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Pressure ulcers – Review on market and treatment

Abstract

Pressure ulcers represent a substantial clinical and economic burden, affecting millions of immobilized, elderly, and critically ill patients globally. Driven by population aging and the rising prevalence of comorbidities such as diabetes and cardiovascular disease, the global market for pressure ulcer diagnostics, prevention, and treatment is projected to grow strongly over the next decade. This paper reviews the pathophysiology, classification, and multifactorial risk factors of pressure ulcers. It evaluates the current commercial market landscape and emerging preclinical and clinical therapeutics. A comprehensive review was conducted, segmenting current technologies into preventive measures and treatment interventions, including negative pressure wound therapy, enzymatic ointments, and tissue engineering. Ongoing clinical trials evaluating next-generation biologics, such as human placental and amniotic tissue allografts, were also analyzed. Ultimately, the future of pressure ulcer management is shifting toward early detection and objective, data-driven prevention; the integration of advanced materials, automated closed-loop sensing devices such as the proposed adaptive pad, and regenerative biologic therapies holds significant promise for improving clinical outcomes, reducing individual treatment costs, and mitigating caregiver physical workload.

Keywords: pressure injury, pressure ulcer, pressure mapping, preventive care, skin integrity, tissue engineering, wound care market

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Abbreviations: mm Hg, millimeters of mercury; COVID-19, coronavirus disease of 2019; EPUAP, European pressure ulcer advisory panel; NPIAP, National pressure injury advisory panel; PPPIA, Pan Pacific pressure injury alliance; CAGR, compound annual growth rate; USD, United States dollar; UNFPA, United Nations Population Fund; NPWT, negative pressure wound therapy; SIS, small intestinal submucosa; CAMPs, cellular, acellular, and matrix-like products; ATPs, amniotic tissue products; PAW, plasma-activated water

Introduction

Pressure ulcers are defined as localized damage to the skin and underlying soft tissues, most commonly occurring over bony prominences, and are caused by sustained or intense pressure and shear force.[1] While early-stage pressure ulcers may present as mild skin discoloration, progression without appropriate intervention can lead to deep tissue damage, infection, sepsis, and necrosis.[2,3] Despite advances in preventive care, pressure ulcers remain highly prevalent among immobilized, elderly, and critically ill patient populations.[4] Their development is associated with substantial morbidity, increased risk of infection and mortality, prolonged hospital stays, and a marked decline in patient quality of life.[5]

Market demand for pressure ulcer prevention and treatment technologies has continued to grow due to the increasing prevalence of chronic immobility, aging populations, and comorbid conditions such as diabetes and cardiovascular disease.[6] Advancements in early detection technologies and patient monitoring systems have driven a shift toward proactive and preventative care strategies. Innovations in imaging modalities, pressure mapping, and biomaterial design are reshaping how clinicians identify and manage at-risk patients.[7]

This review will cover the pathophysiology and risk factors associated with pressure ulcer development, current prevention and treatment modalities, and an analysis of the pressure ulcer care market, including key technologies and emerging trends. Finally, it will conclude with an overview of next-generation approaches, including tissue engineering and biologic therapies, that aim to improve clinical outcomes and address existing gaps in care.

Pathophysiology of pressure ulcers

Individuals who have impaired sensation, mobility, or cognition aren't able to reposition themselves when prolonged pressure triggers discomfort, allowing the sustained pressure to persist.[1] Pressure ulcers develop when body weight compresses soft tissue between a bony prominence and an external surface like a mattress, wheelchair, or medical device, as shown in Figure 1.[1,5] If the external pressure exceeds the venous capillary closing pressure of 8 to 12 mm Hg, it impairs blood flow, and the arterial capillary pressure of 32 mm Hg, it impedes blood flow.[5] Continued pressure above these two values compromises blood circulation and results in localized tissue hypoxia, ischemia, and ultimately necrosis.[1,5]

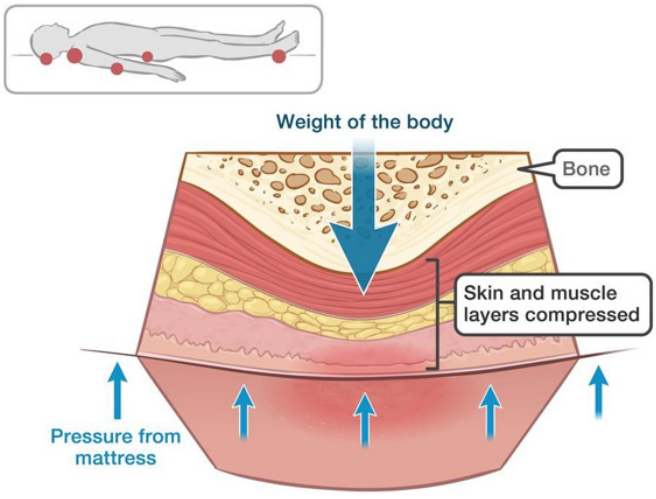


Figure 1 Anatomical depiction of how external pressure compresses soft tissue.[4]

The image shows an anatomical cross-section diagram illustrating how external pressure creates compression on soft tissues, typically leading to pressure ulcers (bedsores).

There are many factors that can contribute to the development of pressure ulcers, including friction, moisture, and inflammation.[1,5] Friction from contact with bedding or clothing can disrupt the superficial skin barrier, and excessive moisture promotes tissue maceration and breakdown.[1,8] Systemic inflammatory states, such as those observed in conditions like COVID-19, may amplify tissue damage through elevated cytokine activity, further contributing to ulcer formation and progression.[5]

Risk factors

Individuals at the highest risk for developing pressure ulcers are those with impaired mobility or reduced sensory perception, as well as elderly populations, because they often possess multiple overlapping risk factors.[1] Limited mobility, such as being confined to a bed or wheelchair, prevents regular repositioning and leads to prolonged pressure on specific areas of the body.[5] Similarly, diminished sensation, which is common in conditions such as spinal cord injuries or neurological disorders, reduces the ability to perceive discomfort and delays necessary position changes.[1] Nutritional status also plays an important role, as inadequate intake of calories, protein, and essential nutrients can result in loss of muscle mass and body weight, increasing the prominence of bony areas and making tissues more susceptible to breakdown.[5,8]

Age-related physiological changes further increase risk, as aging skin undergoes thinning of both the dermal and epidermal layers, decreased cellular turnover, and weakening of the dermoepidermal junction.[1] Additional contributing factors include prolonged exposure to moisture from incontinence, which weakens the skin barrier, and medical conditions that compromise blood flow, such as diabetes, vascular disease, and heart failure.[8] Other associated conditions, including cognitive impairment, edema, deep vein thrombosis, and rheumatoid arthritis, may further increase vulnerability by impairing circulation, mobility, or overall tissue health.[1] Together, these factors highlight the multifactorial nature of pressure ulcer development.[8]

Complications

Pressure ulcers are associated with a range of complications, with infection being the most common.[5] Stage 3 and 4 ulcers often require intensive management due to their potential for severe, life-threatening outcomes. When infection extends into deeper tissues or bone, it can lead to complications such as cellulitis, periostitis, osteomyelitis, septic arthritis, and sinus tract formation. In severe cases, the infection may progress systemically, resulting in sepsis, which can be fatal.[5,8]

These wounds are also highly catabolic, leading to significant loss of fluids and proteins and resulting in hypoproteinemia and malnutrition. Over time, chronic pressure ulcers may cause anemia due to ongoing protein depletion, fluid loss, and intermittent bleeding, and in rare cases, secondary amyloidosis.[5,8]

Additional complications may arise following reconstructive surgery if postoperative care is inadequate, including hematoma or seroma formation, wound dehiscence, abscess development, and surgical site infection. Beyond local and surgical complications, pressure ulcers are also associated with an increased mortality risk.

Pressure ulcer classification

The classification of pressure ulcers is standardized by the European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP), and Pan Pacific Pressure Injury Alliance (PPPIA), which categorize ulcers based on the extent of tissue damage and depth of involvement. The staging chart is shown in Figure 2, and it identifies six primary categories.[2,3]

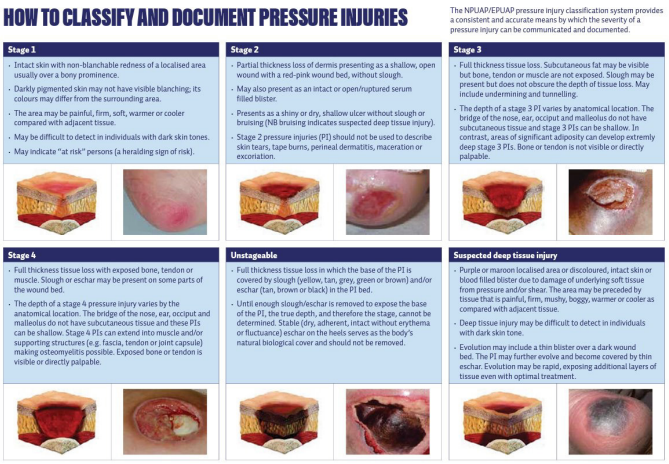


Figure 2 The pressure ulcer staging chart.[6]

This image shows a medical pressure ulcer staging chart illustrating the four primary stages of tissue damage, progressing from skin redness to deep wounds that expose muscle and bone.

Stage I pressure ulcers present as non-blanchable erythema, where the skin remains intact but exhibits persistent redness or discoloration, often accompanied by changes in temperature, texture, or pain.[2,3] Stage II ulcers involve partial-thickness skin loss, appearing as shallow open ulcers or fluid-filled blisters with a red or pink wound bed,[2,9] In Stage III, full-thickness skin loss extends into the subcutaneous tissue, potentially including slough, tunneling, or undermining, but deeper structures such as bone, tendon, and muscle are not exposed.[2,9] Stage IV represents full-thickness tissue loss with exposure of underlying structures, including bone, tendon, or muscle, and is often associated with extensive necrosis and complications such as infection.

In some cases, wounds are classified as unstageable when their depth cannot be determined due to coverage by slough or eschar, although stable eschar on the heel may serve a protective role and is not always removed. The last category, suspected deep tissue injury, describes areas of discolored skin or blood-filled blisters that indicate underlying damage not yet visible at the surface but with high risk of rapid progression.[2,9]

Pressure ulcers may occur on mucosal membranes, such as within the oral, nasal, gastrointestinal, or urinary tracts, often because of medical devices like tubes or catheters. These mucosal injuries differ structurally from skin injuries and therefore are not staged using the same classification system. Additionally, early detection of pressure ulcers can be particularly challenging in individuals with darker skin tones, as traditional signs such as erythema may be less apparent. In these cases, clinicians rely on alternative indicators including changes in skin temperature, moisture, firmness, and patient-reported pain, sometimes supplemented by diagnostic tools designed to improve assessment accuracy.[2]

Market size, products, and companies

Pressure ulcers represent a significant and growing healthcare burden, particularly in aging populations and nursing home settings. In the United States, an estimated 2.5 million individuals develop pressure ulcers each year, contributing to approximately 60,000 deaths

annually. The prevalence of pressure ulcers is expected to increase in the coming decades, largely driven by the expanding elderly population and the rising number of patients with chronic conditions and limited mobility.[10] These demographic shifts, combined with global population aging and disparities in healthcare, have led to a greater proportion of individuals at risk, particularly those in low- and middle-income countries.[4]

The economic impact of pressure ulcers is substantial, with annual healthcare costs in the United States estimated to cost between $9.1 billion and $11.9 billion, with individual treatment costs ranging from $20,900 to $151,700 per injury depending on severity.[10] On a global scale, pressure ulcers affect millions of patients across both developed and developing regions, with prevalence rates particularly high in hospitalized and long-term care populations, as shown in Figure 3. In developed countries, increased awareness, standardized prevention protocols, and improved access to care have contributed to reductions in incidence in some settings. However, disparities in healthcare resources continue to drive higher prevalence and worse outcomes in low- and middle-income countries.[4]

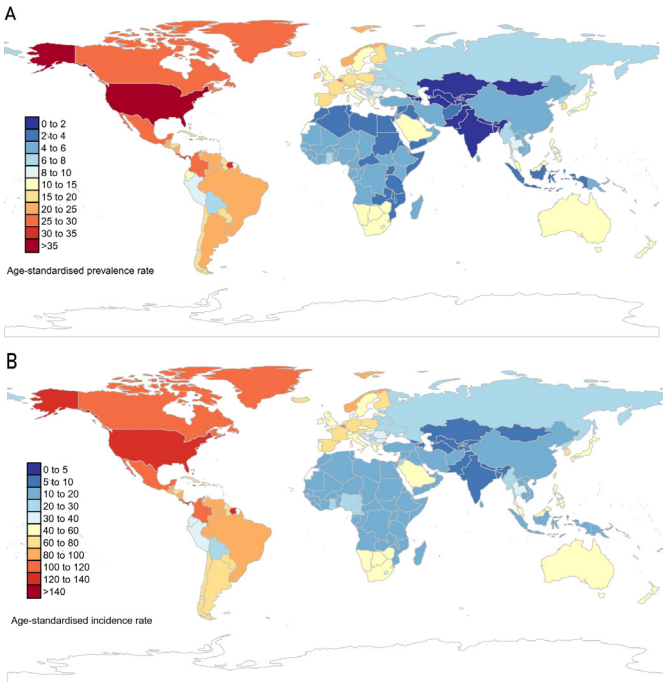
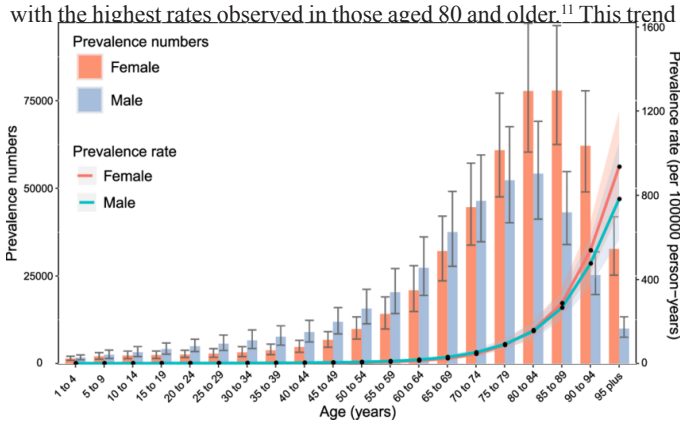


Figure 3 Global prevalence and incidence rate of pressure ulcers in 2019.[9]

This image shows two global heat maps presenting the age-standardized prevalence (Map A) and incidence rate (Map B) of pressure ulcers per 100,000 people across different countries and territories in 2019.

The age distribution of pressure ulcers is skewed toward older populations due to age-related physiological changes and the increased prevalence of immobility and comorbid conditions. The prevalence of pressure ulcers rises markedly with advancing age. Incidence remains relatively low in younger adults but increases substantially in individuals over the age of 65, as shown in Figure 4, with the highest rates observed in those aged 80 and older.[11] This trend



is largely attributed to factors such as reduced skin integrity, impaired circulation, and decreased mobility associated with aging.[6]

Figure 4 Global prevalence cases of pressure ulcers by age and sex.[9]

This image shows a combined bar and line graph detailing the global prevalence numbers and prevalence rates of pressure ulcers per 100,000 populations, categorized by five-year age intervals and sex.

Global pressure ulcer market size and trends

In 2022, the global pressure ulcer treatment market was valued at USD 5.8 billion and is expected to grow to USD 11.1 billion by 2032, reflecting a compound annual growth rate (CAGR) of 6.7% over the forecast period, as shown in Figure 5. In addition to an aging population causing a rising prevalence of pressure ulcers, this growth is also driven by a greater adoption of advanced wound care technologies, increased healthcare spending, and the development of more sophisticated treatment methods.[12] In 2023, the global pressure ulcer diagnostics market was valued at USD 1.54 Billion and is expected to grow to USD 2.55 Billion by 2033, reflecting a CAGR of 5.2%, as shown in Figure 6.[13] Finally, in 2025, the global pressure ulcer prevention market size was valued at USD 1.17 billion and is expected to grow to 1.69 billion by 2034, reflecting a CAGR of 4.3%, as shown in Figure 7.[14]

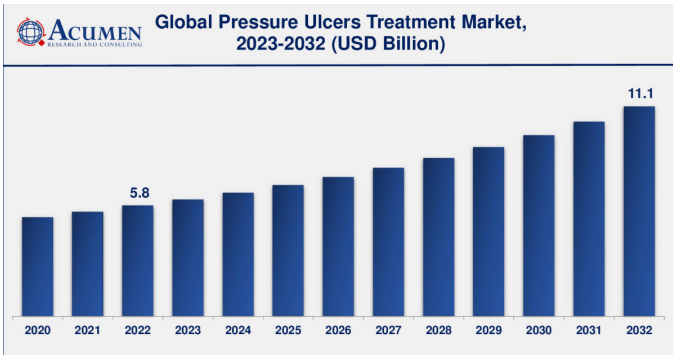


Figure 5 Global pressure ulcer treatment market size from 2020-2032.[11]

This image shows a bar chart detailing the global pressure ulcer treatment market size in USD billions from 2020 to 2032.

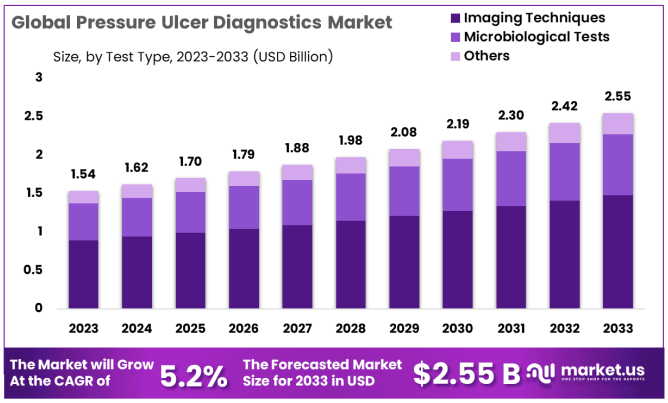


Figure 6 Global pressure ulcer diagnostics market size from 2023-2033.[12]

This image shows a bar chart detailing the global pressure ulcer diagnostics market size in USD billions from 2023 to 2032.

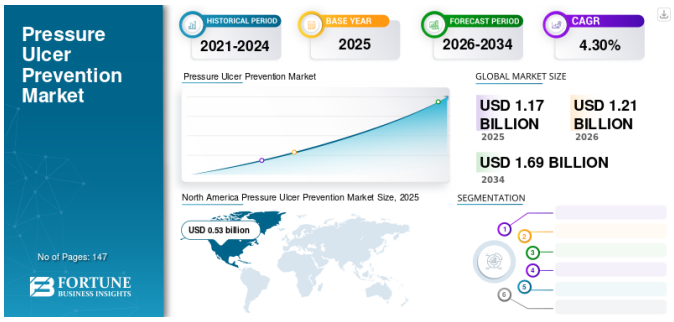


Figure 7 Global pressure ulcer prevention market size from 2026-2034.[13]

This image shows a bar chart detailing the global pressure ulcer prevention market size in USD billions from 2026 to 2034.

In addition to the global pressure ulcers market being divided into treatment, diagnostics, and prevention, it is also segmented by ulcer stage, treatment type, end user, and region. As shown in Figure 8, based on ulcer type, Stage 1 pressure ulcers accounted for the largest market share in 2021. However, Stage 2 ulcers are expected to experience the fastest CAGR over the forecast period, driven by a rising number of patients presenting with Stage 2 ulcers and adoption of treatment options.[15,16] While earlier stages dominate in prevalence, Stage 4 ulcers have a higher market value due to their high treatment costs, estimated at approximately $16,618 per ulcer.[16]

Among treatment types, the wound care dressing segment is projected to maintain market dominance and continue expanding at a strong growth rate, as shown in Figure 9.[15] This growth is primarily driven by their widespread adoption as a first-line treatment option and their effectiveness in accelerating the healing process.[16] The wound care devices segment is projected to have the highest CAGR of 5.6%, as ongoing technological advancements and the development of innovative products such as collagen-based dressings incorporating epidermal growth factors, vitamin C derivatives, and hyaluronic acid have strengthened their clinical adoption.[15]

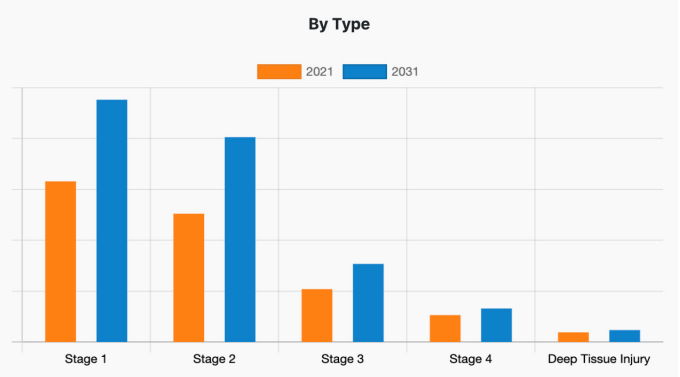


Figure 8 Pressure ulcer market by type and prevalence.[14]

This image shows a grouped bar chart comparing the pressure ulcer market by severity type and prevalence for the years 2021 and 2031.

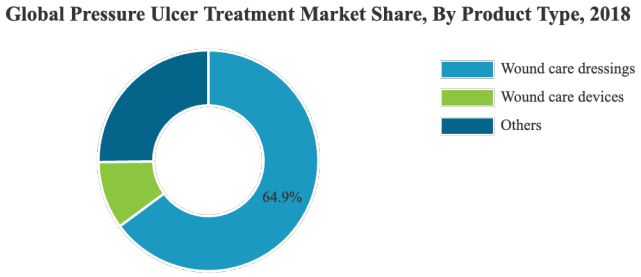


Figure 9 Market analysis of the treatment type segment.[15]

This image shows a donut chart illustrating the global pressure ulcer treatment market share by product type in 2018.

Based on end-user outlook, the hospital segment currently holds the largest market share, as shown in Figure 10. It is expected to maintain its dominance throughout the forecast period due to the higher adoption of advanced wound care technologies in hospital settings, the availability of skilled healthcare professionals, and increased hospital investment in treatment options.[15,16] In contrast, the home care segment is projected to experience the fastest growth. This trend is driven by the increasing geriatric population, a growing preference for at-home treatment, and the development of improved protocols and resources that support pressure ulcer prevention and care in home settings. Other settings like clinics are also expected to have growth due to the rise of specialized wound care centers equipped with advanced facilities, trained staff, and personalized treatment approaches that enhance patient outcomes.[16]

In the global pressure ulcer market, North America held the largest market share in 2018 because of the high prevalence of pressure ulcers, well-established healthcare infrastructure, continuous introduction of advanced technologies, and the high cost of treatment products in the region, as shown in Figure 11. Europe represented the second-largest market share due to the growing elderly population and an increasing incidence of pressure ulcers. Also, higher treatment

costs in countries such as Germany, France, and the U.K. are expected to create further growth opportunities in the coming years. The Asia Pacific region is expected to experience the fastest CAGR, driven by a rapidly expanding geriatric population and a rising number of pressure ulcer cases. According to the United Nations Population Fund (UNFPA), the aging population in this region is increasing at an unprecedented pace, with projections indicating that by 2050, one in four individuals in Asia Pacific will be over the age of 60. Finally, Latin America and the Middle East & Africa are still anticipated to see steady growth because of improving healthcare infrastructure and increasing awareness of available pressure ulcer treatment options.[16]

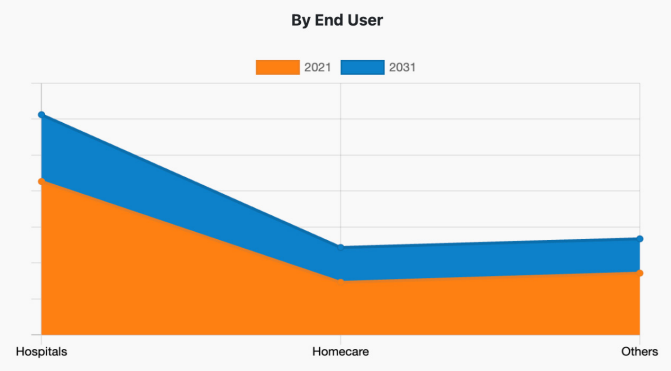


Figure 10 Pressure ulcer market by end-user and amount of growth.[14]

This image shows an area chart comparing the pressure ulcer market by end-user segments for the years 2021 and 2031.

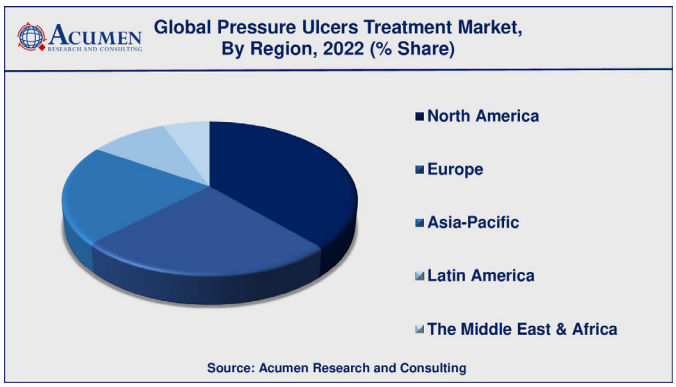


Figure 11 Analysis of the global pressure ulcers treatment market by region.[11]

This image shows a pie chart illustrating the percentage share of the global pressure ulcers treatment market by region in 2022.

Pressure ulcer products

Pressure ulcers can be managed through a combination of prevention and treatment strategies. Prevention focuses on reducing risk factors and maintaining skin integrity, while treatment aims to promote healing and prevent further complications. A wide range of products has been designed to address each stage of this process, from minimizing pressure and protecting vulnerable areas to supporting wound healing and tissue regeneration.[17]

Prevention products

Many pressure ulcers can be prevented through daily self-care and proactive management. Patients or their caregivers should perform full-body skin checks every day, paying close attention to high-risk areas where pressure ulcers commonly develop and repositioning often.[17,18] In addition, proper nutrition and hydration play a critical role in skin integrity. A balanced diet supports skin health, while adequate fluid intake helps maintain tissue resilience.

Beyond lifestyle and care practices, a wide range of products are designed to help prevent pressure ulcers by reducing pressure, friction, shear, and moisture.[19] These include skin care products, prophylactic dressings, repositioning systems, heel protection devices, specialized mattresses, cushions, wedges, and stretcher pads, as shown in Figure 12. These products are most effective when used in combination as part of a prevention strategy tailored to the patient's level of mobility and risk. Skin care products are applied routinely to maintain hydration and protect against moisture-related damage, while prophylactic dressings are placed over high-risk areas to reduce friction and shear forces.[20] Repositioning systems, wedges, and cushions are used to offload pressure by supporting proper body alignment and facilitating regular position changes. In bedbound patients, specialized mattresses and heel protection devices help redistribute pressure, minimizing prolonged stress on tissues. During transfers or medical procedures, stretcher pads help reduce localized pressure and friction.[19] Together, the use of these products help to significantly lower the risk of pressure ulcer development.[17]

A comparison of the different categories of pressure ulcer prevention products is presented in Table 1. Table 2 lists some products and compares them based on their company, composition, characteristics, and regulatory status, and Figure 12 shows pictures of the examples.

Figure 12 Example commercial pressure ulcer prevention products.[1a-1f]

This image shows a collection of six commercial pressure ulcer prevention products labeled A through F, specifically featuring (A) Cavilon™ Durable Barrier Cream, (B) Optifoam Gentle EX Silicone-Faced Foam Wound Dressings, (C) ComfortGlide Repositioning Sheets, (D) Prevalon Heel Protector, (E) Ultimate Pressure Care Mattress, and (F) Quadtro Select® Cushion.

Treatment products

Pressure ulcer treatment depends on the severity. Stages 1 and 2 pressure ulcers can often be treated at home by patients or caregivers, while Stage 3 and 4 ulcers require evaluation by a wound care specialist.[24] Initial treatment usually includes cleansing the wound with soap and water or sterile saline, followed by application of specialized dressings or topical agents designed to promote healing.[24,25] For more severe wounds, debridement may be necessary to remove necrotic tissue, using either surgical tools or enzymatic ointments that help dissolve dead tissue.[24] After debridement, additional interventions may be used to promote tissue regeneration and wound closure, including skin grafts, negative pressure wound therapy (NPWT), and regenerative skin products using tissue engineering.26–28

Table 1 Pressure ulcer prevention products comparison based on category[17–23]

Product Category	Composition	Advantages	Limitations	Used For	Reference
Skin Care	Specialized cleaners, moisturizers, barrier creams, topical solutions, pH-balanced cleansers, skin protectants	Maintains skin integrity, prevents dryness, creates a protective barrier, relatively low cost	Requires frequent, consistent application	Anyone at risk for pressure ulcers, but especially people with fragile skin, incontinence	21
Prophylactic Dressings	Foam, film, or hydrocolloid dressings	Prevents leakage and bacterial contamination, reduces friction and shear, protects high-risk areas	Variations in the effect based on where the dressing is placed	Placed at the sacrum and heels, as they are high-risk areas	22
Repositioning Systems	Sheets, foam wedges, drypads	Helps move patients using much less effort, relieves pressure, manages moisture	Labor intensive	Immobile or bedbound patients	17, 19
Heel Protection Devices	Foam or air-filled supports	Reduces pressure on heels, reduces prolonged loading	Needs to be properly fitted and applied	Immobile or bedbound patients	17, 18
Specialized Mattresses	Foam, gel, or air-filled	Creates an even pressure distribution, reduces prolonged loading	Expensive, requires maintenence	High-risk or long-term bedridden patients	17, 19, 23
Cushions	Foal, gel, or air-filled	Redistributes pressure, provides comfort, maintains blood flow	Patient still needs someone to help them shift their weight often, could lose density over time	High-risk patients	19

Table 2 Examples of commercial pressure ulcer prevention products[20]

Product	Company	Category	Composition	Characterisics	Reference
Cavilon™ Durable Barrier Cream	3M	Skin Care	Concentrated, long-lasting, pH-balanced, waterproof, durable skin barrier cream	Formulated with 3M polymer technology to resist wash-off and provide protection from bodily fluids	20, 1a
Optifoam Gentle EX Silicone-Faced Foam Wound Dressings	MEDLINE	Prophylactic Dressings	Foam dressing with silicone adhesive, 5 layers with a superabsorbent core	Absorbs exudate, converts it into a gel, and locks it away	1b
ComfortGlide Repositioning Sheets	MEDLINE	Repositioning Systems	Breathable material, low-friction bottom	Reduces the effort needed when repositioning patients, material is compatible with low air loss mattresses	1c
Prevalon Heel Protector II	SAGE PRODUCTS	Heel Protection Devices	Outer covering made of ripstop nylon, dermasuede fabric interior	Cradles the foot and elevates the heel to eliminate pressure, offers continuous pressure relief	1d
Ultimate Pressure Care Mattress	Opera Beds	Specialized Mattresses	U-shaped core and castellated foam center, wipe-clean antimicrobial cover	Offers pressure relief while giving stability and support, distributes weight evenly	1e
Quadtro Select® Cushion	ROHO	Cushions	Air cells, four-compartment design	Inflation levels across the cushion can be controlled, reduces pressure and discomfort	1f

A comparison of the different categories of pressure ulcer prevention products is presented in Table 3. Figure 13 and Table 4 show images of some products and compare them based on their company, composition, characteristics, and regulatory status.

Table 3 Pressure ulcer treatment products comparison based on category[25–29]

Product Category	Composition	Advantages	Limitations	Used For	Reference
Dressing	Alginate, hydrocolloid, foam, iodine-containing, soft polymer	Maintains moist wound environment, absorbs exudate, supports faster healing	Needs to be changed often, not effective for deep/necrotic wounds	Stage 1 or 2 pressure ulcers	25
Topical Agent	Antimicrobial, growth factor	Easy application, promotes healing, reduces microbial load	Not effective for deep/necrotic wounds	Stage 1 or 2 ulcers, infection control	25
Enzymatic Ointment	Collagenase, papain urea	Non-surgical option to remove slough and eschar, less invasive than sharp wound debridement	Slower action, less affection when there is infected or extensive necrosis	Stage 3 or 4 ulcers that require non-invasive debridement	29
Negative Pressure Wound Therapy	Sealed wound system, vacuum pump	Removes exudate, reduces edema, improves blood flow, promotes tissue formation	Require equipment and monitoring, costly, not suitable for all wound types	Post-debridement wounds, moderate-severity ulcers	27
Tissue Engineering	Bioengineered skin substitutes, scaffolds, growth factor matrices	Promotes tissue regeneration and healing, reduces need for donor skin grafts	Expensive, limited availability	Stage 3 or 4 ulcers	26, 28

Table 4 Examples of commercial pressure ulcer treatment products

Product	Company	Category	Composition	Characterisics	Reference
AlgiSite M	Smith & Nephew	Dressing	Calcium-alginate	Absorbs when it comes into contact with exudate	1g
Silver Sulfadiazine Cream	Ascend	Topical Agent	Silver Sulfadiazine 1%	Topical, antimicrobial, resists gram-negative and gram-positive bacteria	1h
SANTYL Ointment	Smith & Nephew	Enzymatic Ointment	Collagenase	Debrides by cleaving necrotic tissue at specific sites, aids wound progression by creating polypeptide bioactive byproducts	1i
Avelle™ Negative Pressure Wound Therapy	ConvaTec	Negative Pressure Wound Therapy	Combines negative pressure wound therapy with Hydrofiber Technology, silicone adhesive border with foam and film layers	Locks away exudate, provides a bacterial and viral barrier	1j
OASIS® Wound Matrix	Smith & Nephew	Tissue Engineering	Natural extracellular matrix derived from a single layer of porcine small intestinal submucosa (SIS) technology	Allows for host cell migration, can be used in a variety of settings, contains components similar to those found in the human dermis	1k

Figure 13 Example commercial pressure ulcer treatment products.[1g-1k]

This image shows a collection of five commercial pressure ulcer treatment products labeled A through E, specifically featuring (A) AlgiSite M Calcium Alginate Wound Dressing, (B) Silver Sulfadiazine Cream, (C) SANTYL Ointment, (D) Avelle™ Negative Pressure Wound Therapy system, and (E) OASIS® Wound Matrix.

Pressure ulcer companies—key players

In the treatment market, Mölnlycke Health Care, B. Braun, and ConvaTec Group Plc are among the leading companies.[15] In the prevention market, the key companies are Stryker, Hill-Rom Holdings, Inc., and Invacare Corporation.[13] Finally, in the diagnostics market, the leading companies are Smith & Nephew, 3M Company, Mölnlycke Health Care, ConvaTec Group Plc, and B. Braun.[16]

Ongoing studies and clinical trials

Currently, researchers and industry players are increasingly focused on the development of next-generation biologics and advanced topical therapies aimed at accelerating wound closure and preventing pressure ulcers.[31–36] Some companies that are recruiting for their clinical trials include Tiger Biosciences and i+Med S.Coop, while companies like Cellution Biologics, and Carbon Life Sciences have gone through the preclinical stage but aren't at the recruiting step yet.[31–34]

Tiger Biosciences is recruiting for a Phase 4 clinical trial, which is a post-marketing clinical trial, meaning that the FDA has already approved their product.[31] The purpose of their clinical trial was to evaluating cellular, acellular, and matrix-like products (CAMPs) on their performance on nonhealing pressure ulcers. It examined two CAMPs: ACApatch™ (shown in Figure 14.A) and caregraFT™, both of which are derived from human amniotic membrane tissue. Outcomes from this study were expected to provide insight into the added benefit of biologically derived therapies in enhancing pressure ulcer healing.[31]

i+Med S.Coop. is conducting a clinical trial evaluating the efficacy and safety of ZKARE®, a topical polymeric gel, used alongside standard wound care for the treatment of chronic ulcers. The gel is applied using a specialized applicator (ZKAPI®) to ensure precise and consistent coverage of the wound. Their product, ZKARE®, is designed to create a moist healing environment, absorb excess exudate, and help control bacterial growth, so the study aims to determine whether the addition of their product improves healing outcomes compared to standard treatment.[32]

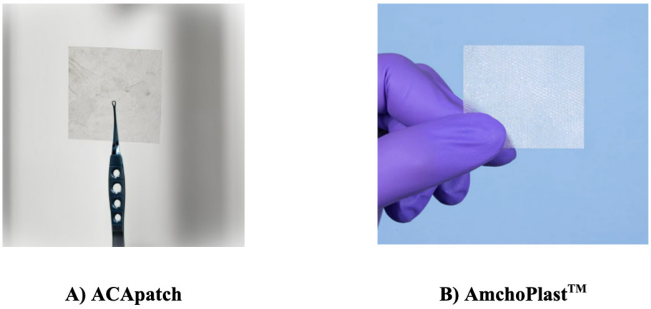


Figure 14 Industry products that are undergoing or about to undergo clinical trials.[37,38]

This image shows two industry products undergoing or preparing for clinical trials labeled A and B, specifically featuring (A) ACApatch and (B) AmchoPlast™.

Cellution Biologics is carrying out an observational study evaluating the safety and effectiveness of the dehydrated human placental tissue (dHPT) allografts, shown in Figure 14.B, that they developed for the treatment of chronic and surgical wounds. They aim to investigate whether dHPT can improve healing outcomes and assess the clinical value of placental-derived allografts.[33]

Carbon Life Sciences is about to start their Phase 3 clinical trial evaluating the efficacy and cost-effectiveness of their amniotic tissue products (ATPs) in the treatment of chronic wounds. The primary outcome is complete wound closure, defined as full epithelialization without drainage within 12 weeks. Overall, they want to determine whether amniotic tissue allografts improve healing outcomes, while also providing insight into their broader clinical and economic value.[34]

On the research side, the National Institute of Nuclear Research in Mexico is recruiting for a randomized controlled trial to investigating a Plasma-Activated Water (PAW) hydrogel developed using Carbopol® 940. This hydrogel is engineered to incorporate reactive oxygen and nitrogen species, which may enhance antimicrobial activity and tissue repair. They want to monitor the patients over a 12-week period to look at factors such as wound size reduction, bacterial load, tissue quality, and pain levels to determine whether this hydrogel can accelerate wound closure and improve overall healing.[35] The University of Baghdad is evaluating the effectiveness of a combined Aloe vera and peppermint gel in preventing pressure ulcers. Their goal is to see whether applying the gel will reduce the incidence of pressure-related ulcers (Appendix).[36]

Conclusion and future considerations

The future of the pressure ulcer industry is poised for steady growth, driven by demographic and clinical trends that continue to increase demand for effective solutions.[9] Specifically, the market for pressure ulcer detection and management technologies is expected to expand as the global geriatric population rises and the prevalence of chronic immobility-related conditions increases.[39] As rates of obesity, diabetes, and cardiovascular disease continue to climb, the incidence and severity of these wounds are also likely to grow, reinforcing the need for more advanced and proactive care strategies.[39,40]

A key shift in the field is the movement toward earlier detection and prevention. Emerging diagnostic tools such as infrared thermography, multispectral imaging, sub-epidermal moisture scanners, and pressure mapping systems are allowing clinicians to identify tissue damage

before it becomes visible on the skin surface. These technologies, combined with patient monitoring systems, are helping to transform care from reactive treatment to proactive risk management.[39] At the same time, advances in materials science are improving the design of support surfaces, like specialized mattresses, high-density foam pads, and low-friction fabrics, which help better redistrubute pressure and reduce tissue stress.[40]

On the treatment side, there is a growing emphasis on next-generation biologics and tissue-engineered solutions, as mentioned in the previous section[41]. Innovations such as amniotic tissue allografts, placental-derived materials, and advanced hydrogels are designed to promote faster wound closure, support tissue regeneration, and modulate the wound environment[41]. Topical therapies incorporating enzymes, antimicrobial agents, or bioactive compounds are being developed to enhance healing while also preventing further tissue breakdown.[37] These approaches reflect a broader shift toward therapies that address the underlying biological complexity of pressure ulcers rather than simply managing symptoms.[41] Overall, the integration of advanced detection technologies, improved preventive materials, and biologic treatments signals a more comprehensive and patient-centered future for pressure ulcer care.

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Conflict of interest

Authors declare that there is no conflict of interest.

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