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The Economic Burden of Chronic Wounds on Global Healthcare Systems

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Abstract. *Chronic wounds, such as diabetic foot ulcers, pressure sores, and venous leg ulcers, represent a significant and growing challenge for global healthcare systems—not only due to their clinical complexity but also because of their profound economic implications. This paper investigates the direct and indirect costs associated with chronic wound management, emphasizing the disproportionate resource burden they place on health services, particularly in aging populations and individuals with comorbidities. By integrating global statistics with focused case studies from Romania, the analysis reveals that while wound dressings comprise a small portion of care expenses, the majority of costs stem from hospital stays, nursing care, and treatment of infections. The paper further explores the societal costs of productivity loss and welfare dependence, especially in low- and middle-income countries. Additionally, it examines the role of modern wound therapies—such as negative pressure systems and antimicrobial dressings—as well as AI-driven tools in improving clinical outcomes and enabling cost-effective care delivery. The Romanian healthcare context is analyzed as a case study to illustrate disparities in cost allocation and access to advanced treatments. Policy recommendations underscore the importance of early intervention, multidisciplinary management, and adoption of emerging technologies to ensure sustainable and equitable care models for chronic wound patients globally.*

Keywords: Chronic wounds, healthcare economics, diabetic foot ulcers, Romania, AI in healthcare, cost-effectiveness.

Introduction

Chronic wounds are injuries to the skin and underlying tissue—such as diabetic foot ulcers, pressure ulcers, and venous leg ulcers—that fail to heal within a typical timeframe, often persisting for weeks or months. These wounds are especially prevalent among older adults and individuals

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with chronic conditions like diabetes or vascular disease (Sharma et al., 2024). While primarily viewed as a clinical issue, chronic wounds have far-reaching economic implications due to their high treatment costs and the long-term disability they cause (Kinfe et al., 2024). For economists, they represent a significant and growing source of productivity loss, healthcare expenditure, and social welfare strain globally (Graves et al., 2022; Sen et al., 2009). Chronic wounds affect an estimated 1.67 per 1,000 individuals globally, the majority of these wounds are chronic leg ulcers, particularly venous ulcers, with a higher prevalence in older adults (aged 70-80) and females (Järbrink et al., 2016).

Underreporting in low-income countries and inconsistent diagnostic standards further complicate accurate burden assessment. In Europe alone, approximately 1.5 to 2 million people suffer from either acute or chronic wounds (Lindholm & Searle, 2016). Among the most burdensome are diabetic foot ulcers (DFUs) and pressure ulcers, which carry high risks of infection, amputation, and mortality. The global prevalence of DFUs is 6.3%, and 5.1% in Europe, predominantly affecting men with type 2 diabetes (Zhang et al., 2017). DFUs significantly increase the risk of lower extremity amputation and death, with amputation rates around 109 per 100,000 diabetics annually, and mortality rates rising to 22% in amputees (Martins-Mendes et al., 2014). Pressure ulcer rates vary globally, with some regions reporting rates up to 2.32 per 1,000 individuals, depending on age, gender, and healthcare access. These ulcers, along with arterial and venous wounds, are often classified under the "hard-to-heal" umbrella, indicating their resistance to conventional treatment.

This paper aims to assess the economic burden of chronic wounds on healthcare systems, with a particular focus on direct and indirect costs associated with their management. By integrating international cost data with regional case studies from Romania, the analysis highlights the substantial resource consumption linked to diabetic foot ulcers and other hard-to-heal wounds. In addition, the paper explores the potential of modern wound therapies and AI-driven technologies to mitigate these costs through improved clinical outcomes and systemic efficiency. The study contributes to a growing body of literature at the intersection of health economics, technology adoption, and policy development, offering data-driven recommendations for sustainable healthcare strategies in both national and global contexts.

Literature review

Contrary to perception, wound dressing materials represent only a fraction of the total care cost. Studies show that nursing care, hospital stays, and inpatient services constitute 80-85% of total wound-related expenditure (Al-Gharibi et al., 2019; Busu, 2012). For instance, the average hospitalization cost for DFU management in the United States ranges between $12,851 and $16,267 per episode, while the annual European expenditure exceeds €4-6 billion (Olsson et al., 2019).

Infection dramatically increases economic burden. Surgical site infections (SSIs) can extend hospital stays by 11 days and add €5,800 in Europe, or up to $20,000 in the United States. (Defez et al., 2008; Zimlichman et al., 2013) Approximately 13.3% of venous leg ulcers and 10.4% of pressure ulcers become infected, necessitating systemic antibiotic therapy in over 60% of cases, prolonging healing times and workforce absenteeism. Sharma et al., 2024). In severe cases, such as osteomyelitis, the cost per pressure ulcer case in Europe can exceed €34,500 (Järbrink et al., 2017).

A UK cohort study estimated that healed chronic wounds cost between €805 and €4,611 per patient, while unhealed wounds ranged from €1,982 to €6,892, highlighting a 135% cost increase when wounds do not resolve (Guest et al., 2017).

Globally, chronic wounds diminish the labor force by reducing full-time work participation and impairing informal labor productivity, particularly in low- and middle-income countries (LMICs) where specialized wound care is scarce (Kinfe et al., 2024). These losses reverberate through increased welfare dependency and reduced GDP contributions. In publicly funded healthcare systems, this also translates into elevated tax burdens to sustain prolonged care. Moreover, the psychological consequences of chronic wounds-such as pain, depression, and social isolation-further curtail workforce reintegration and intensify economic dependency (Augustin et al., 2017). The indirect costs of productivity loss are particularly striking when evaluated in proportion to GDP. For instance, in Hungary, a pooled analysis of chronic disease cost-of-illness studies (including diabetes and vascular disorders associated with chronic wounds) revealed that productivity loss can account for up to 70% of GDP per capita in some disease groups (Rashdan and Brodszky, 2020).

In Romania, chronic wounds-particularly diabetic foot ulcers (DFUs)-impose a substantial economic burden on the national healthcare system. The literature does not contain many relevant sources. A study conducted at a diabetes center in Cluj-Napoca found that the median hospitalization cost for patients with diabetic foot ulcers and amputations was €724, approximately 40% higher than for patients without such complications. Hospitalization represents over 80% of total costs per patient (Sima et al., 2021).

Another study analyzing 1,094 DFU-related hospitalizations at a tertiary hospital reported a median cost of €810.8 per hospitalization, with ischemic and neuroischemic DFUs incurring significantly higher costs than neuropathic ulcers. The total cost for DFU-related hospitalizations over four years exceeded €1.27 million, (an average of €317.000 per year) representing 4.8% of the total diabetes-related inpatient care budget during the same period. The study relates that the Cluj Emergency hospital serves a community of over 500.000 inhabitants in the surrounding area or over 4,5 million inhabitants for rare, complex revascularization procedures (Rusu et al., 2025).

Romania has a population of about 19 million inhabitants (*Romania Population (2025) - Worldometer*, n.d.). Using some basic calculation we can assume that about €12 million is spent annually in Romania on DFU related hospitalizations. Romania's Healthcare is dominated by the public sector, which owns most of the hospitals and provides national health insurance to almost all eligible Romanian citizens. The cost of healthcare in Romania in 2021 was USD16.7 billion, 5.69 percent of GDP, one of the EU's lowest per capita (*Romania - Healthcare*, n.d.).

These findings highlight the disproportionate cost burden of DFUs relative to their incidence and emphasize the economic need for early prevention and multidisciplinary management in Romanian healthcare policy. Modern therapies for chronic wound treatment have advanced significantly in recent years, with innovations such as negative pressure wound therapy (NPWT) and advanced dressings playing a central role in improving healing outcomes and potentially reducing long-term healthcare costs. NPWT uses controlled suction to remove exudate and promote blood flow, accelerating wound closure and reducing the need for surgical intervention. Though NPWT dressings can cost between $100–$400 per application and total

therapy costs can exceed $20,000 per patient in some cases, studies suggest it can be cost-effective by reducing healing time and hospital stay (Fatoye et al., 2018). Similarly, modern dressings-including antimicrobial, hydrocolloid, and honey-based products—are designed to maintain a moist wound environment, minimize infection risk, and enhance patient comfort. While more expensive than traditional gauze (ranging from $10–$70 per dressing), these dressings often require fewer changes and reduce complications, which may offset higher upfront costs (Rafter, n.d.). Economic evaluations have shown that these advanced therapies can be cost-effective or even cost-saving by decreasing healing time, reducing infection rates, and minimizing hospital admissions (Cheng et al., 2018; Fatoye et al., 2018). Given the growing economic burden of chronic wounds, adopting these technologies is not only clinically sound but also economically prudent.

Methodology

This study employs a mixed-methods narrative review approach to assess the economic burden of chronic wounds on global and national healthcare systems. The methodology is structured around two core components: (1) a comprehensive synthesis of recent international literature and cost-effectiveness analyses, and (2) a contextual economic case study of Romania, used to illustrate localized implications and disparities.

A systematic search of peer-reviewed journal articles, clinical studies, and grey literature was conducted using databases such as PubMed, Scopus, and Google Scholar. Keywords included *"chronic wounds", "diabetic foot ulcers", "economic burden", "healthcare costs"* and *"Romania."* Inclusion criteria prioritized studies published between 2009 and 2025 that provided quantitative or qualitative data on wound-related expenditures, cost-effectiveness of interventions, or health policy implications. Particular attention was given to studies reporting on direct (e.g., hospitalization, wound care materials, advanced therapies) and indirect costs (e.g., productivity loss, quality of life impairment, long-term disability).

To contextualize the findings, a focused case study of Romania was developed using data from national health reports, institutional studies, and healthcare economics literature. This case study emphasizes the structure and funding of the Romanian healthcare system, hospitalization costs for diabetic foot ulcers, and access to modern wound therapies. Cost extrapolations were made using population-based incidence estimates and hospitalization figures drawn from published Romanian studies (Sima et al., 2021; Rusu et al., 2025).

Cost data were categorized into direct and indirect components. Direct costs included medical expenses such as hospitalization, surgery, wound dressings, and advanced therapies. Indirect costs were estimated based on reduced work productivity, disability, and welfare dependency. Economic comparisons were made between high-income and low-to-middle-income countries, with Romania serving as a representative LMIC case. Descriptive statistics and comparative analysis were used to highlight disparities in cost allocation and outcomes.

Additionally, this paper evaluates the potential cost-saving impact of modern wound management technologies—including negative pressure wound therapy (NPWT) and artificial intelligence (AI)-driven tools—based on previously published cost-effectiveness studies. These innovations were analyzed for both their clinical and economic value using qualitative synthesis.

Results and discussions

Artificial intelligence (AI) is increasingly being adopted in the field of chronic wound management due to its potential to improve clinical outcomes and reduce healthcare expenditures. AI systems use machine learning algorithms and image analysis tools to automatically assess wound characteristics such as size, depth, tissue composition, and infection status from clinical photographs. These tools enable remote, real-time wound monitoring, more accurate diagnoses, and individualized treatment planning, which are critical for improving healing rates and minimizing complications.

From an economic perspective, AI technologies offer cost-saving opportunities by reducing the need for frequent in-person visits, avoiding hospital readmissions due to infection or deterioration, and facilitating earlier intervention. For example, AI-based wound assessment platforms have demonstrated feasibility in capturing standardized wound data and integrating it into clinical workflows, thereby supporting cost-effective telemedicine approaches (Jun et al., 2016) In a user trial, AI-assisted mobile applications were shown to enhance documentation, promote continuity of care, and improve healing outcomes-all of which contribute to healthcare cost reduction (Jun et al., 2016).

Table 1. AI-Powered Applications for Wound Management

Application	Key Features	Use Case
FootSnap	AI-based smartphone imaging; wound measurement and tracking	Diabetic foot ulcers; remote monitoring
imitoWound	Secure wound photo documentation with AI-aided size calculation and EHR integration	Hospital and outpatient wound tracking
KroniKare	Real-time wound assessment using multispectral imaging and machine learning	Emergency and community wound triage
Tissue Analytics	Advanced wound imaging, healing prediction, and integration with Epic/EMR systems	Hospital-grade wound surveillance
MOWA (Mobile Wound Analyzer)	Wound image capture, size tracking, and real-time monitoring	Long-term care and home health
Swift Skin and Wound	AI for wound scanning, 3D measurement, and healing score calculation	Multi-setting wound management
Cares4Wounds	AI-based decision support system for wound classification and treatment guidance	Educational and clinical decision support
DermaViz	Deep learning tool for detecting wound margins and changes over time	Dermatological wound surveillance
SmarWoundCare	AI wound analysis through pattern recognition and healing simulation	Clinical diagnostics and treatment modeling
WoundZoom	Imaging tool with cloud-based analysis and reporting features	Centralized wound documentation for care teams
WoundMatrix	Secure telehealth wound documentation platform using AI tools	Remote patient management
WoundVision	Infrared thermography and AI to predict pressure injuries before they form	Prevention-focused in hospitals and nursing homes
Healee Wound	Romanian telemedicine tool with AI for wound consultations and tracking	Remote care in Eastern Europe

Moreover, AI tools that integrate with electronic health records and secure cloud databases enable predictive analytics by comparing new wound data to extensive historical datasets. These

systems use algorithms to suggest treatment plans and predict healing times, allowing clinicians to optimize resource allocation and reduce unnecessary interventions (Marian, 2022).

The cost-effectiveness of AI-based wound care has been supported by systematic reviews. One economic analysis found that advanced digital tools for wound assessment can be cost-effective by decreasing dressing change frequency, accelerating healing time, and reducing hospital length of stay-key drivers of chronic wound care costs (Fatoye et al., 2018). The ability of AI systems to monitor wounds remotely also reduces caregiver burden and limits work absenteeism for patients and family members, contributing further to indirect economic savings.

While initial setup costs for AI platforms vary, the long-term return on investment is supported by reductions in complications, emergency interventions, and prolonged care needs. As chronic wounds disproportionately affect aging and diabetic populations-groups associated with high healthcare utilization—the integration of AI technologies presents a high-impact, scalable solution for both clinical and economic challenges in wound care.

Conclusions and recommendations

When compared to other EU member states, Romania allocates considerably fewer resources per capita to chronic wound care, despite facing a growing burden from diabetes-related complications. The average cost per hospitalization for diabetic foot ulcers (DFUs) in Romania is €724–€810.8 per episode, as reported in two Cluj-based studies (Rusu et al., 2025; Sima et al., 2021), which is significantly lower than estimates from Western European countries. For instance, in Germany, the mean cost of DFU care can reach €9,000–€10,000 per patient, while France and the UK report similar figures, largely due to more intensive use of multidisciplinary care and advanced therapies (Guest et al., 2017; Olsson et al., 2019). However, Romania's lower costs reflect limited access to high-cost interventions and longer healing times, rather than greater efficiency. Moreover, Romania ranks among the lowest in the EU for healthcare spending per capita, at approximately €1,000, compared to the EU average of €3,000–€4,000, exacerbating disparities in wound care quality and outcomes (*Current Health Expenditure per Capita (Current US$) - Romania, European Union | Data*, n.d.). These differences underscore the need for national investment in evidence-based wound care and highlight opportunities for policy alignment with EU best practices.

Chronic wounds represent a substantial and escalating economic burden on healthcare systems and societies worldwide. Beyond the high costs of clinical management-including hospitalization, infection control, and long-term care-these wounds impose significant indirect costs through productivity loss, welfare dependency, and reduced labor force participation. Modern therapies and AI-driven solutions offer promising avenues for improving outcomes while potentially lowering total costs, yet their adoption requires sustained investment and systemic integration. For policymakers and health economists, addressing the economic impact of chronic wounds is not only a clinical imperative but a strategic priority for sustainable healthcare financing.

Based on the results above, we come with some recommendations. First, early intervention and prevention strategies-particularly in diabetic and elderly populations-can curb wound progression and associated disability. Second, investment in advanced wound care technologies such as negative pressure wound therapy and antimicrobial dressings has demonstrated cost-effectiveness in improving healing times. Third, the development of multidisciplinary care models

and occupational rehabilitation programs is essential for reducing care duration and restoring economic productivity.

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