A Time Motion Study of Manual versus Digital Technology Methods for Wound Assessment

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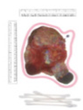
Introduction

- Chronic wounds are highly prevalent and can significantly diminish patients' quality of life and impose a financial burden on patients and the health care system [1].
- Evidence shows that careful assessment and continuous measurements of a wound using valid and reliable methods are fundamental to wound care management [2,3,4].
- Traditional wound assessment methods are widely used in healthcare settings [5]. However, using traditional methods consumes a considerable amount of clinicians' time [6,7]. Also, they do not necessarily yield accurate measurements, especially with irregular wounds with an unequal distance from the edges [7].
- In recent years, considerable efforts have been spent on procuring digital services and embracing technology in healthcare settings to redefine organizational processes and ensure benefits at higher productivity [8].
- A self-standing outpatient wound clinic operating in California, US, receiving an average of 130 wounds of all types per day had launched a comprehensive wound care model (CWCM). This model is designed to support wound care trained clinicians in assessing and managing wounds in a fraction of time through a non-invasive digital wound evaluation solution (DES) employing artificial intelligence (AI) to provide clear, high-quality images of the wounds and accurate wound measurements, irrespective of shape, during the routine evaluation follow-up appointments at the clinic.

Objectives

This time-motion study aimed to quantify the time clinicians saved completing wound assessments using a digital tool vs. manual methods in a real-world clinical setting.

Methodology



Over two weeks, clinicians who agreed to join the study were asked to record wound assessment activities using manual and digital methods for patients 18 years of age or older with chronic, active wounds referred for a routine evaluation follow-up appointment at the clinic.

Digital Wound Assessment (N=115)

Record time to:

- Capture wound image
- Confirm automated measurements
- (Width, length and surface area)
- Transfer files to EMR

Manual Wound Assessment (N=115)

Prepare labels necessary to register and assess patients manually.

- The labels had: patient's initials, wound number and date
- The labels were placed in the camera's field of view and time to complete the labelling process was recorded.

Record time to:

- Capture wound image
- Transfer the camera SIM card to the computer
- Review SIM card files
- Transfer files to the EMR
- Measure the wound length and width using the manual paper-ruler
- Transfer the measurements to the system
- Calculate wound surface area

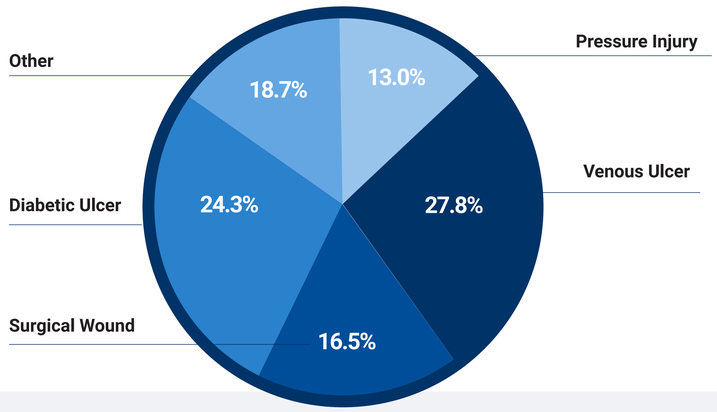
SWIFT

Results

A total of 91 patients with 115 wounds were assessed. 53.8% of patients were females.The mean age of was 62.8

A total of 115 wounds were identified with a wide range of wound types. Of this total, 32 (27.8%) were venous, 28 (24.3%) were diabetic, 19 (16.5%) were surgical. Other(18.7%) included: abrasion, abscess, arterial, cancer lesion, laceration, and skin tears.

Types of wounds assessed using manual and digital methods



Venous Ulcer

Pressure Injury in trochanteric area

Diabetic Ulcer

Number of times pictures was taken until deemed acceptable by clinicians

	MANUAL METHODS	DIGITAL N (%)	P VALUE
Number of pictures taken until acceptable Once	N= 145 87 (75.7%)	N= 115 106 (92.2%)	P<0.004*
By wound type			
Diabetic ulcer (N=28) Once	20 (71.4%)	25 (89.3%)	P=0.177
Pressure ulcer (N=15) Once	11 (73.3%)	15 (100.0%)	P=0.100
Surgical wound (N=19) Once	16 (84.2%)	18 (94.7%)	P=0.604*
Venous ulcer (N=32) Once	23 (71.9%)	29 (90.6%)	P=0.107

Acquiring a clear acceptable wound image was significantly more likely to be achieved the first-time using digital compared to the manual methods (92.2% vs. 75.7%, P<0.004).

The proportion of captured wound images on the first attempt is consistently higher with digital methods compared to the manual methods for the different types of wounds.

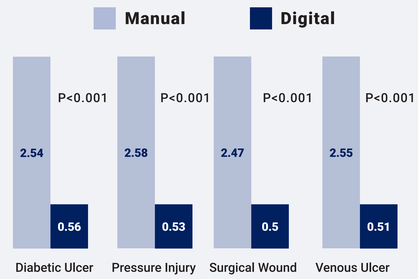
Time to successfully complete activities necessary to evaluate wounds

	MANUAL (N=115) MEAN ± SD (MM.	DIGITAL (N=115) MEAN ± SD (MM.SS.SS)	P VALUE
Average time to capture and transfer pictures to system	1.31.15 ± 00.20	00.29.38± 00.16	P<0.001
Total time to measure and calculate surface area	01.10.10± 00.22	00.25.05± 00.16	P<0.001
Total workflow Label/ image /transfer image /measure/ calculate wounds	02.53.15± 00.38	00.54.44± 00.26	P<0.001

Overall, the average time to capture and access the wound image with the digital method was significantly faster by 78% with an average of 62 seconds (P<0.001). With the digital technology, calculating the surface area automatically, was significantly faster by 77% than manual methods with an average of 45.05 seconds (P<0.001). Overall, the average time to complete a wound assessment using digital method was significantly faster by 79% with an average of 2.39 minutes than manual methods (0.54.44 vs. 2.53.15, P<0.001).

In total, slightly more than half of the clinicians' time (54%) was saved assessing 115 wounds using Swift with 2:44:20 hours spent on wound evaluation vs. 5:31:21 hours spent using manual methods.

Average (Mean) time to complete a wound assessment per wound type



ANOVA test was computed to determine the effect of wound type on the assessment time using different methods. The main effect of assessment methods showed a significant difference in the time spent assessing wounds between the manual vs. digital method, P<0.001, while no significant differences were detected between the method and wound.

The time to assess wounds was most likely impacted by the assessment method even if the type of wounds changed.

Discussion

- The digital application was 79% faster to complete an assessment with a reduced time by an average of 2.4 minutes to complete a wound assessment and documentation.
- Clinicians successfully captured quality images of the wounds on the first attempt 16.5% more often with digital methods.
- Digital technology improved clinicians' satisfaction as clinicians completed assessments in about half the time (54%) typically spent on wound manual evaluation activities.
- The average time saving of 2.39 minutes per wound assessment using reliable digital technology could result in a potential saving of up to 51.7 days of clinicians' time a year, which is one to two months. Accordingly, it can increase organizational capacity and patients' throughout if applied on a larger scale.
- There is the potential for a decreased rejected claim reimbursement with more accurate and complete documentation using wound digital application.
- This study was implemented in a large outpatient clinic with daily wound referrals and workflow comparable to diverse wound care settings. Therefore, this model can be expanded to other wound care facilities to support a more observed clinical efficiency and organizational capacity.

In summary, leveraging digital technology with high accuracy and reliable measurements supports efficient wound evaluation with less burden on clinicians.

References

1 Sen CK, Gordillo GM, Roy S et al. Human skin wounds: a major and snowballing threat to public health and the economy. Wound Repair Regen. 2009; 17(6):763-71.

2 Flanagan M. Improving accuracy of wound measurement in clinical practice. Ostomy/ wound Management. 2003; 49(10):28-40. PMID: 14652419.

3 Keast D, Bowering K, Wayne E, Gerald M, Burrows C, D'Souza L. A proposed assessment framework for developing best practice recommendations for wound assessment. Wound Repair Regen. 2004;12 (3): S1-17

4 Flanagan M. Wound measurement: can it help us to monitor progression to healing? J Wound Care. 2003;12(5):189–94

5 Ferreira F, Pires IM, Ponciano V, et al. Experimental Study on Wound Area Measurement with Mobile Devices. Sensors (Basel). 2021; 21(17):5762. doi: 10.3390/s21175762. PMID: 34502653; PMCID: PMC8433956.

6 Majeske C. Reliability of wound surface area measurements. Phys Ther. 1992;72(2):138–41 Bowling FL, Paterson J, Ndip A. Applying 21st century imaging technology to wound healing: an Avant-Gardist approach. J Diabetes Sci Technol. 2013;7(5):1190-4. doi: 10.1177/193229681300700536.

7 Marikyan, D. & Papagiannidis, S. (2021) Unified Theory of Acceptance and Use of Technology: A review. In S. Papagiannidis (Ed), http://open.ncl.ac.uk