

Affordable and Scalable Hydrogel Technologies for Wound Care in Low-resource Settings

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Introduction

Chronic wounds and infections represent a major public health burden, especially in Low- and Middle-Income Countries (LMICs) where access to effective wound care materials is limited. Hydrogel-based wound dressings have gained popularity due to their unique ability to maintain moist environments, absorb exudate, provide cooling relief and serve as carriers for antimicrobial agents. However, the production and deployment of commercial hydrogels are often cost-prohibitive and infrastructure-dependent, making them inaccessible in many resource-constrained settings. With rising rates of diabetic ulcers, trauma injuries and burn-related wounds in LMICs, there is a critical need for affordable, scalable and easy-to-use wound care technologies. This brief report highlights the recent advances in low-cost hydrogel systems designed specifically for use in such environments. These innovations prioritize local material sourcing, ease of synthesis, ambient storage and compatibility with minimal healthcare infrastructure. The discussion also reflects on successful case studies and the integration of such hydrogels into community-based care models. As global health systems strive toward equity in essential services, innovations in wound care especially those that bridge performance and affordability are poised to play a transformative role [1].

Description

Recent developments in hydrogel technologies tailored for low-resource settings focus on balancing performance with affordability and manufacturability. Natural polymers such as alginate, chitosan, gelatin and carrageenan are widely used due to their biocompatibility, abundance and cost-effectiveness. These materials can be derived from agricultural and marine sources readily available in many LMICs. Incorporating additives like silver nanoparticles, honey, or plant extracts further enhances antimicrobial action while maintaining low production costs. Moreover, several hydrogel formulations have been optimized for in situ application either as preformed sheets or injectable gels that conform to wound contours. Shelf-stable powder formulations that rehydrate upon use are also gaining traction due to their portability and long shelf life. Importantly, many of these designs are developed in partnership with local institutions, ensuring that fabrication protocols and raw materials align with regional capabilities. Pilot deployments of hydrogel dressings in clinics across South Asia and East Africa have shown promising results in accelerating wound closure, reducing infection rates and improving patient comfort. Nevertheless, challenges remain in scaling production, ensuring quality control and achieving regulatory approval across borders. Despite these barriers, hydrogel innovations represent a significant step

forward in democratizing wound care technologies [2-3].

The success of hydrogel-based wound care in low-resource settings hinges not only on material innovation but also on integration within existing health delivery systems. Community health workers (CHWs), who often provide frontline care in rural or underserved areas, play a vital role in the application and monitoring of these dressings. Hydrogels designed with intuitive use in mind such as color-change indicators for infection or self-adhering sheets reduce the need for specialist intervention. Training modules developed alongside hydrogel products can empower CHWs and caregivers, further decentralizing wound management. Moreover, social enterprise models have emerged that leverage local manufacturing and distribution, reducing costs while building local economic capacity. For example, programs in Uganda and Bangladesh have piloted hydrogel production cooperatives that supply rural health centers while providing employment opportunities. However, these efforts require strong policy support, procurement channels and investment in quality assurance. Mobile health (mHealth) integration offers another layer of support allowing remote wound monitoring, patient follow-ups and real-time inventory tracking. The combination of low-cost biomedical materials and digital health platforms exemplifies the innovation required to sustainably address chronic wound care in LMICs. Governments and NGOs must recognize these solutions not as stopgaps, but as viable long-term strategies for expanding access to essential care. With proper support, hydrogel technologies can significantly improve outcomes for patients who would otherwise be left behind in global healthcare delivery [4-5].

Conclusion

Affordable hydrogel technologies represent a promising and scalable solution to the wound care crisis in low-resource settings. By leveraging locally sourced biomaterials, simple manufacturing processes and context-driven design, these systems can overcome traditional barriers of cost and access. Continued collaboration between scientists, clinicians, policymakers and communities is essential for ensuring these innovations reach the people who need them most. As the burden of chronic wounds continues to grow globally, especially in LMICs, equitable access to effective wound care materials must be considered a public health priority. Hydrogel-based systems offer not only therapeutic efficacy but also a model for frugal innovation that aligns with broader global health goals.

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Conflict of Interest

None.

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