Comment

Artificial Intelligence in Wound Care: From Experimental Promise to Clinical Reality

José Verdú-Soriano[1,2]

[1] *Community Nursing Preventive Medicine Public Health and History of Science Department, University of Alicante, Alicante, Spain (mail: pepe.verdu@ua.es)*
[2] *Grupo de Investigación WINTER-Heridas: Wounds, INnovation, ThErapeutics and Research University of Alicante, Alicante, Spain*

Citation: Verdú Soriano J. "Artificial Intelligence in Wound Care: From Experimental Promise to Clinical Reality" (2025) *International Journal of Wound Research* 1(2): 64-66. DOI: https://doi.org/10.64115/ijwr-2025-259

The Global Burden of Wounds and the Need for Transformation

Wounds constitute a major global healthcare challenge, affecting millions of individuals and consuming substantial healthcare resources. Chronic wounds, in particular, are associated with prolonged healing times, high recurrence rates, and significant impacts on patient quality of life.[1] Despite advances in dressings, biomaterials, and multidisciplinary care models, wound assessment and management remain highly dependent on subjective visual inspection and clinician experience.

This reliance on subjective assessment contributes to inter-observer variability and inconsistent clinical decision-making. As healthcare systems face increasing pressure from aging populations and chronic disease, there is a clear need for tools that improve objectivity, efficiency, and standardization in wound care.

Artificial intelligence (AI) has emerged as a promising candidate to address these challenges. By leveraging machine learning (ML), deep learning (DL), and computer vision, AI systems can analyse complex wound data at scale and support more consistent clinical evaluation.[2-4]

Current Applications of AI in Wound Care

The most mature applications of AI in wound care are image-based. AI models have demonstrated the ability to detect wounds, segment wound boundaries, classify wound types, identify tissue components, and quantify wound size and depth.[2-4] These capabilities are particularly relevant in conditions such as diabetic foot ulcers, pressure injuries, venous leg ulcers, and burns.

Beyond static assessment, AI has increasingly been applied to **longitudinal monitoring and prediction**. Predictive models integrating wound images with clinical and electronic health record data have been developed to estimate healing trajectories and identify wounds at risk of delayed healing or complications.[3] Such approaches support earlier intervention and more personalized care planning.

A notable recent development is the framing of AI within **wound repair theragnostics**, integrating diagnosis, monitoring, prediction, and treatment guidance into a closed-loop system.[5] This paradigm emphasizes the continuous interaction between data acquisition, algorithmic analysis, and therapeutic decision-making, highlighting AI's potential to move beyond isolated tasks toward holistic wound management.

Remote wound monitoring is another rapidly expanding application. Smartphone-based AI systems allow patients or caregivers to capture wound images for automated analysis, facilitating telemedicine and home-based care.[3,6] Human-centred innovations, such as marker-free wound measurement using anatomical references, further enhance usability and scalability in real-world settings.[6]

Clinical Opportunities and Practical Benefits

AI-assisted wound care offers several practical advantages. Automated measurement and documentation can reduce clinician workload and improve consistency, addressing long-standing challenges in wound care practice.[2,3] Standardized assessments may also improve communication across care teams and settings.

From a systems perspective, predictive analytics may enable a shift from reactive to proactive wound management, optimizing resource allocation and potentially reducing complications and costs.[5] Importantly, AI systems are best positioned as decision-support tools, augmenting clinical expertise rather than replacing professional judgment.

Barriers to Translation and Real-World Adoption

Despite encouraging progress, significant barriers limit widespread clinical adoption. Many AI models are trained on small, single-center datasets that lack diversity in wound types, imaging conditions, and skin tones, restricting generalizability.[3,5] Data fragmentation and the absence of standardized wound datasets further impede model validation and comparison.

Algorithm transparency and interpretability remain critical challenges. Black-box models may undermine clinician trust and limit accountability, particularly when AI outputs influence clinical decisions.[4] These concerns are amplified by unresolved legal and ethical issues surrounding data privacy, liability, and informed consent in AI-driven healthcare.[7]

Ethical, Legal, and Professional Considerations

The ethical deployment of AI in wound care requires careful governance. AI systems must respect patient autonomy, ensure data protection, and avoid reinforcing existing biases.[7] Clear regulatory frameworks are needed to define responsibility and accountability when AI tools are used in clinical decision-making.

Equally important is preserving the clinician–patient relationship. Over-reliance on algorithmic outputs risks marginalizing contextual, psychosocial, and patient-specific factors that are central to wound care. AI should therefore support, not supplant, holistic clinical judgment.[4,7]

Future Directions

Future research should prioritize multicentre, prospective studies evaluating clinically meaningful outcomes, including healing rates, complication reduction, patient-reported outcomes, and cost-effectiveness.[3,5] The development of standardized datasets and interoperable digital infrastructures will be essential for scaling AI solutions.

Education and training initiatives are also needed to equip wound care professionals with the skills required to critically appraise and responsibly use AI-based tools.[4] Interdisciplinary collaboration among clinicians, data scientists, engineers, and ethicists will be key to translating innovation into safe and effective clinical practice.

Conclusion

Artificial intelligence has the potential to transform wound care by enhancing assessment, monitoring, and personalized management. However, its true clinical value will depend on robust evidence, ethical governance, and thoughtful integration into existing care pathways. AI should be embraced as a supportive technology that strengthens expert, patient-centred wound care rather than replacing it.

References

1. Sen CK. Human Wounds and Its Burden: An Updated Compendium of Estimates. *Adv Wound Care* (New Rochelle). 2019;8(2):39-48. doi: https://doi.org/10.1089/wound.2019.0946
2. Anisuzzaman DM, Wang C, Rostami B, Gopalakrishnan S, Niezgoda J, Yu Z. Image-Based Artificial Intelligence in Wound Assessment: A Systematic Review. *Adv Wound Care* (New Rochelle). 2022;11(12):687-709. doi: https://doi.org/10.1089/wound.2021.0091
3. Rippon MG, Fleming L, Chen T, Rogers AA, Ousey K. Artificial intelligence in wound care: diagnosis, assessment and treatment of hard-to-heal wounds: a narrative review. *J Wound Care*. 2024;33(4):229-242. doi: https://doi.org/10.12968/jowc.2024.33.4.229
4. Dabas M, Schwartz D, Beeckman D, Gefen A. Application of Artificial Intelligence Methodologies to Chronic Wound Care and Management: A Scoping Review. *Adv Wound Care* (New Rochelle). 2023;12(4):205-240. doi: https://doi.org/10.1089/wound.2021.0144
5. Liu H, Sun W, Cai W, et al. Current status, challenges, and prospects of artificial intelligence applications in wound repair theranostics. *Theranostics.* 2025;15(5):1662-1688. Published 2025 Jan 2. doi: https://doi.org/10.7150/thno.105109
6. Chang DH, Nguyen DK, Nguyen TN, Chan CL. Application of deep learning in wound size measurement using fingernail as the reference. *BMC Med Inform Decis Mak*. 2024;24(1):390. Published 2024 Dec 18. doi: https://doi.org/10.1186/s12911-024-02778-8
7. Gerke S, Minssen T, Cohen G. Ethical and legal challenges of artificial intelligence-driven healthcare. *Artificial Intelligence in Healthcare.* 2020;295-336. doi: https://doi.org/10.1016/B978-0-12-818438-7.00012-5