



Closing The Distance: Engaging Patients Using Remote Wound Monitoring

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Chronic wounds cost the Canadian health-care system approximately \$12 billion per year.¹ These costs include direct expenses, such as dressings and wound care materials, as well as indirect costs borne by patients.¹ Indirect costs encompass out-of-pocket expenses due to the inability to perform domestic tasks, loss of income from reduced work capacity and welfare or disability payments provided by the government or insurance companies.¹

Chronic wounds significantly impact activities of daily living (ADLs), making life more challenging for affected individuals. They may require more frequent health-care visits for assessments and interventions due to longer healing timeframes. This can be especially burdensome for those living in

underserved communities, where access to care is limited.

A relationship also exists between quality of life and chronic non-healing wounds.² According to a paper published in *Wounds International*, chronic wound patients often experience poor quality of life, as multiple areas of their lives are compromised.²

One study that conducted an assessment on chronic wound patients using the Wound Quality of Life (Wound-QoL) and Freiburg Life Quality Assessment (FLQA-Wk) found that values for patients with chronic wounds were below average.³ The total quality of life value was 37.50/100 (Wound-QoL) and 44.20/100 (FLQA-Wk).³ Pain is consistently identified as one of the most common and disabling symptoms

related to quality of life.² It can lead to issues such as mobility, sleep disorders and loss of employment.²

A major question that remains is which populations are a higher risk of developing chronic wounds. Chronic wounds, specifically venous leg ulcers, have been found to be more prevalent in lower socioeconomic classes. Factors such as socioeconomic status includes marital status, employment, income, social security benefits and housing, have direct effects on wound-healing processes.⁴ A study conducted in patients with venous leg ulcers concluded that being single, being of a lower socioeconomic status and having a lack of central heating in the home led to significantly prolonged wound healing or lower likelihood of healing at 12 weeks follow-up.⁴

Remote And At-risk Communities

The health-care needs of Indigenous peoples are of particular concern. Between 2017 and 2020, reports indicated that a significantly higher percentage of First Nations peoples living off-reserve (20.3%), Métis (17.9%) and Inuit (56.5%) lacked a regular health-care provider compared to their non-Indigenous counterparts.⁵

Indigenous communities have been cited in the literature as having a higher risk of developing diabetic foot complications, including foot ulcers, amputations and peripheral arterial disease.⁶ Diabetes is a large issue within Indigenous communities, as people are affected at a rate which is three to five times higher than the general population.⁶ Among individuals with diabetes, 34% will develop a diabetic foot ulcer (DFU) in their lifetime, which can cause significant disability, diminish quality of life and increase the risk of premature death.⁶

Lower limb amputations are a critical concern, with research showing that DFUs precede 85% of these cases.⁷ Additionally, 60% of all lower limb amputations occur in individuals with diabetes.⁷

The town of Sioux Lookout Northwestern Ontario is home to 30,000 people and serves 33 remote Indigenous communities, where the documented

rate of diabetes is approximately 25% of the population.⁸ The amputation rates in the town are four to seven times higher than the provincial average. The nearest vascular surgeon program is in Thunder Bay, 393 km away, which is equivalent to a five-hour drive or a two-hour flight.

Patient Empowerment In Wound Care

Patient empowerment can be defined as a process in which patients can understand their role in their health care, and where they are given the required knowledge and skills demonstration by their health-care providers to perform a task in an environment that recognizes community and cultural differences and encourages patient participation.⁹ Empowering patients is crucial in chronic wound management, as it enables them to take an active role in their care.

There has been an emerging trend of the adoption of technology for patient empowerment. For example, smartphone apps are now being designed to empower patients to contribute towards safer surgical care.¹⁰ The successful implementation of smartphone apps within clinical practice can lead to improved treatment options, as they can encourage behaviours such as patients being more involved in their care conversations and increased awareness of safety-related behaviours.¹⁰

A study done by Keegan and colleagues involved patients who were trained to use a mobile app to obtain weekly-at-home scans during regular dressing changes.¹¹ The results proved that remote wound monitoring could enhance patient engagement, with a 94% satisfaction rate and early intervention in 36% of the cases.¹¹ Many of the participants in this study noted that they felt more involved in their wound care, more responsible for their health, and had increased access to health-care services.¹¹

Applications Of Digital Tools In Wound Care

The use of digital tools has been previously applied to the wound care space. The Photographic Wound Assessment Tool (PWAT) has been validated as an instrument to determine ulcer status wound imaging and has been included as an educational

tool for wound care clinicians.¹² Smart devices (e.g., phones, tablets) continue to increase the quality and resolution of their built-in cameras, with some including built-in 3D scanners. These devices are becoming widely adopted by patients and in the workplace, making wound imaging more feasible.

Using the PWAT system, clinicians can assess the following features all graded between zero and four with a higher total score indicating wound deterioration:¹³

- Size
- Depth
- Necrotic tissue type
- Total amount of necrotic tissue
- Granulation tissue type
- Total amount of granulation tissue
- Edges (directly touching and within 0.5 cm of the wound edge)
- Peri ulcer skin viability.

While the PWAT system remains clinically valuable for remote wound assessment, artificial intelligence (AI) and computer vision (CV) have the potential to transform how clinicians and patients can use digital imaging to support wound care. Digital wound imaging can use AI to automatically identify and measure a wound. Studies of several software applications that provide wound measurement have found high rates of accuracy and inter- and intra-rater reliability.¹⁴ AI can also facilitate the rapid analysis of a vast array of wound images, working in combination with intelligent algorithms and extensive databases to accurately identify, classify, and predict tissue characteristics.¹⁵ One paper was able to demonstrate a strong correlation between a machine learning model's PWAT score and the clinician's PWAT score.¹⁶

Wound healing can also be predicted, as proposed by Telemedicine Based Wound Tissue Prediction (TWTP), which uses linear discriminant analysis to classify tissue types.¹⁵ This has been proven

to achieve a prediction accuracy of 91.45%, thereby being applicable in the remote diagnosis of chronic wound healing statuses.¹⁵

A home health region in Ontario implemented a digital wound management solution (DWMS) inter-professional remote wound care, which included the ability for patients to collect images. The mobile application (Swift Skin & Wound, Patient Connect, Toronto ON) uses CV technology to automatically focus and calculate wound dimensions from images taken within the mobile app. Additional features are also captured in the application, such as healing-associated metrics, wound-bed information, anatomical location and patient identifiers. Through remote collaboration using the DWMS, the region was able to improve healing, reduce home health readmission and reduce wound care costs.¹⁷

DWMS have been around for over a decade, however, until recently, DWMS were focused on the clinician. Shifting the emphasis to the patient requires a simplification of the user interface and careful design of the experience to support patient adoption. Figure 1 shows an example of a clinician application, which has options for detailed documentation of the wound's size, appearance and analysis of progress. For the patient application, a streamlined interface, embedded training videos on wound imaging, educational material on dressing changes and low literacy level questions are available during the process.

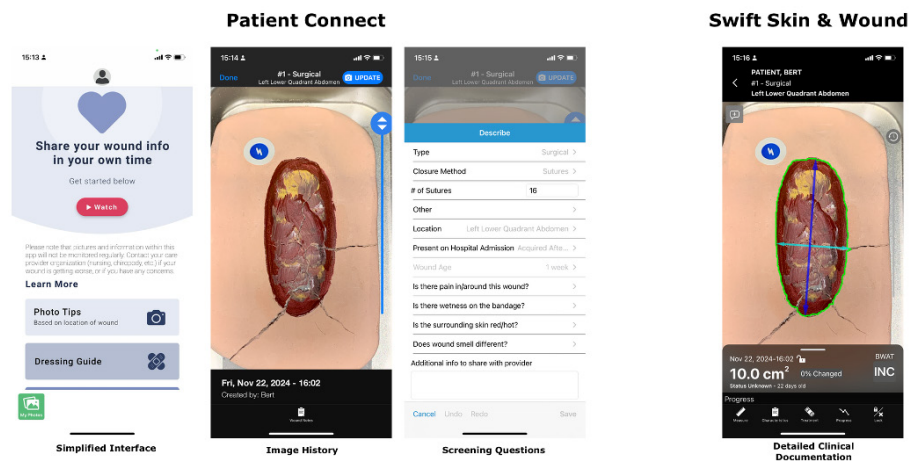


Figure 1: Digital Wound Management Solution. Patient facing interface with simple language and documentation interface (left) and Clinician Interface with detailed wound care documentation and analysis (right).

A feasibility study included patients with diabetic ulcers, venous ulcers, pressure ulcers and post-surgical wounds who were recruited and trained to use the Patient Connect App developed for wound imaging and secure data sharing with health-care team members.¹⁸ Throughout the study, the 28 participants captured a median of 13 images per wound and achieved an 80% wound closure rate.¹⁸

As highlighted in the study, remote monitoring fostered patient engagement through weekly assessments, while remote follow-ups proved beneficial in reducing patient anxiety.¹⁸ Additionally, clinicians reported that the system enhanced their confidence in delivering care remotely.¹⁸

General Attitudes Towards Patient-Owned Surveillance

When implementing remote wound care monitoring, it is essential to consider the unique needs of specific patient populations. Capturing images of patient wounds may be a sensitive subject. A majority (81%) of patients studied at an outpatient wound clinic in Toronto reported photographing their wound increased their ability to track their wound progress and 58% percent felt more involved in care.¹⁹ Another paper from Montreal reported positive feedback from the use of a patient application for wound monitoring due to the decrease in travel requirements and objective data captured by the patient wound imaging application. However, successful adoption requires thoughtful implementation.²⁰

Lo and colleagues conducted a qualitative study on patient-owned surveillance systems in patients with DFUs, identifying four key themes.²¹

- 1. Technology Literacy:** Some patients were hesitant to use digital applications due to low technological literacy, despite having access to the internet.
- 2. Application Usability:** Challenges were noted, particularly among elderly patients with diabetic foot ulcers. Many expressed a need for educational tools on foot care and infection prevention.
- 3. Feasibility of Wound Imaging:** Patients generally lacked a habit of taking wound photos, as clinicians typically handled this during visits.
- 4. Social and Physical Support:** Many patients had difficulty in taking wound images due to visual impairments or physical disabilities. Support from family members was crucial for wound care. Retinopathy is a complication of diabetes which is present in 22.7% of the diabetic population globally, further underscoring the need for social assistance for wound imaging.²² These themes can be considered in the patient education in support of adopting digital wound monitoring. The feasibility study on patient adoption used build-in education within the application, and teaching was facilitated by the clinician having the patient capture an image while still at the ambulatory clinic (see Figure 2).



Figure 2: Digital Wound Management Solution imaging of a post-surgical wound. Each image identifies who captured the image and the amount of time from the first date of evaluation.

Although digital wound imaging and patient captured images are more feasible. Wound care clinicians need to consider how the technology fits into their practice to support efficiency and drive improved outcomes.

Logistics Of Care

It was concluded from the Lo and colleagues' study that patients, carers and their health-care practitioners had a positive attitude towards a patient-operated imaging system.²¹

Some patients acknowledged that remote monitoring saved time and reduced costs, particularly during the COVID-19 pandemic.²¹ However, some preferred in-person consultations, believing they would receive better care.²¹

During the COVID-19 pandemic, a crucial response involved postponing or transitioning wound care appointments to telephone consultations.²³ To limit exposure, it was recommended by the Wound Healing Society that the frequency of wound dressing changes decreased and caregivers and patients undertaking interval dressing applications was encouraged.²³ Initially, there were concerns about the challenges involved in educating patients on the proper technique.²³ However, resources were made available, such as a self-education tool from Wounds Canada available for downloading and printing out as a handout.²⁴ These digital resources can support clinicians to implement patient empowerment programs supported by evidence-based resources.

Remote wound care monitoring was also tested in the Virtual Wound Care Command Centre (VWCCC) in Australia.²⁵ All patients who participated in this study reported high satisfaction with their wound care, with 86.4% of patients recommending the VWCCC to other patients.²⁵

Potential savings due to reduced travel was mentioned in this study.²⁵ Participants within Metropolitan Sydney potentially saved an average distance of 20.5 km, travel time of 54 minutes and travels costs of \$AU 6.37 for a single visit. For those who lived in regional New South Wales (NSW), the

mean travel savings were 260 km, 3.1 hours, and \$AU 38.02.²⁵

The greatest savings by far were for those accessing wound specialist services remotely, with a single visit costing a mean of 638 km, 8.6 hours of travel time, and \$AU 99.65 in fuel costs.¹⁶

This thereby support the notion that remote wound care monitoring can address indirect costs to patients while also enhancing patient satisfaction.

Future Research

The current availability of smart devices provides a confluence of digital imaging and internet connectivity making wound imaging more feasible for patients living with wounds. Barriers need to be addressed including how to securely capture data and communicate with patients in a privacy-compliant way. The studies mentioned in this paper highlight the growing number of applications being made for adoption within clinical practice. While there are positive indicators for this area for patient acceptance and usability, larger studies and quality improvement initiatives are needed to understand the impact on health-care systems, such as improved healing rates, lower wound reoccurrence and reduced complications.

Beyond outcomes, research wound care clinicians need to continue to work with machine learning and data scientists. Increasing image capture will result in more data. Machine learning and other forms of AI can help to analyze and triage images for health-care providers. With limited health human resources, wound care clinicians need to partner in the design of technology to meet the challenges of managing chronic wounds.

Patient Empowerment In The Context Of Remote Wound Monitoring

To conclude, patient empowerment in the context of remote wound monitoring is certainly a viable option as a part of management planning. AI and CV can enhance monitoring strategies, as they are useful to collect relevant data such as healing-associated metrics, wound-bed information and anatomical

location, as in the reported case from SWIFT Medical technology.¹¹

Remote wound monitoring can be beneficial for those with chronic wounds who are suffering with ADLs. There is an overall positive attitude towards the application of remote wound monitoring as it can reduce patient anxiety, decrease transportation costs, and save time for patients with long commutes.

Of note, is crucial to educate patients about this treatment option and assess whether they are suitable candidates, taking accessibility into account.

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References

1. Queen D, Botros M. The true cost of wounds for Canadians. *Wound Care Canada*. 2024;22(1):16-20. doi:10.56885/NXMW2913.
2. Woo K, Conceição de Gouveia Santos VL, Alam T. Optimising quality of life for people with non-healing wounds. 2018. Available from: <https://woundsinternational.com/wp-content/uploads/2023/02/566e1faa0681fc8b4e05c1145897b3b2.pdf>
3. Vogt TN, Koller FJ, Santos PND, Lenhani BE, Guimarães PRB, Kalinke LP. Quality of life assessment in chronic wound patients using the Wound-QoL and FLQA-Wk instruments. *Invest Educ Enferm*. 2020;38(3):e11.
4. Fayne RA, Borda LJ, Egger AN, Tomic-Canic M. The potential impact of social genomics on wound healing. *Adv Wound Care (New Rochelle)*. 2020;9(6):325-331.
5. Yangzom K, Masoud H, Hahmann T. Primary health care access among First Nations people living off reserve, Métis and Inuit, 2017 to 2020. *Statistics Canada*; 23 Sep 18, 2023. Available from: <https://www150.statcan.gc.ca/n1/pub/41-20-0002/412000022023005-eng.htm>
6. Blanchette V, Patry J, Brousseau-Foley M, Todkar S, Libier S, Leclerc AM, et al. Diabetic foot complications among Indigenous peoples in Canada: a scoping review through the PROGRESS-PLUS equity lens. *Front Endocrinol (Lausanne)*. 2023 Aug 14;14:1177020.
7. Xu S, Herrera A, Schechter C, Tabassum H, Milosavljevic J, Lopez Fanas R, et al. The risk of and associated demographic and laboratory variables for amputations for inpatients with diabetic foot ulcers. *Endocr Pract*. 2024 Aug;30(8):758-764.
8. Caul J, Najafi B. Challenges to and opportunities for limb preservation in rural and remote communities. *Limb Preservation in Canada*. 2021;2(1):21-24.
9. World Health Organization. WHO guidelines on hand hygiene in health care: first global patient safety challenge clean care is safer care. Geneva: World Health Organization; 2009. 2. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK144022/>
10. R Russ S, Latif Z, Hazell AL, Ogunmuyiwa H, Tapper J, Wachuku-King S, et al. A smartphone app designed to empower patients to contribute toward safer surgical care: community-based evaluation using a participatory approach. *JMIR Mhealth Uhealth*. 2020 Jan 20;8(1):e12859.
11. Keegan AC, Bose S, McDermott KM, Starks White MP, Stonko DP, Jeddah D, et al. Corrigendum: implementation of a patient-centered remote wound monitoring system for management of diabetic foot ulcers. *Front Endocrinol (Lausanne)*. 2023 Jun 23;14:1235970.
12. Registered Nurses' Association of Ontario. Appendix I: pressure injury assessment tools. in: assessment and management of pressure injuries for the interprofessional team. 3rd ed. Toronto, ON: Registered Nurses' Association of Ontario; 2016:130-133.
13. Photographic Wound Assessment Tool PWAT -Revised. https://www.southwesthealthline.ca/healthlibrary_docs/b.9.3b.pwatinstruc.pdf

14. Casanova-Lozano L, Reifs-Jiménez D, Martí-Ejarque MdM, Reig-Bolaño R, Grau-Carrión S. Evaluation of two digital wound area measurement methods using a non-randomized, single-center, controlled clinical trial. *Electronics*. 2024; 13(12):2390.
15. Chen MY, Cao MQ, Xu TY. Progress in the application of artificial intelligence in skin wound assessment and prediction of healing time. *Am J Transl Res*. 2024 Jul 15;16(7):2765-2776.
16. Curti N, Merli Y, Zengarini C, Starace M, Rapparini L, Marcelli E, Carlini G, Buschi D, Castellani GC, Piraccini BM, Bianchi T, Giampieri E. Automated prediction of photographic wound assessment tool in chronic wound images. *J Med Syst*. 2024 Jan 16;48(1):14.
17. Parrott W, Nurse M, Scales AS, Spice T, Mannion D, Fraser RDJ. Addressing hard to heal wounds using a virtual inter-professional wound care team. Poster session presented at: Symposium for Advanced Wound Care; 2022 October; Las Vegas NV.
18. Raizman R, Ramírez-GarcíaLuna JL, Newaz T, Wang SC, Berry GK, Kong LY, et al. Empowering patients and caregivers to use artificial intelligence and computer vision for wound monitoring: nonrandomized, single-arm feasibility study. *J Particip Med*. 2025 Jun 4;17:e69470.
19. Wang SC, Anderson JA, Jones DV, Evans R. Patient perception of wound photography. *Int Wound J*. 2016 Jun;13(3):326-30.
20. Kong LY, Ramirez-GarciaLuna JL, Fraser RDJ, Wang SC. A 57-year-old man with type 1 diabetes mellitus and a chronic foot ulcer successfully managed with a remote patient-facing wound care smartphone application. *Am J Case Rep*. 2021 Dec 15;22:e933879.
21. Lo ZJ, Chong B, Tan E, Ooi D, Liew H, Hoi WH, et al. Patients, carers and healthcare providers' perspectives on a patient-owned surveillance system for diabetic foot ulcer care: A qualitative study. *Digit Health*. 2023 Jun 21;9:20552076231183544.
22. Teo ZL, Tham YC, Yu M, Chee ML, Rim TH, Cheung N, et al. Global prevalence of diabetic retinopathy and projection of burden through 2045: systematic review and meta-analysis. *Ophthalmology*. 2021 Nov;128(11):1580-1591.
23. Mufti A, Sachdeva M, Maliyar K, Sibbald RG. COVID-19 and wound care: a Canadian perspective. *JAAD Int*. 2020 Dec;1(2):79-80.
24. Wounds Canada. Additional best practice resources. Available from: <https://www.woundscanada.ca/health-care-professional/resources-health-care-pros/wcc-magazine/28-publications/wound-care-canada/200-library-2>
25. Barakat-Johnson M, Kita B, Jones A, Burger M, Airey D, Stephenson J, et al. The viability and acceptability of a Virtual Wound Care Command Centre in Australia. *Int Wound J*. 2022 Nov;19(7):1769-1785.



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References:

1. PARTNER observational study: Preliminary results on the utility of the combination of two dressings in the management of acute and chronic wounds in private practice. TOMASI J, Yvon, C, Lucas, A. P20, poster presented at Journées Cicatrisations, Paris, France, 26-28 Jan 2020
2. Visual Assessment of Fluid Handling by Aquacel® Extra covered by Different Foam Dressings WHRIS397 MS147. Data on file, ConvaTec Inc.
3. Mixing Wound Dressings: Does it Affect Clinical Outcomes, Tickle J. Poster presented at World Union of Wound Healing Societies, Florence, Italy 2016.
4. Bowler PG, Parsons, D. Combatting wound biofilm and recalcitrance with a novel antibiofilm Hydrofiber™ wound dressing. *Wound Medicine*. 2016; 14: 6-11.
5. Newman, G.R., et al., Visualisation of bacterial sequestration and bactericidal activity within hydrating Hydrofiber wound dressings. *Biomaterials*. 2006. 27(7): p. 1129-39.
6. Robinson BJ. The use of a Hydrofibre dressing in wound management. *J Wound Care*. 2000;9(1):32-34.
7. Bishop SM et al. Moisture balance: optimising the wound dressing interface. *J Wound Care*. 2003;12:125-128

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