An Observational Study to Assess an Electronic Point-of-Care Wound Documentation and Reporting System Regarding User Satisfaction and Potential for Improved Care

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Abstract
The integration of information technology into daily patient care potentially provides a means to standardize care and enable continuous quality improvement through improved communication among care teams. A 2-month observational study was conducted on 38 residents with pressure ulcers at a 51-bed skilled nursing facility to rate the Ease of Use and Wound Management Effectiveness of a point-of-care electronic wound documentation system. Nine nurses evaluated the use of handheld “smart phone” devices equipped with a digital camera to document pressure ulcer assessment and treatment at point of care. Ease of Use (five items) was scored on a 5-point Likert scale (5 = very easy); Wound Management Effectiveness (eight items) was scored on a 5-point Likert scale (5 = very effective). Statistically significant mean changes in nurses’ ratings were found for baseline compared to 2-month follow-up by paired t-test. Ease of Use ratings across the five criteria increased from an overall mean of 3.3 at baseline to 4.7 at follow-up (P = 0.5), while Wound Management Effectiveness increased from an overall mean of 3.3 at baseline to 4.4 at follow-up (P = 0.5). The greatest gains for single items were reviewing wound progress (mean difference = 2.35; P = 0.000) and recognizing changes in wound status (mean difference = 1.78; P = 0.001) within the Ease of Use and Wound Management Effectiveness scales, respectively. The smallest change occurred in reading charts and notes (mean difference = 0.89) and ability to determine resident’s risk level (mean difference = 0.39). Further research is needed to assess use of a wound documentation system in this and other settings, as well as to ascertain validity and reliability.

Keywords: electronic wound documentation, mobile device, mobile wound care application, point-of-care documentation, wound care management process

Index: Ostomy Wound Management 2012;58(3):46–51

Potential Conflicts of Interest: Ms. Scheurich is an employee; Dr. Croghan and Dr. Sheridan own stock; and Ms. Kurtz is a consultant for Telemedicine Solutions, LLC. Telemedicine Solutions, LLC provided an editing grant to Ms. Kurtz and Dr. McClain and a statistical analysis grant to Dr. McGill.

Literature Review
The annual prevalence of persons with a pressure ulcer in the United States has been estimated at approximately 2.5 million. Using an observational, cross-sectional cohort design, VanGilder et al., reporting the results of the International Pressure Ulcer Prevalence Survey in the United States in 2008 and 2009, indicated overall prevalence and facility-acquired pressure ulcer rates of 13.5% and 6% (2008, N = 90,398) and 12.3 and 5% (2009, N = 92,408), respectively; in both study years, overall prevalence rates were highest in long-term acute care (22%) settings. Chronic pressure ulcers affect patient quality of life and are costly for both the facility and the overall healthcare system. Long-term care providers encounter numerous challenges, ranging from documentation requirements to the provision of proper pressure ulcer care. Preventing and treating wounds, including managing chronic wounds that do not heal or heal slowly, are
challenging, even for nurses with specialty training in pressure ulcer care.4

Evidence-based nursing is standard practice in healthcare.5,6 Yet despite the availability of evidence-based guidelines, the gap between research and clinical practice remains.7,8 Specifically, results of a retrospective, noncomparative interventional case series9 (n = 400) suggest that staff members in long-term care may not always adhere to published guidelines on wound documentation or treatment of chronic wounds. Soban et al10 conducted a systematic review of the literature and identified nurse-focused quality improvement intervention strategies for managing patients with pressure ulcers; nursing documentation and a variety of reminders that indicate patient risk and/or repositioning needs were used with the least frequency. In another study,11 four hospitals with established pressure ulcer programs participated in the Nurse Safety Scholar-in-Residence (nurse scholar) program focused on pressure ulcer prevention. Each hospital completed an inventory of prevention program components and identified common gaps, including the fact that staff may struggle to provide appropriate documentation for patients at risk for pressure ulcers, as well as documentation on the management of patients with pressure ulcers.

Documentation of pressure ulcer care and assessment is important not only for patient and wound monitoring, but also for administrators of skilled facilities that must comply with regulatory reporting required by the US Centers for Medicare and Medicaid Services (CMS), which drives reimbursement.12,13 Reporting is also important for quality assurance purposes and to ensure proper risk management for the facility. The initial step in pressure ulcer prevention is accurate identification of individuals at risk, which requires an established, valid, and reliable risk-assessment tool. A study of self-reported pressure ulcer prevention and treatment practices in rehabilitation facilities demonstrated that without a valid and reliable risk assessment tool, nurses may over- or under-estimate a resident’s risk.14

The Institute of Medicine’s15 (IOM) initiative to identify sweeping revisions to the healthcare system includes bringing state-of-the-art care that embraces technology to all Americans in every community. The IOM states, “Information technology (IT) has enormous potential to improve the quality of healthcare with regard to ... six aims (safety, effectiveness, patient-centered, timeliness, efficiency, and equity). IT must play a central role in the redesign of the healthcare system if a substantial improvement in healthcare quality is to be achieved during the upcoming decade.”

The safe and appropriate application of new technology into practice remains a challenge, and clinical information technology systems are absent in most long-term care facilities.16 A descriptive analysis17 of a nursing home’s clinical information technology systems is to be achieved during the upcoming decade.15

<table>
<thead>
<tr>
<th>Wound criteria</th>
<th>Description of data captured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification</td>
<td>With regard to pressure ulcer: blister, erythema, ulceration</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Healed, closed, open</td>
</tr>
<tr>
<td>Pressure ulcer stage (if applicable)</td>
<td>Stage I, Stage II, Healing Stage II, Stage III, Healing Stage III, Stage IV, Healing Stage IV, Deep Tissue Injury, Unstageable</td>
</tr>
<tr>
<td>Tissue type</td>
<td>Epithelial tissue, granulation tissue, slough, necrotic (with percentage of each indicated)</td>
</tr>
<tr>
<td>Drainage type and amount</td>
<td>Exudate: amount, type (serous, serosanguineous, bloody, purulent, purulent and malodorous)</td>
</tr>
<tr>
<td>Periwound criteria</td>
<td>Abnormal, normal, unknown</td>
</tr>
<tr>
<td>Measurement</td>
<td>Length, width, depth (in cm, manually entered); Undermining: location (to and from o’clock) and extent (cm); Tunneling: location (o’clock) and extent</td>
</tr>
<tr>
<td>Anticipated outcomes</td>
<td>Subjective measure as determined by assessing nurse</td>
</tr>
<tr>
<td>Other criteria</td>
<td>Infection present (Yes/No); odor present (Yes/No); dressing present (Yes-Date/No); pain (10-point scale)</td>
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</tbody>
</table>

Key Points
- Integrating technology into daily patient care has the potential to standardize documentation.
- A 2-month observational study conducted among 38 residents of a skilled nursing facility allowed nine nurses to evaluate a point-of-care documentation system.
- As nurses became more familiar with the system, processes such as reviewing wound progress and recognizing changes in wound status improved.
- Further research hopefully will support improved documentation and communication among care team members will benefit patient outcomes.
system with decision support in wound care that involved descriptive analysis of 172 residents in three different nursing homes showed that use of an internal positioning program to prevent pressure ulcers resulted in more frequent skin integrity alerts and a decline in the percentage of high-risk residents who developed pressure ulcers.

Despite the importance of pressure ulcer documentation and care standardization, many long-term care facilities struggle with paper systems that may or may not include all required information. As a result, wound prevention and care may be difficult to standardize.

An electronic wound documentation and reporting program (WoundRounds®, a service of Telemedicine Solutions, LLC, Hoffman Estates, IL) was developed based on wound assessment guidelines from using the Agency for Health Care Policy and Research and on the documentation standards from the core text used in WOCN certification. The system uses a camera-enabled, mobile device to capture data and images at point of care; a secure website enables authorized users to access documentation, analysis, and reports over the Internet. Wound assessment data captured at point of care include wound type, site, and date of occurrence; tissue type; drainage type and amount; wound measurement and stage when appropriate; and anticipated outcomes (see Table 1).

The wound system also includes clinically validated tools, including the Braden Scale for Predicting Pressure Sore Risk and the Pressure Ulcer Scale for Healing (PUSH) Tool for tracking wound healing. In this study, the wound nurses used the camera-enabled mobile device with a digital camera at bedside to enter wound assessments and risk assessments and to record treatment recommendations.

Data and images captured on the mobile device are encrypted and uploaded over the Internet to secure servers. Authorized members of the care team can access information 24/7 via the website to review assessments and download and print documentation for the patient’s chart, as well as to evaluate trends and generate reports for quality and regulatory purposes. The wound photograph is embedded into the documentation and watermarked with the patient’s medical record number, date and time of assessment, and wound site location. The system provides comprehensive documentation and reporting at the patient level and also in the aggregate, so facility-wide trends for risk and wound healing can be identified. Data elements reported include the number of facility-acquired ulcers, time to healing, patient Braden Scale scores and subscores, and the PUSH score. The photos and data are stored on the server and integrated with the assessment. Photos can be reviewed sequentially to show wound healing over

![Ease of Use ratings.](image-url)
time. Per the Wound Ostomy Continence Nurses (WOCN) Society™ Professional Practice series, it is the position of the WOCN Society that photography used in wound care is adjunct to assessment documentation and serves only to support the written word documentation.

The validity and reliability of the system have not been tested. However, the facility internally validated the system by running parallel systems along with the WoundRounds System. The purpose of this observational study was to evaluate skilled nurses’ user satisfaction regarding ease of use and wound documentation effectiveness with the use of the electronic wound documentation system at the point of care.

Methods
This prospective observation study and user survey was conducted at Provena Heritage Village, Kankakee, IL, a 51-bed skilled nursing facility. New residents admitted during the initial 2-month project period were enrolled if they required a Braden Scale Risk Assessment, had a Stage I or greater pressure ulcer, and written informed consent was provided by the resident or legal designate. The study was approved by the Institutional Review Board (IRB) of Provena Senior Services, Mokena, IL.

Nine skilled nurses elected to use and evaluate the electronic documentation system. Of those, five were Registered Nurses, and four were Licensed Practical Nurses, including two designated wound care nurses. The two designated wound nurses received 3 hours of in-service training on the electronic wound care system plus weekly updates and coaching sessions from the study sponsor staff. They were responsible for capturing all wound and risk assessment data on the handheld devices and uploading the information over the Internet to a secure server. The wound nurses also were responsible for downloading, printing, and signing documentation of each wound and placing this information in the patient’s chart, where it could be shared with members of the care team (staff nurses, physicians, the nutritionist, physical therapist, MDS coordinator, and nursing administrator).

User satisfaction evaluations were conducted for 2 months, beginning on September 24, 2008 through November 30, 2008. Wounds were assessed weekly by the wound care nurses, and more frequently if the daily skin assessments performed by other nursing staff indicated need for more frequent monitoring. Photos of wounds were taken upon admission and then weekly and upon discharge along with scheduled wound assessments.

Evaluation. At the beginning of the project and after the 60-day study period, nurse study participants were asked to complete a two-page product use evaluation. Using a 5-point Likert scale (range 1 = very difficult to 5 = very easy),
participants were asked to rate how easy it was to locate resident’s medical information, read charts and notes, document risk of developing wounds, review wound progress, and use the data for quality assurance (QA) and regulatory reporting. The second page of the survey contained questions about the perceived effectiveness of the system. Specifically, on a scale of 1 (= very ineffective) to 5 (= very effective), they were asked to rate the following variables:

• Maintain consistent documentation shift-to-shift
• Determine resident’s pressure ulcer risk level
• Manage treatment of existing wounds
• Communicate with other professionals
• Prevent avoidable wounds
• Recognize changes in wound status
• Revise care plans for changes
• Promote healing to prevent wound progression.

Data analysis. All information was collected in an Excel spreadsheet (Version 2003, Microsoft, Redmond, WA). All analysis was performed using JMP 6.0 (Cary, NC) and SPSS 16.0 (IBM, Armonk, NY). Baseline nurse evaluation survey results were compared to end-of-study scores using a paired t-test. All primary information was collected in two different surveys. Initial averages and standard deviations were reported for the 13 questions asked in the survey. Significance was set at $P = 0.005$.

Results

User evaluation. Statistically significant mean changes in nurse's ratings of both the Ease of Use and Wound Management Effectiveness scale scores were found for baseline (initiation month) to 2-month follow-up. Ease of Use ratings across the five items increased from an overall mean of 3.3 at baseline to 4.7 at follow-up (see Figure 1), while Wound Management Effectiveness rating increased from an overall mean of 3.3 at baseline to 4.4 at follow-up (see Figure 2).

The greatest gain for any single item within the Ease of Use scale was found for reviewing wound progress (mean difference = 2.35), while the smallest change was found for reading charts and notes (mean difference = 0.89). The greatest gains for any single item within the Wound Management Effectiveness scale was found for recognizing changes in wound status (mean difference = 1.78), and the smallest change was found for ability to determine resident’s risk level (mean difference = 0.39).

Little or no change was seen in nurses’ ratings of avoidable wounds. This was not unexpected, because the facility did not fully implement the system’s risk functionality until the last 30 days of the 60-day evaluation period, leaving little time for prevention to be realized.

Discussion

Wound management in nursing homes is generally recognized to be highly variable, costly, and time-consuming. The lack of standardized processes for wound assessment and documentation inhibits communication and coordination of care, and exposes facilities to significant costs, risks, and liability. The experience of the nurses from this facility suggests that an electronic wound documentation system may facilitate wound care processes.

Before embarking on the study, the implementation team at the facility performed an audit to establish a baseline on current operations. The audit included a technical assessment, a chart audit, and an analysis of nursing workflow and processes. The audit revealed that comprehensive assessments were performed every 10 days, not weekly; assessments varied among charts; wounds documented on admission were not always reflected in the care plans; intervention/treatment documentation did not always match assessments; MDS updates were difficult to discern; gaps existed between Braden risk assessments and care plans; and PUSH scores, which calculate the rate of healing, were captured, but their use was not documented. Based on these findings, the facility established three objectives for this study: 1) improve data collection and documentation; 2) improve reporting and data sharing; and 3) achieve better outcomes.

Following the 2-month system evaluation period, nurses reported greater ease of use across all attributes, especially in reviewing wound progress, using data for quality and regulatory reporting, and locating information, and greater Wound Management Effectiveness, especially in recognizing changes in wound status, promoting healing to prevent ulcers, and managing treatment of existing wounds.

Increased familiarity. Wound nurses became more fully versed in the mobile device after the baseline period. Once the system was utilized comfortably, documentation was available to all care team members in a complete, consistent, and readable format. This accessibility of patient data was perceived to have a positive effect on wound care processes.

Improved communication. Communication and collaboration also were improved as all care team members, including referring physicians, could review the printed wound documentation, including wound photographs; and monitor trends using PUSH Scores, which were automatically calculated and charted in the system, in order to track wound healing in real time.

Enhanced efficiencies. The primary wound nurses verbally reported that the electronic wound care system eliminated redundant paperwork and enabled more time to focus on patient care.

Before the point-of-care documentation system was implemented, the facility administrator as well as the corporate director of quality and clinical excellence had concerns as to whether staff would embrace the use of technology in wound care. However, they found that nurses not only adopted the mobile device technology, but they also reported greater ease of use and greater effectiveness in managing wound care with the electronic documentation solution. Areas of greatest increased effectiveness, as rated by the nurse participants, were...
recognizing changes in wound status, communicating with other professionals, managing treatment of existing wounds, and promoting healing to prevent progression of the wound.

Little change was seen in the nurse ratings of two attributes related to prevention: ability to determine a resident’s risk level and to prevent avoidable wounds. This was not unexpected, because the facility did not fully implement the system’s risk functionality until the last 30 days of the 60-day evaluation period.

Limitations

Several limitations to this study may affect the ability to generalize results. The facility had a limited number of patients and nurses. A sample of nine nurses poses difficulties for the reliability of related findings.

As with any observational study, it is possible that participants may have had reporting biases. The nurses may have believed they were making good assessments both before and after program implementation. Or the nurses may have believed that the system was merely capturing their assessments and, as such, assessment quality was not affected. However, users reported the biggest gains in how the assessments were used to “review wound progress” and “recognize changes in wound status,” which likely relate to how the wound information was used, rather than how assessments were made. Also, the facility did not implement the wound prevention module until the second month of the 2-month pilot, which probably limited nurse perception of their ability to prevent some wounds.

Anecdotal reports from the wound nurses suggest the mobile wound care system eliminated redundant paperwork and enabled more time to focus on patient care. With increased time for direct patient care, wound care from the nursing staff has the potential to improve.20 Increased nursing time also may correlate with the decreased future pressure ulcers21 that was observed subsequent to this study.

Other issues include the absence of a comparison group (ie, the inclusion of a patient group followed over the same period who experienced usual wound management protocols). Also, measures of the wound management process itself were based only on pre- and post perceptions of system users and therefore subject to a possible Hawthorn effect.20

Conclusion

An observational study suggests a long-term care facility may improve documentation using an electronic, point-of-care wound documentation system. Long-term care nurses in the study reported improvements in ease of use and wound care effectiveness once they became acclimated to the system. Improved documentation and communication among caregivers may improve wound care in long-term care settings. Further research on the mobile wound care management devices, including their validity and reliability, using a larger sample and comparison group is needed. Additionally, other wound environments will likely need to be studied.

Acknowledgment

Provena Heritage Village received a partial grant by Telemedicine Solutions, LLC for the WoundRounds solution during the initial evaluation phase described in this study. Following this evaluation, there has been no additional financial support.

References