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Author: Piratheepkumar. R, Amal Wageesha N.D, Sivakanesan. R, Sahayam. S. C

Eastern University, Sabaragamuwa University, University of Peradeniya,

Sri Lanka, Sastra University, India

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A REVIEW OF THE PREVALENCE AND FINANCIAL BURDEN OF VARIOUS FORMS OF WOUNDS

[1]Piratheepkumar. R, [2]Amal Wageesha N.D, [3]Sivakanesan. R, [4]Sahayam. S.C

[1]Department of Basic Philosophy, Faculty of Siddha Medicine, Trincomalee Campus, Eastern University, [2]Faculty of Medicine, Sabaragamuwa University, [3]Postgraduate Institute of Science, University of Peradeniya, [4]Sastra University,

[1,2,3]Sri Lanka, [4]India

ABSTRACT

Wounds are a significant global health issue that places a significant burden on healthcare organizations, doctors, patients, and their families. The review conducted to find out the prevalence and financial burden of various forms of wound. All relevant publications in Google Scholar databases search terms like a chronic wound, wound management, and economic impact, were used. Manual search was conducted in other relevant journals and primary article reference lists. The study took place between June 2022 and May 2023. The authors read every one of the chosen articles. It was decided which facts were crucial after taking thorough notes and recording impressions. Data from the collection were examined. The prevalence of different types of wounds showed an increasing trend over the years. The healthcare cost of treating wounds also increased. The Asian countries had a poorer setup in hospitals compared to European countries to treat chronic wounds. Understanding the humanistic and economic impact burden of different categories of complications among patients with chronic wounds could inform policymakers on the cost-effectiveness of implementing early screening and other prevention or treatment efforts. Also, quantifying the humanistic and economic burden of different forms of wounds will help guide decision-making for the allocation of scarce healthcare resources and funding. Finally, conclusions were drawn from this systematic review highlighting the burden of chronic wounds, methods of estimation, and settings and their correlates.

Key words: Wound, Wound prevalence, Wound types

INTRODUCTION

Wounds are a significant global health issue that places a significant burden on healthcare organizations, doctors, patients, and their families, according to Boakye et al (2018). The concern is currently being expressed around the globe due to the increasing number of people who have terrible chronic wounds. Globally, there are about 6 million people who suffer from chronic wounds, according to Kumar et al (2007). Ulcers and wounds were the two categories that the International Classification of Diseases 9 (ICD-9) divided cutaneous lesions into. Skin lesions associated to underlying chronic conditions are referred to as ulcers, and skin lesions brought on by physical trauma or surgical procedures are referred to as wounds (Nussbaum et al., 2018). The demand for health care has continued to rise due to an increase in the prevalence of

chronic diseases, an increase in life expectancy, and rising expectations (Dowsett et al., 2012). With costs in the millions of euros, acute or chronic wounds have a substantial financial impact on the world. According to estimates, wounds add around 4% of the health system's overall costs, and this number is rising (Wilhelm et al., 2017).

Wound care requires professionals with specialized training to identify and treat patients effectively. Additionally, improved wound care, including accurate diagnosis, treatment, and prevention of wound complications, will help reduce treatment costs. Better patient management and product selection for wound care could potentially lead to better results and lower costs (Guest et al., 2015). The market for wound closure devices was expected to reach more than 15 billion USD by 2022, and it is expected that the number would reach 22 billion USD by 2024, per the 2018 market research report (Wound Closure Products Market Share, 2018). Age, environment, and line of work all have a significant impact on the kind of wound-causing substances that are present. Diabetes, neuropathic ulcers (like leprosy), pressure ulcers, burns, venous ulcers, and arterial ulcers are a few of the most typical causes of chronic ulcers in Sri Lanka. Pyodermagangrenosum and Marjolin's ulcers are two types of ulcers that do not heal (Kumarasinghe, 2004). Wound treatment is now in a terrible state in Sri Lanka. Methods can be improved to give better wound care even with the restricted resources available. A collaborative effort between medical professionals with the necessary subspecialties, wound care nurses, and health care management is necessary to raise the caliber of wound care in Sri Lanka (Kumarasinghe, 2004).

Currently, there is a lack of research on the humanistic and economic burden of chronic wounds and there is consequently a need to comprehensively quantify the burden of chronic wounds to the individual and healthcare system. Decision-makers would have a tool for evaluating therapies and a deeper grasp of what influences cost-effective wound care with an expanded information base. Therefore, it is crucial to quantify illness burden accurately and thoroughly in order to plan future health care services and improve therapeutic pathways (Sen, 2019). Few cost-effectiveness studies are available to inform decision-makers on strategy-based or guideline-based therapies for chronic wounds, according to a 2014 systematic review. However, the research that is currently available suggests that more intensive wound care is rarely cost-saving and is typically cost-effective (Sen, 2019). The review was carried out to comprehend the incidence of various wound kinds and the effects of wounds, particularly economically, and globally.

METHODOLOGY

In order to find and assess all relevant publications inGoogle Scholar databases search terms like a chronic wound, wound management, and economic impact, were used. Additionally, a manual search was conducted in other relevant journals and primary article reference lists. The study took place between June 2022 and May 2023. The chosen articles were then checked once more for relevancy and duplication. The studies that didn't have access to the entire paper were left out of all the searches. The authors read every one of the chosen articles. It was decided which facts were crucial after taking thorough notes and recording impressions. Data from the collection were examined.

RESULTS & DISCUSSION

Prevalence of wound; Type of wounds with Age, sex, and countrywide

Chronic wound prevalence in wealthy nations ranges from 1% to 2%, which is the same proportion as heart failure (Nussbaum et al., 2018). The chronic wound prevalence in the USA was 6.5 million in August 1997 (Sen et al., 2009). In a 2019 systematic review and meta-analysis of 17 observational studies on the frequency of chronic wounds in the general population, all based on Western data, women were more likely to have chronic wounds (range: 53%–68%). However, the prevalence of chronic wounds among men (53%) is higher among 80% of Chinese of Chinese ancestry. Additionally, evidence from the literature indicates that chronic wounds are most common among the elderly and frequently coexist with other comorbidities (Lo et al., 2020)

The most common chronic wounds that elderly individuals endure, according to the Wound Healing Society, are venous stasis ulcers, pressure ulcers, and diabetic (neuropathic) foot ulcers. In India, the prevalence of acute wounds is 10.5 per 1000 people, more than twice as high as the prevalence of chronic wounds, which is 4.5 per 1000 people (Karunanithi et al., 2019). Around 50 lakh people died from wounds in 2008, according to WHO estimates, making up 9% of all fatalities worldwide. The predicted fatality rate from wounds is 98/100,000. The rates are 128/100,000 (38 lakh deaths) for men and 67/100,000 (19 lakh deaths) for women. Each year, 1.6 million cases of traumatic wounds are believed to have occurred worldwide. There were 15.03 wounds per 1000 people in the study's population of India. The prevalence of acute and chronic wounds was 10.55 and 4.48 per 1000 individuals, respectively. Five of the top 10 global causes of death are related to injuries (Karthik et al., 2011). Over the age of 60 years,0.6–3% of persons has chronic leg ulcers (CLU), and that number rises to approximately 5% for those over the age of 80. With an incidence rate in the community ranging from 1.9% to 13.1%, CLU is a common cause of morbidity. Over 10% of people will experience chronic wounds at some point in their lives, and 2.5% of wound-related mortality occur in this group (Karunanithi et al., 2019).

Most cases of chronic wounds occur in the elderly. In the US, open wounds are present in 3% of people over the age of 65. The US government predicted that there will be over 55 million older people in the country by 2020, indicating that chronic wounds will continue to be a persistent issue in this demographic. According to estimates, chronic wounds affect 2% of the population in the United States overall. Chronic wounds have negative effects on people all around the world. For instance, a 2016 analysis from Wales indicated that the National Health Service would incur a cost of 5.5% for every 6% prevalence of chronic wounds (NHS) (Sen, 2019). The annual incidence rate of venous leg ulcer among the Medicare population was 2.2%, according to Rice et al., 2014. The prevalence of venous ulcers is 1% of the population globally among those aged 18–64 (Asaf ,Salim , Tuffaha, 2018)

Economic impact of wound

The United Kingdom's National Health Service (NHS) spends a significant amount of money on treating chronic wounds. It was estimated that the NHS in the UK was spending close to one billion pounds yearly in the 1990s. In the UK, the NHS spends 17 million pounds a year treating 24000 patients with diabetic foot ulcers in hospitals, community nurse visits and treatments for venous leg ulcers including community nurse visits cost an estimated 400 million pounds annually (Wadinamby, 2013). In order to quantify the health outcomes, resource implications, and associated costs attributable to managing wounds, Guest et al. (2015) undertook a study in 2012/2013. The yearly NHS budget for treating

wounds ranges from 4.5 to 5.1 billion pounds, with two thirds of those costs occurring in primary care and the remaining third in secondary care. This is comparable to the 5 billion pound cost to the NHS in 2013 to manage obesity in the UK (Guest et al., 2015)

The NHS in the Bradford and Airedale region of the UK performed a district-wide survey to determine the prevalence and cost of wound care, which was found to be two million pounds per 10,000 individuals, or 1.3 billion pounds for the UK as a whole. In addition, it was calculated that from 2005 to 2006, NHS spent between 2.3 and 3.1 billion pounds annually on treating people with chronic wounds. According to earlier prevalence surveys, there could be up to 190,000 venous leg ulcer sufferers in the UK at any given moment. Sensitivity analysis predicted that between 250 and 788 million pounds will be needed to manage the comorbidities of the wound patients (Guest et al., 2015). Wales was expected to have a 6% prevalence of chronic wounds in primary care between 2012 and 2013, costing the National Health Service 5.5% of its budget. In the United Kingdom (UK), the cost of wound care was predicted to be between 4.5 and 5.1 billion pounds in 2012.

Chronic or non-healing wounds have a significant financial impact on healthcare; it is estimated that these expenses exceed 3 billion USD yearly. Even though wound care is a 20 billion USD problem globally, it only affects 5.7 million Americans (or nearly 2% of the population) and costs 20 billion USD annually. The number of persons who utilized complementary and alternative medicine (CAM) increased from 34% in 1990 to 42% in 1997, according to a study conducted in the USA by Eisenberg et al., 1997 In addition, the study found that American consumers spent 27 billion US dollars in 1997 on alternative therapies and an estimated 5.1 billion US dollars on herbal medicines, as opposed to an estimated 20 billion US dollars for the global herbal medicine market (Dan et al., 2018). Foot ulceration is the most common diabetes complication that requires hospitalization, and it is estimated that treating this problem costs US 150 million pounds each year (Wadinamby, 2013). Between 2016 and 2024, the worldwide Diabetic Foot Ulcer market anticipates 6.6% compound annual growth. By the end of 2024, the market might be valued at 4.9 billion USD if it continues in this direction. With an estimated 38.1% share of the global market in 2016, the United States dominated it regionally. It is anticipated to continue to rule during the predicted 2024 era. A retrospective analysis of 5% of the Medicare dataset, which included both acute and chronic wounds, estimated that 8.2 million Medicare beneficiaries will suffer at least one type of wound. Medicare in the US cost between USD 28.1 billion and USD 96.8 billion in 2014 (Aging population, growing awareness and innovations drive the global pressure ulcer relief products market. 2017)

There is significant demand for wound care products in the two regions with the greatest demand for wound dressings worldwide; the United States and Europe. In 2014, the average yearly cost of wound treatment was 2.8 billion USD worldwide. In 2021, it is anticipated to increase to 3.5 billion USD. By 2022, the market for wound-closure devices will be worth more than 15 billion USD, according to a 2018 market research report. By 2024, the market for advanced wound care, which targets surgical wounds and chronic ulcers, is anticipated to reach more than 22 billion USD, driven by advances in technology, an increase in the prevalence of chronic wounds, greater government funding, and an aging population (Sen, 2019). A total of 56,583 wound-related hospital admissions for 41,461 patients occurred between 2013 and 2017, with a 95.1% rise in the number of wound

episodes per 1000 inpatient admissions, from 142 to 277 in 2013 and 2017, respectively. In 2017, each wound episode had an average length of stay (ALOS) of 17.7 days and an average gross charge of USD 12,967. Gross medical expenses for all inpatient wound episodes were 216 million USD in 2017; in primary care settings, they were 596 million USD. From eight NeuroIschemic Ulcers wound episodes per 1000 inpatient admissions in 2013 to 12.3 wound episodes per 1000 inpatient admissions in 2017, there was a 54% rise between those two years. The average gross price per episode of wounding in 2017 was USD 11,045, with the ALOS being 15.8 days for 949 episodes in 633 patients (Lo et al., 2020).

A prevalent illness is foot and leg ulcers, which affect 1% of the population in Europe. They are chronic and recurrent (Agyare et al., 2016). In India, the attributable cost of wound care in 2006-2007 was 340 cores (Karthik et al., 2011). According to estimates, the direct expenses of treating chronic wounds in Australia amount to 3 billion Australian dollars annually, or about 2% of all national health care spending. Considering that they are regarded as side effects of other illnesses, chronic wounds are frequently underreported. This is made worse by the dearth of information from the Tropics (Laura et al., 2018). The ALOS in a smaller study carried out at another local tertiary hospital in Singapore was 13.2 days, and the estimated gross direct cost per patient was 19,532 Singapore Dollars. These patients had diabetic, pressure venous, ischemic, and unspecified chronic skin ulcers. In hospital facility, the average gross charge for a wound episode in 2017 was SGD 17 558. The overall gross healthcare expenditures for all inpatient wound episodes were SGD 293 million in tertiary care and SGD 807,000 in primary care (Lo et al., 2020). In Sweden, a 150,000-person intervention using a wound healing center, multidisciplinary care, and ongoing education lowered annual wound care expenses by SEK 6.96 million over a ten-year period.

How could the cost of managing wounds be reduced? Views of the different countries.

Regular dressing changes, the length of therapy, and the frequency of complications are common factors that influence wound care costs. Changing wound dressings requires both material and personnel expenditures, and is a significant portion of the overall cost of wound care, particularly if nursing staff are duty-bound todo so at the patients' homes. Although the cost of the dressing materials may not make up a significant amount of the overall cost, their impact on later healing and problems may be significant. This makes the choice of dressings critical. It is obvious that the length of time a wound takes to heal affects resource utilization, and wound complications like infection can have major repercussions and may necessitate hospitalization or surgical intervention (Dowsett et al., 2012).

Impact of improper management of wound individually, communitywide and economically.

Inadequate care of ulcers can have an immediate serious medical outcome or a great socio-economic impact (Kumarasinghe, 2004). A diabetic patient may lose a limb through an emergency amputation or even die of septicemia or ketoacidosis, as an immediate effect, if a wound is not managed properly. Proper management of diabetes and diabetic ulcers would save lives as well as prevent amputations, and in the long run, save millions of rupees that would be spent on unnecessary wound care. As a long term sequel, any chronic wound has the potential to develop a squamous cell carcinoma (Marjolin's ulcer) which could lead to fatal secondary deposits if not detected and treated early. Even a non-

malignant ulcer, if badly managed, may lead to fibrosis of the surrounding tissue and contractures, which will delay or prevent healing. Loss of productivity by amputees as well as loss of man-hours, cost of surgery and hospitalization have great implications on the person, family, society and the economy (Kumarasinghe, 2004).

What drives a cost-effective wound care?

Wounds present a substantial clinical and economic burden to healthcare systems globally with significant reductions in quality of life for those affected (Lo et al., 2020). The Centers for Medicare and Medicaid Services (CMS) designed the hospital-based outpatient payment system. Around 1500 hospital-based outpatient "wound centers" provide standard wound care throughout the US. Home health services (HHS) and skilled nursing facilities have planned home visits to treat the wounds (Nussbaum et al., 2018). In many chronic wounds, effective wound bed preparation and standard dressings alone would result in wound healing even without high-tech, pricey dressings. Debridement, the removal of wound exudate, and the improvement of the wound microenvironment are all steps in the preparation of the wound bed (Kumarasinghe, 2004). Genetically modified biological materials and more advanced dressing materials have both been developed as a result of some chronic ulcers. Examples include advanced hydrocolloid dressings, dressings that absorb exudate, dressings made of calcium alginate, dressings made of hydrofibre that traps bacteria, dressings made of cadexomer iodine, dressings made of nanocrystalline silver, collagenase ointment, and dressings that contain growth factors that promote wound healing. Other developments include cultured epidermal grafts and synthetic skin substitutes, which act as a scaffold for the development of epithelial cells. Some kinds of ulcers have responded well to the use of vacuum pumps in big wounds with a lot of serous exudate. Another effective technique for improving wound healing in ischemic ulcers is hyperbaric oxygenation. However, this is pricey because this type of therapy requires specialized airtight, pressurized chambers (Kumarasinghe, 2004).

Thus, chronic non-healing wounds would place a tremendous cost burden on society through a decline in production as well as financial strain on the health care system. Chronic wounds can take years to heal, and some don't get better for many years. Patients may go through a period of excruciating pain, major emotional and physical discomfort, decreased mobility, and social isolation during this time. Studies have also demonstrated that both the patient and their families experience considerable emotional and physical suffering as a result of chronic wounds. When all therapeutic options have failed and an amputation is required, chronic wounds may also lead to impairments (Sen, 2019). Nearly 85% of all amputations begin with an ulcer, while diabetic ulcers account for 70% of all lower limb amputations. Every 30 seconds, someone worldwide has to have an amputation because of a diabetic ulcer that won't heal. According to reports, the 5-year death rate after amputation ranges between 40 and 70% and is higher in individuals who have significant amputations. Unfortunately, situations like infections, amputations, and death from a wound are all too frequent but may be prevented with a proper diagnosis and prompt effective treatment (Sen, 2019).

The need for better wound care is urgent and crucial due to the aging populations in various regions of the world and the rise in chronic disease prevalence. However, in order for implementation to be successful, there must be more awareness of the growing clinical difficulty that wounds provide and methodology must be created

to identify and guarantee the use of cost-effective clinical treatments (Sen, 2019). In Singapore, majority of four-layer compression bandaging are performed by specialist wound nurses in the specialist outpatient setting. A recent retrospective review of the Medicare 5% dataset for 2014 found that 8.2 million Medicare beneficiaries experienced at least one type of wound or related infection. Acute and chronic wounds were included in this investigation along with all other wound types. Surgical wounds and diabetic ulcers were the most expensive to treat, with Medicare's expected costs for treating infections for all wounds ranging from 28.1 billion to 96.8 billion dollars. In addition, outpatient costs (9.9-35.8 billion USD) were higher than inpatient costs (5.0-24.3 billion USD), possibly due to an increase in the number of outpatient wound therapies currently available (Sen, 2019).

Almost 53% of Venous Leg Ulcers (VLU) in the UK recover within a year, with mean recovery duration of 3 months. The average 1-year VLU recurrence rate from 2013 to 2017 was 52.5%, with a median interval of 9.5 months between healing and recurrence. Socioeconomically speaking, the chronic nature of VLU lowers quality of life and incurs high expenditures for both patients and healthcare providers. The cost of VLU treatment in the US was predicted to be more than 2.5 billion USD annually, while in the UK, it is estimated to cost between 300 and 600 million pounds annually, or roughly 1% of the national healthcare budget. In the UK, it was predicted that each VLU patient would spend 10,000-30,000 pounds annually. In light of this, the VLU assessed gross healthcare cost per patient for hospital care (inpatient and specialist outpatient) and primary care to be 16,761 USD, which was comparable to the cost for other types of wounds. In the UK, the cost of wound care for managing an unhealed VLU over the course of a year was 4.5 times more than for managing a cured VLU (Lo et al., 2020). The US healthcare system incurred annual costs of USD 8.5 billion in the 1990s due to the treatment of pressure injuries.In the UK between 1999 and 2000, the annual cost of Pressure Injuries was projected as between 1.4 and 2.1 billion pounds (4% of all National Health Service spending). According to a more recent audit of all patients in acute and community inpatient settings in Wales (n = 8365 patients) in 2015, pressure ulcer prevalence was 8.9%, with half of those ulcers developing in a hospital environment. In a study carried out in Singapore in 2002, showed the pressure ulcer prevalence as 18.1% and incidence as 8.1% (Lo et al., 2020).

One percent of people worldwide between the ages of 18 and 64 have venous ulcers. In the US, 4% of cases (over 65 years) of chronic venous disease have active ulcers. This represents 10-35% of the population. Venous leg ulcers cost between 300 million and 600 million pounds in the UK and 2.5 billion pounds in the US, respectively. 10,563 pounds was needed each year to treat venous ulcers. The cost of treating persistent, non-healing venous ulcers was predicted to be at least 34,000 pounds. The annual loss of 4.6 million workdays due to chronic venous ulcers reduces economic productivity (Sen, 2019). In 2004, Bennett et al., estimated that the cost of an episode of Grade IV pressure ulceration was approximately 10,500 pounds in UK (Bennett et al., 2004). According to a 2018 market research estimate, the value of the global market for wound-closure treatments is predicted to exceed 15 billion USD by 2022. An aging population, increased prevalence of chronic wounds, increased government financing, and technological advancements are expected to propel the market for advanced wound care, which focuses on surgical wounds and chronic ulcers, to more than 22 billion dollars by 2024 (Sen, 2019).

According to data from the Agency for Healthcare Research and Quality, PU care is expensive and costs the US more than 11 billion USD yearly. Care for a single patient can cost anything from 20,900 and 151,700 USD each PU. Aside from medical expenses, extra costs for meals, transportation, and upkeep add up to 43,180 USD annually. Every year, over 2.5 million Americans experience PUs. By 2024, it is anticipated that the global market for PU care products will amount to 4.5 billion USD. The aging population and accompanying mobility and neurological diseases are factors that contribute to this rise (Sen, 2019). The chance of developing these ulcers in diabetics is thought to range from 15% to 25%, and the annual prevalence of Foot Ulcers is predicted to be between 4 and 10%. In the US, managing DFUs costs between $9 and $13 billion. The market for T2D is anticipated to grow from 28.6 billion USD in 2026 to an estimated 64 billion USD in 2026. In the United States, France, Germany, Italy, Spain, the United Kingdom, and Japan, an annual compound growth rate of 8.4% is anticipated. In2022, the demand for insulin pumps in the US wasanticipated to grow to a 3.8 billion USD market, driven by both the rising prevalence of diabetes and medical technology (Sen, 2019).

Recently, utilizing searches in the databases of PubMed, EMBASE, ISI Web of Science, and Cochrane, a systematic review and meta-analysis of the global epidemiology of FUs was carried out. This was the largest study of its type, with more than 800,000 participants from 33 different nations. The prevalence of Diabetic Foot Ulcer was reported to be 6.3% worldwide. A notable distinction is the decreased prevalence of DFU in Europe (5.1%) compared to North America (13.0%). Belgium had the most frequency, at 16.6%, and Australia had the lowest, at 1.5%, out of 33 countries. Men (4.5% vs. 3.5%) appeared to be more susceptible to FUs than women. In addition, patients with T2D experienced FUs more frequently than those with type 1 diabetes (6.4% vs. 5.5%). In comparison to those without FUs, patients with FUs were typically older, had a lower body mass index (BMI), longer duration of diabetes, higher rates of hypertension, a greater incidence of diabetic retinopathy, and a history of smoking. Between 2016 and 2024, the worldwide DFU market anticipates 6.6% compound annual growth. By the end of 2024, the market might be valued at $4.9 billion if it continues in this direction. With an estimated 38.1% share of the global market in 2016, the United States dominated it regionally. It is anticipated to continue to rule during the predicted (2024) era (Sen, 2019).

CONCLUSION

This systematic review was performed to critically examine the world's relevant literature on the prevalence and economic burden of various forms of wounds. Specifically, it wasaimed to identify and report the estimated humanistic and economic burden of different forms of wounds in the categories of pressure ulcers, diabetic ulcers, venous ulcers, and arterial insufficiency ulcers and related complications. Understanding the humanistic and economic impact burden of different categories of complications among patients with chronic wounds could inform policymakers on the cost-effectiveness of implementing early screening and other prevention or treatment efforts. Also, quantifying the humanistic and economic burden of different forms of wounds will help guide decision-making for the allocation of scarce healthcare resources and funding. Finally, conclusions were drawn from this systematic review highlighting the burden

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