CWOCN over the patient's phone line during a home health visit. The CWOCN confirmed that the home health nurse was following proper dressing regimen and answered other questions the patient had about their wound. The patient demonstrated greater confidence in the plan of care and improved in their compliance.

It was found that it would be beneficial to the study to have a nurse in a rural area without a CWOCN to have the additional training for this specialty. Grant funds helped with her final training costs. She was then active in the telehealth study and, with telehealth technology, was able to help patients in five counties which covered a total of 6,500 sq. miles. Home health agencies that used this CWOCN's services commented that they would continue to use them after the study end.

> *"Prior to the study it was almost impossible for this type of patient to get the consultation and specialized care that is not accessible in a small rural community" Betty Laughlin, RN, Rural Home Health Administrator*

An existing HIPAA compliant, password protected Electronic Health Record (EHR) by Cybernet Medical System was used for all patients enrolled in the study. A wound care page was developed during the study to archive the digital pictures of the wounds and other information such as size, color, and wound drainage. Remote vital sign monitoring that was the basis for this EHR was used with patients with diabetes. The wound pictures could be linked to glucose, blood pressure, and weight readings for the seven days prior to a specific picture. The EHR also housed a dynamic progress report that could be read and added to by the patient and any of the patient's providers.

A disappointment of the study was that this electronic health record was never viewed directly by physicians. One physician instructed personnel what to put in it for him and two physicians asked for reports to be sent to them. When asked why they didn't use it, answers ranged from time constraints already in their practices to outright resistance to learning a new program.

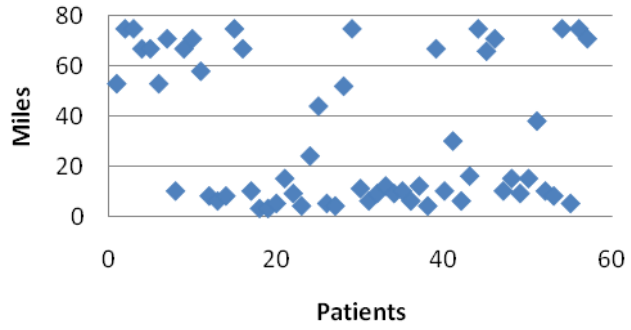
Two home health agencies used the vital sign monitoring with all their patients in the study, but didn't utilize the progress reports. The two main users of the wound care page were the CWOCN and CDE who also were the educational session presenters. They both commented that the most useful part of the EHR for them was the combined progress report that was created in the EHR. The progress report helped them coordinate respective plans of care including medication changes, and gave them the opportunity to reinforce each other on items such as nutrition when they spoke with patients and caregivers.

Impact on Wound Healing

The study's primary purpose was to evaluate the effectiveness, as reflected in wound healing time, between a telehealth strategy and the standard care provided in the community. The comparison group included individuals who received the community standard of care. A total of 56 individuals participated in this study, but only 2 individuals were allocated to the comparison group. Because the comparison sample's small size prohibits between-group comparison, analysis had to be made within the telewound group for outcomes. The group was too small to adequately describe statistics on risk factors and outcomes. Though this limits the scope of the findings, some information could be derived.

There were 34 males and 22 females in the study. Patients were from both metro (56%) and rural (44%) counties. Figure 1 shows travel and time as a measure of access to wound specialty care. Patients in metro counties averaged 9.2 miles and 17.3 minutes drive time one-way to a wound care specialist. Rural patients averaged 61.6 miles and 66 minutes drive time one-way to the nearest wound care specialist.

Figure 1. Mileage (one-way) from the nearest wound specialist or clinic



Patient care sites shown in Figure 2 included three metro wound clinics, one metro and two rural physician clinics, 1 rural and 1 metro hospital, two rural home health agencies, and two rural long term facilities (LTC). Home health agencies were the primary wound caregivers for patients in LTC, and wound clinic personnel attended the patient in the metro hospital setting.

The percentage of wounds that healed among the patients in telehealth group was 27/55 (49.09%). Among those with unhealed wounds (50.91%) are patients whose wounds had not healed when the study closed, patients who left the study, and certain participants who were not eligible.

Figure 2. Site where the patient was when wound care was administered

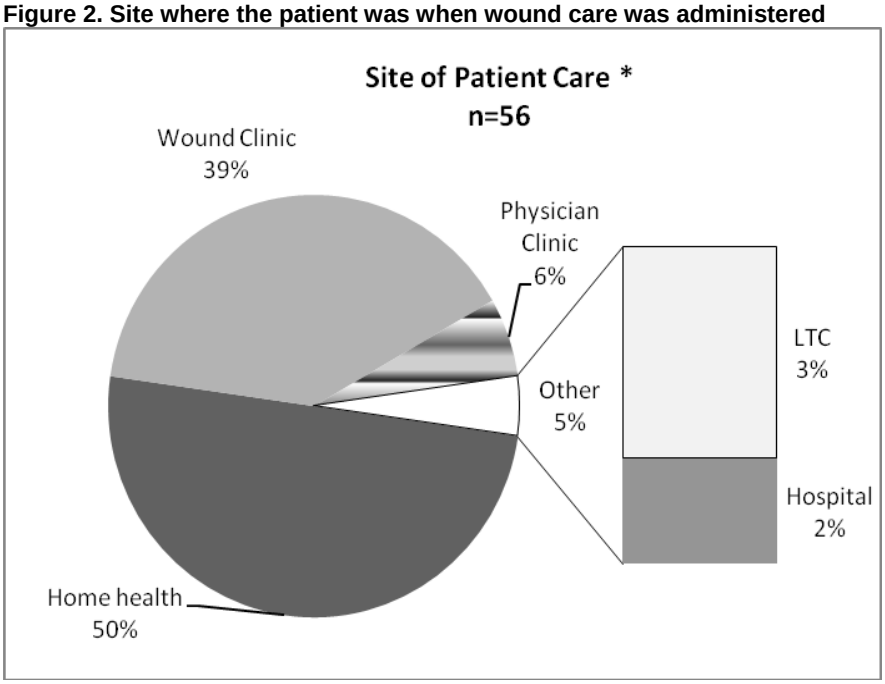


Table 1 shows that the mean healing time was 36.10 weeks (only those whose wounds healed in the study limits are included in this table). The 95% confidence interval refers not to this sample of 27 persons with healed wounds, but to a theoretical population from which these patients were randomly sampled. Nine patients in the telewound group had two wounds. For Time-to-event analysis, specifically the Kaplan-Meier method, estimated mean healing time by using data on all wounds (healed and unhealed) among patients in the Telehealth group. Times for unhealed wounds (censored observations) were calculated as the duration from the date the wound appeared to either (1) the date on which the patient was last seen by study personnel with an unhealed wound or (2) the date of termination of the study, which was September 3, 2008. The Kaplan-Meier method underestimates the mean survival time (58.1 weeks) and its standard error (5.3 weeks) because there were wounds still unhealed at the end of the study.

Table 1. Summary statistics for wound healing time (weeks)

N	Mean	Std Dev	Minimum	Maximum	Lower 95% CL for Mean Healing time (in weeks)	Upper 95% CL for Mean healing time (in weeks)
27	36.10	23.82	6.81	95.88	26.68	45.52

Table 2 illustrates other healing times estimated by Kaplan-Meier analysis, including median (as opposed to mean) estimated healing time:

Table 2. Estimated healing times based on time to event analysis

Percentile	Point Estimate	95% Confidence Interval: [Lower	95% Confidence Interval: Upper)
75	.	78.069	.
50 (median)	56.054	34.907	95.885
25	30.562	16.946	42.149

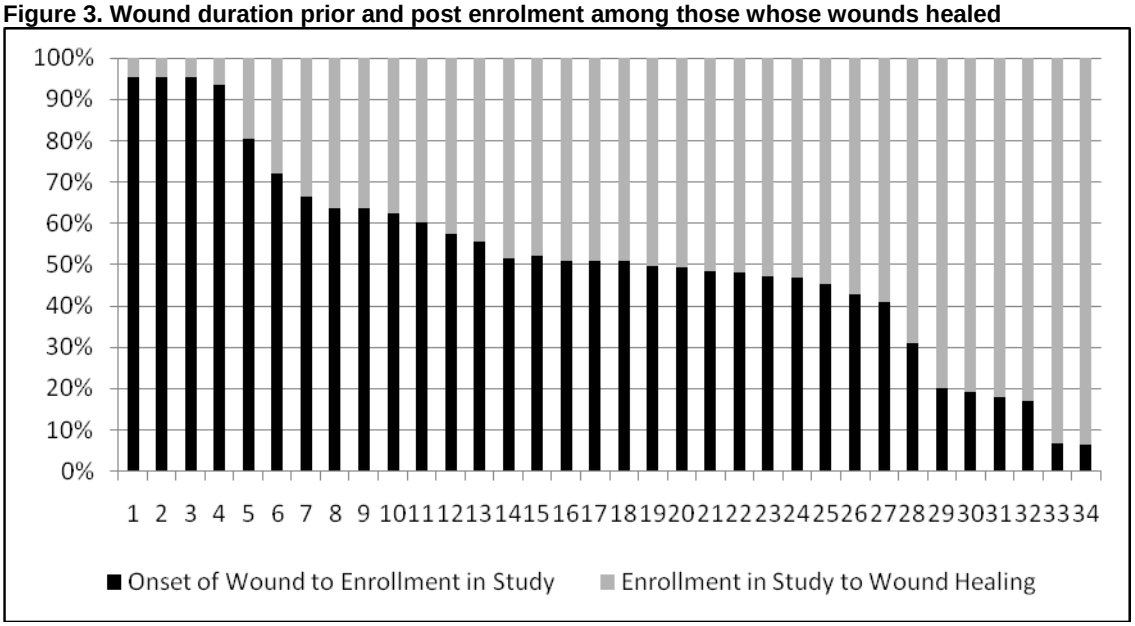
We investigated whether patients with longstanding wounds healed relatively quickly. This chart indicates that the picture is mixed. Certain patients with longstanding wounds did heal quickly once enrolled in the program.

One patient, for example, had a wound for three years before entering the study. Evidence-based protocols called for more complete lab work than was standard, and it was discovered that this patient had undiagnosed diabetes. Individualized diabetes and wound plans of care based on evidence-based protocols were created. It was determined through telemedicine that the patient needed to be brought to the wound care center for more advanced intervention than could be provided locally. After the specialized intervention, the patient returned home where the local providers followed both wound and diabetes care plans and the patient was healed in eight months after enrollment in the study.

Another patient in a hospital with a swollen limb and physicians were debating amputation. The patient was enrolled in the study, again diabetes was uncontrolled, and therefore diabetes as well as wound plans of care were developed. The patient healed in six weeks.

These were examples of dramatically positive outcomes from the study. Others in the study, however, had long healing times in the telewound program. Figure 3 relates wound onset calculated from the date the wound began to the enrollment date, and healing time, calculated as the time elapsed from enrollment to wound healing.

Figure 3. Wound duration prior and post enrolment among those whose wounds healed



Demographic, lab, and metabolic data was reviewed to help define what variables might have affected the study outcomes. It was discovered during the study that often insurance would not pay for A1C tests unless the patient was already diagnosed with diabetes. Permission was requested and secured for the study to pay for this test should insurance not cover it, since it was a component endocrinologists needed to diagnosis insulin resistance which retards wound healing. Patients were then able to be diagnosed and appropriate plans of care developed. As seen in Figure 4, 73% of the patients had some kind of metabolic condition at enrollment. About half (49%) of those with metabolic conditions were uncontrolled or undiagnosed at study

enrollment. Unfortunately due to incomplete data collection for blood glucose and A1C as well as the small sample size, no specific conclusions could be drawn from longitudinal tracking of this clinical outcome data.

Figure 4. Metabolic status at entry

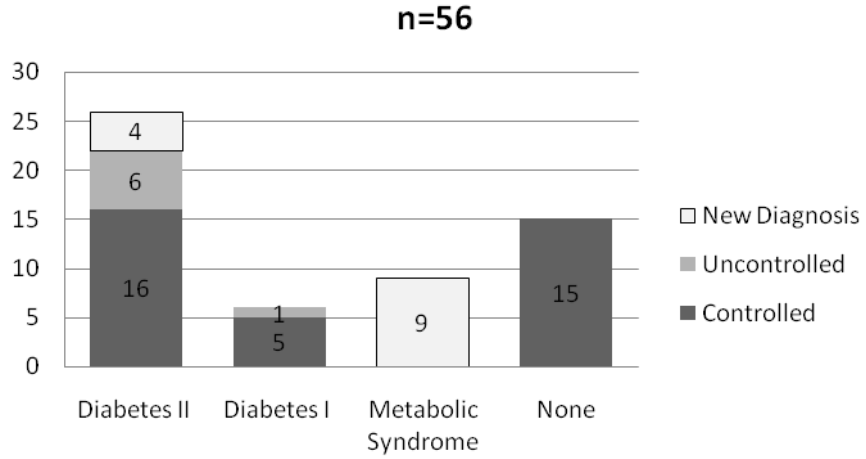


Table 3. Metabolic condition and obesity by gender

	Gender	n	Percent	p-value for chi-square
Metabolic Syndrome	Male	4	10.30%	
Metabolic Syndrome	Female	5	20.80%	0.244
Diabetes II	Male	13	34%	
Diabetes II	Female	12	50.00%	0.39
Obese	Male	9	58%	
Obese	Female	7	34%	0.086

Table 4. Selected lab results at enrollment by gender

	Gender	n	Mean	p-value for t test
Fasting Glucose	Male	26	104.31	
Fasting Glucose	Female	16	123.13	0.241
Triglycerides	Male	21	127.1	
Triglycerides	Female	13	129.7	0.902
HDL	Male	21	48.25	
HDL	Female	12	48.23	0.995

Table 5 shows that early identification and intervention resulted in statistically significant decreased healing time. Unfortunately, the evidence still can't tell us whether timely intervention utilizing an evidence based telewound approach leads to healing times that are superior to or different from those we'd observe with standard wound care treatment modalities. It can be speculated, however, that the improved access to specialized evidence based wound care provided via telemedicine led to more timely referral and intervention. protocols.

Table 5. Healing time related to time of intervention

	Wound Duration (wound began to enrollment)	Median Healing Time	p-value
Healing Time(enrollment to wound healing)	≤50 days	203.79 (47.65 - .)	0.67
Healing Time(enrollment to wound healing)	>50 days	295.04 (122.68 - .)	
Time(wound began to wound healing)	≤50 days	180.98 (68.94 - .)	0.04
Time(wound began to wound healing)	>50 days	546.49 (334.58 - .)	

Log rank test determined if healing time differed.

Study Limitations

There were several execution challenges. The first was recruitment to the study. Since a "real world" setting was proposed, there wasn't a dedicated research group or closed population typical of study methodologies. Local providers had to be convinced to refer to the study and commit to following the study protocols for wound care, and if applicable, diabetes care. While some physicians were supportive of the study and willing to refer, enrollment into the study was sometimes blocked at the home health and long term care facilities. As an example, the medical director of a long term facility made a special effort to tell the nursing director that he wanted his patients included in the study. Follow-up meetings with directors proved futile, however, as they had fears of possible development of negative perceptions within the community of the care given in the facility and resulting liability.

Short staffing, frequent turnover, and narrow profit margins also played into the resistance in long term care facilities. The director of one site, for example, had to cancel our meeting because the cook was sick and he had to cook for the residents that day. For many, the additional work load -- even when financial incentives were provided -- was beyond their capabilities.

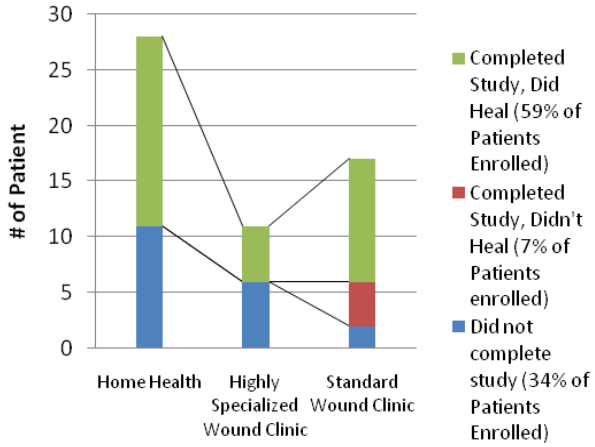
Comparison of a standard to an intervention group was also impossible due to almost no referrals to the standard group. Most physicians were willing to refer to the telewound intervention group but never referred to the standard care group. They voiced concern over referring to the standard group because it was extra work for their staff without immediate benefit to the patient. The two referrals to the standard group were from a champion of the telewound study in a wound care clinic that served patients from both standard and telehealth counties.

When writing the proposal for the study, it was anticipated that the IBMC wound care center, which included all levels of wound care including surgery, would be a robust referral source for both standard and telewound care since they had referrals from all over the state of Oklahoma. Most of their referrals, however, were found to be requiring surgery or other more aggressive treatment which disqualified them from the study. The main referrals from this clinic were patients with advanced wounds suspected as having underlying metabolic conditions. The IBMC Wound Center surgeon, who served as the expert reviewer for wound staging for the study, commented after reviewing all of the wound images that he would have referred more patients if he realized wounds like those [stage II wounds] were accepted in the study.

Several strategies were employed to recruit to the study. Office visits, conference presentations, phone calls, hospital contacts, home health agency visits, letters to providers thanking them for referrals, and advertisement for a month in local newspapers were utilized. A primary care physician research network was approached and despite letters, presentations, follow up calls, and endorsement from its president, few referrals resulted. In the final year, the physician research network staff was enlisted to help promote the study as part of their regular

rounds to rural sites, but had little effect. Recruitment and data gathering required a great deal of time and effort. Typical health care providers and their office staff usually have neither time nor sufficient intellectual curiosity to fit in such an endeavor. Even providers in the primary care physician research network didn't refer. One physician said his staff threatened to quit if he took on another study. Another study in three rural communities found similar time constraints and limited provider buy-in. [22]

Figure 5. Study completion by type of site



We reviewed comments and conversations to assess strengths and weaknesses in conducting the study, and how they might be addressed in the future. It was apparent that there needed to be a local advocate for enrollment. Three sites eventually became the main sources for the study, and each had an internal on-site champion provider who believed in the study and was willing to recruit, enroll, and be responsible for the photos required for the study. It took a great deal of effort to get referrals, especially from long-term care facilities.

Another barrier to referrals to the study was current practice patterns. It is difficult to achieve true "buy-in" by family practice offices to take the time to resolve wounds and related issues when they currently refer out to home health or wound clinics. Almost all referrals to the study came from nurses and one physical therapist, rather than physicians. These providers were champions of the study, and helped both in getting physicians to allow their patients to be in the study and keeping the patients in the study until time limits or wound healing occurred.

A possible solution for future studies would be having dedicated regional resources within ½ hour drive of any providers that were being asked to refer to the study. A dedicated recruiter within each recruitment area could then go to the offices and handle all paperwork and data gathering required. A requirement in this study was for the person taking the photos to have wound dressing changes within their scope of practice, thinking that a dressing change was the most convenient time to take the wound photo. This limited who could take the pictures. Having the dedicated staff person able to do this would lessen the burden on the local provider's staff and increase chances for referral. Regional resources centers might also help address a separate issue found in small communities: fear of lack of anonymity and potential for being the gossip at the local coffee shop. This was one deterrent mentioned when asked about lack of participation in the study.

Finally, there were technical issues. Though digital cameras are considered commonplace, some sites indicated that they didn't want to mess with camera, photos, and protocols. Objections voiced included unfamiliarity with the camera, that they lacked time and/or expertise to send the pictures over e-mail to the central data administrator for the study, that they were afraid they would erase the pictures, or they lacked the computer skills to send the pictures. One change from the original protocols that was implemented as an alternative was to save the wound photos on a memory card, then sending the memory card in a self-addressed and stamped envelopes weekly to the project manager for them to input in the electronic record, rather than sending them electronically as photos were taken. This slowed down the availability of the pictures to the CWOCN when needed, but it did increase participation in three sites.

Another technical issue was use of the on-line vital sign monitoring/wound page/electronic health record. Part of the problem was the computers in some sites were old or/or didn't have the required operating capabilities. One site, security firewalls that the company would not open up created barriers. Broadband, required for the website, was not always available at the care sites. There were wide variances in computer savvy, from high level to those who had never used one. Providers that were already familiar with other electronic health record programs usually didn't want to spend time or effort to learn to use the one in the study. Despite potential advantages of all the technologies, e-mail still seemed the favored mode of communication and information exchange.

We would suggest redesigned studies seeking to show that providing access to evidence based wound care through telehealth services does increase early identification and intervention thereby improving clinical outcome and reducing costs of care. We also would suggest consideration to accept research that is less strict in design for future studies, acknowledging that there are limitations inherent in real world settings that make more traditional research models difficult to implement.

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- Contributors. Cybernet Systems Corporation; Convatec; ediba Diabetes Center of Excellence; Evident Telehealth Services; INTEGRIS Health; LifeScan; Molnlycke

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