

MARKET ASSESSMENT OF ADVANCE WOUNDCARE PRODUCTS IN INDIA

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Master of Business Administration (MBA)

in

Pharmaceutical Management

By

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Under the Supervision and Guidance of

Dr. Sudhinder Singh Chowhan

2024



COMPLETION CERTIFICATE

This is to certify that Mr. **ANKIT SUHAG** in partial fulfillment of the requirements for the award of MBA Pharmaceutical Management from the IIHMR University, Jaipur has successfully completed his internship at Fibroheal Woundcare Pvt. Ltd. during 18/03/2024 to 18/06/2024.

Place : Bengaluru

Date : 24-06-2024

A handwritten signature in black ink, appearing to read 'Vivek Mishra', is positioned above a horizontal line. The signature is stylized and fluid.

Vivek Mishra
Director

DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Market Assessment of Advance Woundcare Products In India** is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.



(Signature)

Ankit Suhag

Date: 3/7/24

CERTIFICATE

This is to certify that the dissertation titled **Market Assessment of Advance Woundcare Products in India** is a record of the research work undertaken by **Ankit Suhag** in partial fulfillment of the requirements for the award of the degree MBA (Pharmaceutical Management) from the IIHMR University, Jaipur under my guidance and supervision and his approach to the research study has been sincere, scientific, and analytical.

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Date: 03/07/2024

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I am overpowered in all humbleness and appreciation to perceive my significance to every single one of the people who have helped me to put these contemplations. I might want to communicate my unique gratitude to my parents and friends for their support during the whole course.

Date:

Place:

(Ankit Suhag)

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LIST OF ABBREVIATIONS: -

S.NO	Abbreviations	Meaning
1.	ISO	International Organization for Standardization
2.	AWC	Advance woundcare
3.	CDSCO	Central Drugs Standard Control Organization
4.	RTA	Road traffic accident
5.	USD	United States dollar
6.	CAGR	Compound Annual Growth Rate
7.	NPWT	Negative-pressure wound therapy
8.	ASCs	Ambulatory surgery centers
9.	DFU	Diabetic foot ulcer

Abstract

The study gives a summary of the topic of Advance Woundcare Products using secondary data sources and provides an overview of the Indian market for Advance Woundcare Market. This explains how the development and progress of this sector is taking place. The Advance Woundcare Products and Indian company's Advance Woundcare Products industry is growing, and their applications are an important component of the study. The market segmentation of Advance Woundcare Products demonstrates how much scope we have in this industry, which immediately corresponds with us and leads us to the question of how much we can investigate and where we stand in this field. The impact of COVID-19 outlines how the market has fluctuated and how the market has demonstrated its potential to influence business and present us with opportunities for expansion, allowing us to get entry to the healthcare system. The general trends of the Advance Woundcare Products market with future impact and trends for prediction of the growth of the Advance Woundcare Products in India is a general indicator that how fast this market is growing as the cost of Advance Woundcare Products is much higher as compared to Gauze and Traditional Dressings and this also leads to the fact that as the population grows and the cost of treatment goes up, this also affects the Advance Woundcare Products market.

Chapter- 1: Introduction

Fibroheal Woundcare Pvt. Ltd.

Background

Fibroheal Woundcare Pvt. Ltd. is a pioneering biotech startup solely dedicated to utilizing Silk Proteins as a revolutionary biomaterial for wound healing. Our focus is on non-textile applications, offering innovative and cost-effective solutions for various wound types.

Our research has garnered government recognition and support from institutions like the Dept. of Biotechnology, Govt. of India, BIRAC, and CCAMP. With patented technological products, We are awarded as one of the winners of ELEVATE 2019 and recognized as one of the most innovative startups from Startup Karnataka, GoK. We are one of the finalists in Maharashtra Startup Week 2020 & National Startup Awards 2020 and have established ourselves as leaders in wound care innovation.

Our state-of-the-art ISO 13485-compliant facility, coupled with automated machines, ensures quality and scalability.

Our aim to make their easily accessible and affordable products a game-changer in the wound management sector, backed by a dynamic team and superior Silk-derived technology.

VISION

To be a comprehensive wound management company addressing various types and stages of wounds that delivers clinical excellence, superior outcomes and value based partnerships.

Certifications



Socio-Economic Impact:

Utilizes sericulture by-products for value addition, benefiting farmers and enhancing silk production economics.

For Sericulture farmers & Industry –

- India utilizes sericulture by products, boosting value and employment.
- Sericulture employs millions in Karnataka and nationwide.
- Non-textile silk applications enhance farmer earnings and silk production economy.

For Woundcare Industry -

- Manufactured in India, promoting self-reliance and economic growth.
- Affordable and cost-effective, ensuring accessibility for patients.
- Reduces hospitalization costs and duration by expediting healing.
- Effective in treating various acute and chronic wounds, including diabetic foot ulcers.
- Requires minimal dressing changes, easing workload for healthcare providers.

Wound care

Wound care is a critical aspect of healthcare, focusing on patients with acute and chronic wounds like surgical wounds, traumatic injuries, burns, diabetic foot ulcers, pressure ulcers as well as other skin damages. In India the burden of wounds is high because of the increased incidence of diabetes resulting to a large number of elderly patients and cases of trauma. Despite the advances in health services, wound care remains an important challenge in both urban and rural settings.

In India traditional methods are still used for wound healing which have been employed for centuries based on natural remedies and basic dressings. However, there has been a shift towards more advanced wound care products due to globalization in health care and introduction of sophisticated medical technologies. These advanced types include various kinds of dressing materials and therapeutic measures that are intended to facilitate faster healing, reduce infection rates and enhance patient outcomes.

India has a mixed healthcare system, with public and private providers. A good proportion of the population depends on public hospitals and clinics, while private sector is significant in urban areas, where it provides advanced wound care options that may not be available in the public health care facilities. Factors such as economic constraints, healthcare infrastructure, patient awareness, and regulatory policies influence the availability and adoption of Advanced Wound Care Products in India.

Classification System in India:

Medical devices are divided into four classes under the Drugs and Cosmetics Rules based on their levels of risk:

Class A: Low risk

Class B: Low-Moderate risk

Class C: Moderate-High Risk

Class D: High Risk

Advanced wound care products typically fall under one of two categories based on their specific characteristics and intended use; either class B or class C. For example,

-Class B: These are basic wound care products like bandages, gauze dressings etc.

-Class C: It covers more advanced wound care products such as hydrocolloid dressings, alginate dressings, hydrogel dressings, silk protein-based dressings among others which have more sophisticated technology aimed at facilitating wound healing.

If you need to classify precisely, it is important to make reference to specific guidelines and notifications given by CDSCO or engage regulatory experts.

Why Advanced Wound Care Products Are Important?

The goal of advanced wound care products is to create an environment that supports the healing process, reduces exudate levels, prevents infection and creates an optimal condition for tissue growth. Some examples include hydrocolloids, alginates, foam dressings, hydrogels, film dressings among others. These are usually used in management of chronic wounds which do not go through normal stages of healing and last for a long time. The commonest types of chronic wounds in India include those affecting diabetic patients, elderly people as well as persons with limited mobility.

Diabetes is a major driver of wound care market prevalence in India. According to the International Diabetes Federation about 77 million Indians have diabetes and this number is expected to increase significantly in the near future. Many such patients suffer from diabetic foot ulcers thereby necessitating effective wound care interventions. The other factor is increased incidences of RTA's and burn injuries which also lead to demand for advanced wound care products.

Market Valuation and Growth:

By 2022, the global advanced wound care market is estimated to have a market size of \$11.2 billion; however, with a CAGR of 9.4%, it is predicted to reach \$17.7 billion by 2027 as a result of escalating surgical operations, new techniques such NPWT, and increased knowledge about advanced wound care products. The preferred regions for this investment include India where favorable regulations, better healthcare facilities as well as an expanding population may offer immense viability to this field in spite its costliness that may limit the penetration levels in low-income markets. Innovation has also come into play with the rise of advanced dressings that can absorb moisture, hydrate wounds, and provide antibacterial solutions.

India Advanced Wound Care Management Market is expected to be valued at USD 263.0 million in 2023 growing at a CAGR of 5.1% during the forecast period from 2023 to 2030. To ensure natural healing through continuous therapy using foam dressings, alginates, hydrogels or hydrocolloids which maintain optimal conditions like oxygen flow, temperature and protection from the external environment is what constitutes advanced wound care treatment strategy.

New product approval and product launch act as new market growth opportunities, such as MediWound's NexoBrid which received approval in India in December of 2022. The MediWound is projected to dominate the North India region because of key deal such as indented distribution agreement with BSV for NexoBrid. This was realised due to disruptions of production, demand, and distribution chains as a result of the COVID-19 pandemic that cut across the economy and the healthcare sector.

The categories involved in the market are dressings, devices, grafts, matrices, and topical agents, and though all of them are important, dressings dominate this market. Surgical and traumatic wounds are the largest segment from the perspective of the wound type, while hospitals, ASCs, and wound care centers are from the perspective of the end user. North America has the highest position in the market because of the acquisition, shift in the population, patient awareness, and higher market share.

Chapter- 2: Literature Review

Wound care products are progressively used by healthcare organizations since such products can help promote the healing process and minimize the occurrence of infections associated with chronic wounds [1]. In writing this literature review, the author looks at offering a snapshot of the present state of advanced wound care.

These include specialty dressings that offer specified treatments intended to enhance wound healing, control exudate levels, guard against infection, and reduce the formation of scar tissue. Current wound care modalities, which include the use of gauze and bandage, have been complemented and sometimes even surpassed by these products. Such as hydrocolloids, alginates, foams, hydrogels and films among others. These categories are all meant to address particular sorts of wounds and different phases of the healing process [2].

Wound Healing Process

Wound healing is a series of processes beginning with coagulation, then inflammation, followed by new tissue formation and finally tissue remodeling. The goal of wound management is to ensure that these phases are accomplished in a smooth sequence to promote effective wound healing. Conventional methods of wound management are inadequate to address the complexity of varying wound types more so the non-healing ones. Modern wound care technologies are intended to address these requirements through optimal moisture supply, pathogenic control, and tissue growth promotion [3].

Advanced Wound Care Products

Advanced wound care range from an array of dressings and therapies which include but not limited to; hydrocolloids, alginates, foam dressings, hydrogels, and film dressings. They are designed to absorb exudates, protect the wound from infection and keep the wound moist with the view of enhancing the rate of healing. These products have been demonstrated to be highly effective in many clinical trials proving their advantage over the regular dressings by providing faster healing rates and less pain to the patients.

Hydrocolloids

Hydrocolloid dressings create a hydrophilic moist environment at the wound site by converting into a gel-like mass upon exposure to exudative enzymes or other fluid components of wound surface, and facilitates autolytic debridement at the same time discouraging colonization of different pathogens. They are most suitable in low to moderately exuding wounds like pressure ulcer and simple burns. These dressings assist in averting the formation of either a dressed wound which is too moist or excessively dry and only the right amount of moist is allowed as it is vital in healing process [4].

Alginates

Alginate dressings prepared from seabed are highly absorptive and become gel like when it absorbs wound exudate. They are suited in use with medium to heavily exuding wounds including, the diabetic ulcer, the venous ulcer. Also, alginates have ability to control bleeding in the case of the wounded tissues due to the presence of calcium ions, which allows using it in the wounds which have an exudate and tendency to bleed [5].

Foam Dressings

Foam dressings offer thermal support, support and absorb and maintain a moist healing environment that is ideal for moderately to highly exuding wounds. Pressure ulcers and traumatic wounds are some of the conditions most commonly managed using these devices. The special foam dressing options are capable of saving a great volume of exudate and at the same time keeping the wound safe from the outside environment which promotes a more comfortable healing process [6].

Hydrogels

I would use hydrogel dressings containing water, as they keep the wound moist, and are ideal to use in dry or necrotic wound. They contribute in autolytic debridement through supplying moisture within the wound curettage to eliminate nonviable tissue. Hydrogels are very versatile in the type of wound that they can be applied in such as burn and radiation skin injuries because they create a moisture environment which helps in healing of wound [7].

Film Dressings

These film dressings are semi-permeable allowing or the passage of gas while at the same time being a barrier to water and bacteria. It can be worn merely as the covering dressings or to dress intravenous sites and modest skin injuries. They reduce the frequency that the hospitals or patients have to check on the wound because the dressing material is transparent thus minimizing chances of the wound getting infected or experiencing more harm [8].

Silk-Based Dressings

Silk-based dressings can be counted among the topical novelties of the AWC product line, applying the distinctive properties of silk protein to facilitate wound healing. Silk as a natural biopolymer material derived from *Bombyx mori*, consists of fibroin and has properties such as biocompatibility, biodegradability. The following properties are perceived to be valuable for biomedical uses of silk and are thus appropriate for use in wound dressings. As presented in plurality of the articles, it has been established that use of the dressings made from silk is effective in improving the results of the wound healing outcomes. For instance, a study conducted about the use of clinical trial regarding the comparison of using dressings made of silk fibroin with gauze dressings commonly used in patients with chronic wounds revealed that patients with dressings made of silk fibroin heal faster and with a reduced rate of infection compared to patients who used conventional gauze dressings. The other one revealed that fibroin scaffold was enhanced the wound healing rate in the diabetic foot ulcer model by demonstrating improved epithelialization without an increase in scarring [9].

Applications in India

In India the use of Silk fibroin dressings are gaining prominence in advanced wound care due to their unique properties that promote efficient healing. These dressings are biocompatible, biodegradable, and possess excellent mechanical strength, making them suitable for a variety of wound types, including chronic and diabetic ulcers, burns, and post-surgical wounds. The intrinsic properties of silk fibroin, such as its ability to maintain a moist wound environment, enhance cell adhesion and proliferation, and exhibit antimicrobial characteristics, significantly contribute to faster and more effective wound healing. In the Indian context, where chronic wounds are prevalent due to the high incidence of diabetes and other conditions, silk fibroin

dressings offer a promising solution to improve patient outcomes and reduce healthcare costs [10].

Market Dynamics in India

As earlier noted, the Indian advanced wound care market is impacted by several factors such as, increasing prevalence of chronic diseases, gradual enhancement in overall perceptions on health care expenditures, and increasing awareness of advanced wound care services. One of the factors that is fuelling this growth is rooted in the fact that India has one of the largest populations of diabetic patients in the world, with an estimate of approximately 77 million people with the changing demographics and rising incidence of diseases such as diabetes further fuelling the need for products in the advanced wound care market, particularly for the treatment of diabetic foot ulcers [11].

Diabetic Foot Ulcers

Today India ranks amongst the countries with high population of diabetic patients, and diabetes incidence over the years will continue to rise. Charcot foot is one of the most daunting comorbidities of DM; whereby patients suffer from foot ulcers, which results in long hospital stays, expensive treatment, and high mortality rates. Diabetic foot ulcers are a serious problem that needs to be addressed to reduce the risk of complications and to promote wound healing, and advanced wound care products are vital for that purpose [12].

Pressure Ulcers

Bedsore is yet another problem that elderly bedridden patients often encounter, Pressure ulcers are basically injuries that happen to the skin and underlying tissue as a result of being subjected to pressure for an extended period. These ulcers become resistant through formation of tough layers that are hard to heal and they easily lead to severe infections. Antimicrobial foam and hydrocolloid products used in ulcer management have been regarded to enhance the close depth and shield the wound from external pathogens.

Venous Leg Ulcers

Venous leg ulcers are long-standing wounds caused by pathology of the venous valves of the lower limbs; this pathology develops into chronic conditions with increased intra-vascular pressure affecting the skin. This is by use of compression therapy alongside using, alginate and foam dressings which are considered the main treatment for these ulcers. These products manages exudate and supports wound healing through establishing favorable wound characteristics [13].

Market Challenges and Opportunities

However, Primary care, secondary care and cost control remain key barriers in the adoption of advanced wound care products including bleeding control, Sudan, cost constraint, accessibility particularly in rural regions, and inadequacy of qualified practitioners. While several factors prevent market growth such as high costs of treatment and inadequate laws pertaining to reimbursement in treating chronic wounds, new activities by the government and private sectors to develop better healthcare and educate the public on wound healing shall fuel market growth [14].

Opportunities for Growth

Potential markets that may register high growth rates in future and are already developing are the emerging economies including India, South Korea, Malaysia, Vietnam, African, and some Middle Eastern countries such as Israel, Saudi Arabia, and UAE among others. Some tangible forces comprise relatively easy regulations, enhancement in healthcare infrastructure, a growing patient pool, especially the geriatric population, and growing expenditure on healthcare that characterize this future growth [15].

Chapter-3: Methodology

Articles available on GOOGLE SCHOLAR published between 2005 and 2023 were screened and selected based on the selection criteria. Many articles were screened, and online survey was disseminated to multiple participants. There were 63 participants that replied to the online survey.

Research Questions:

- a) How often do you prefer advance wound care products in daily life?
- b) How much do you prefer advance wound care products over conventional dressings for woundcare?
- c) At what extent do you think the advance woundcare products are helpful in wound healing?
- d) How familiar are you with advanced wound care products (e.g., hydrocolloids, alginates, foam dressings, hydrogels, film dressings)?
- e) How effective do you find advanced wound care products in promoting wound healing?
- f) How significant is the cost barrier when choosing advanced wound care products?
- g) Are advance wound care products easily accessible in your region?
- h) Do you think that advance woundcare products reduces the burden of healthcare workers?
- i) Has there any problem in the availability of advance woundcare products, post covid-19?

Objective:

The primary objective of this methodology is to conduct a comprehensive market assessment of advance wound care products in India. This involves analyzing the market size, growth trends, key players, product segmentation, pricing strategies, and distribution channels. The dissertation also aims to understand the adoption patterns among healthcare providers and patients, identify challenges and opportunities in the market, and provide strategic recommendations for stakeholders.

Material and Methods:

Study Design: The study employs an Exploratory with Descriptive study design to assess the market.

Setting: This study will involve primary research aimed at gathering data from surveys, legal documents, regulatory documents, and existing reports.

Study Population: Individuals working in healthcare-related domains.

Sampling Technique: Non-Probability Convenient Sampling

Sample Source: Primary and Secondary research sources

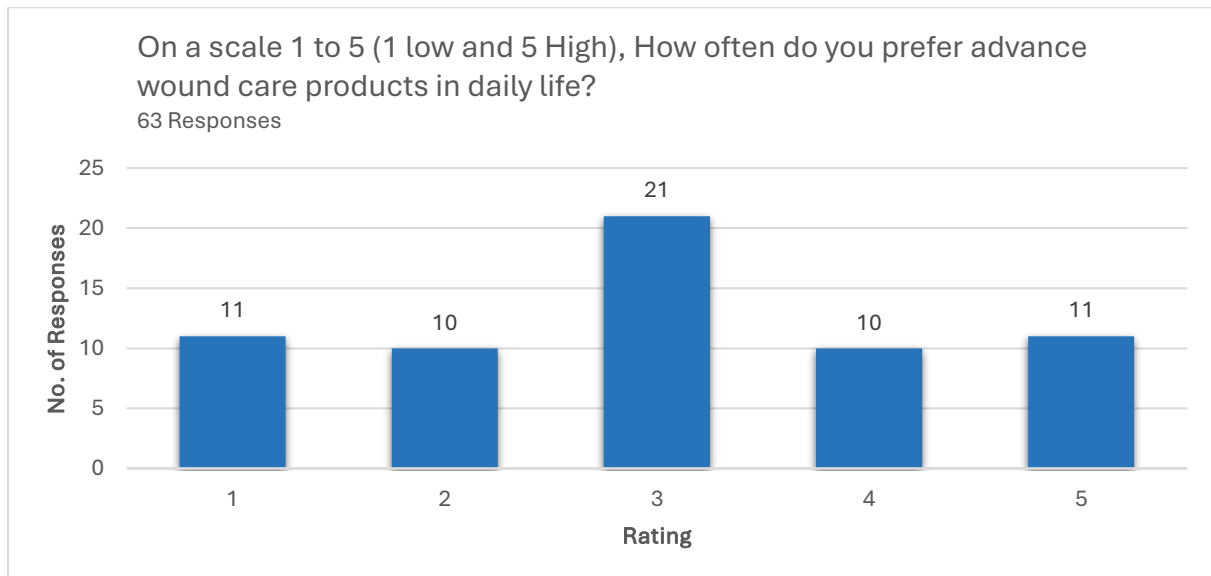
Data Analysis Plan:

Surveys and reports will be analyzed using MS Excel, if necessary.

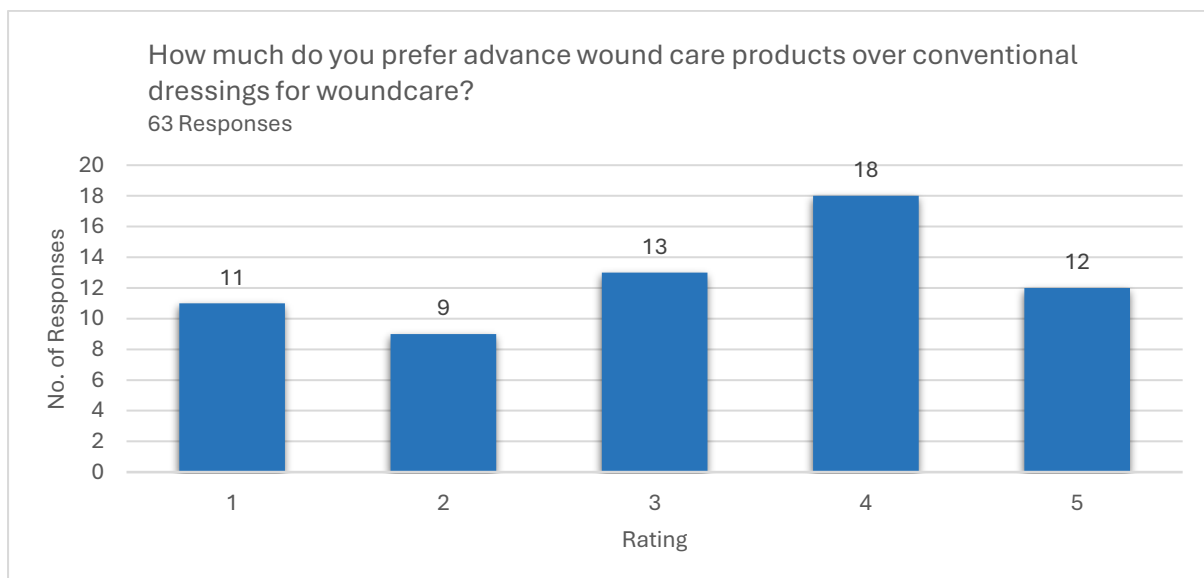
Ethical Considerations:

Considering ethical aspects when conducting research is as important as choosing appropriate research approaches and methods. Since informed consent has been taken from the professionals before asking for the collection of data for the study of advance woundcare products and its future aspects also all the secondary data is collected from open sources which do not claim any privacy about the data. Also, the data and study would be used for the academic purpose only.

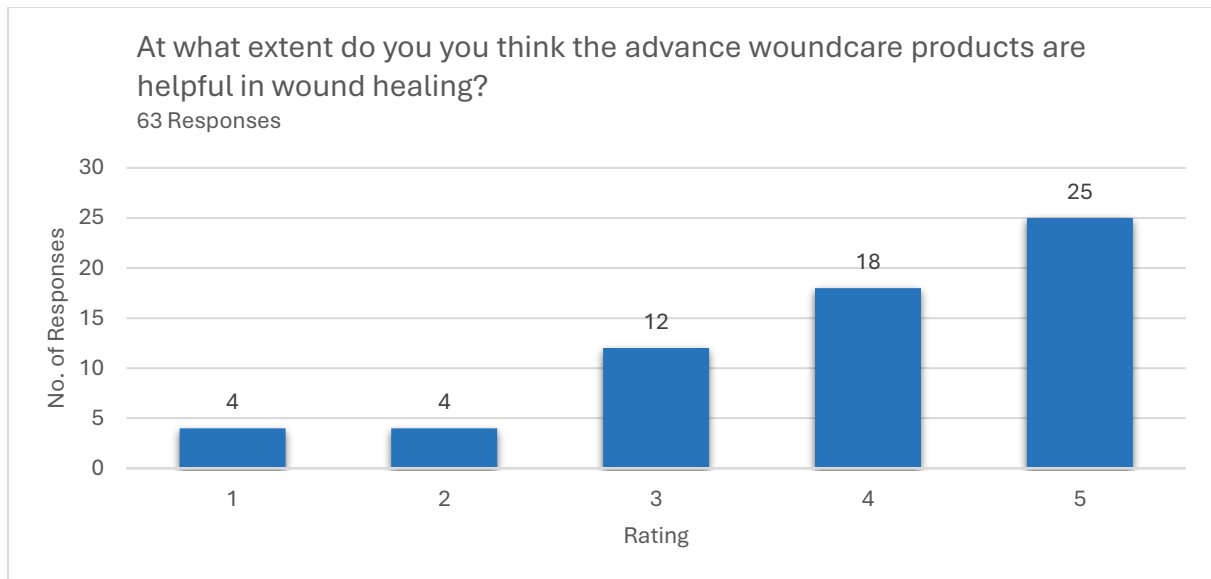
Chapter-4: Result & Discussion



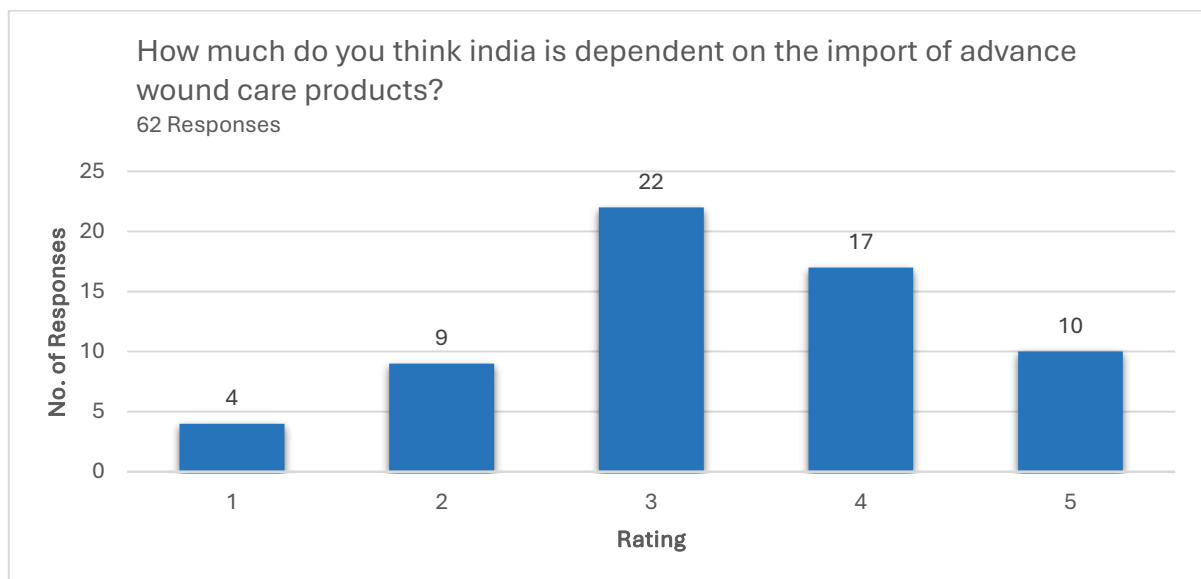
A total of 63 respondents were surveyed out of which 11 are not preferred advance woundcare products in their daily life. The rest 52 were using it somehow in their daily life. There is huge potential in the Indian market, and it needs some awareness about the ease and use of advance woundcare products.



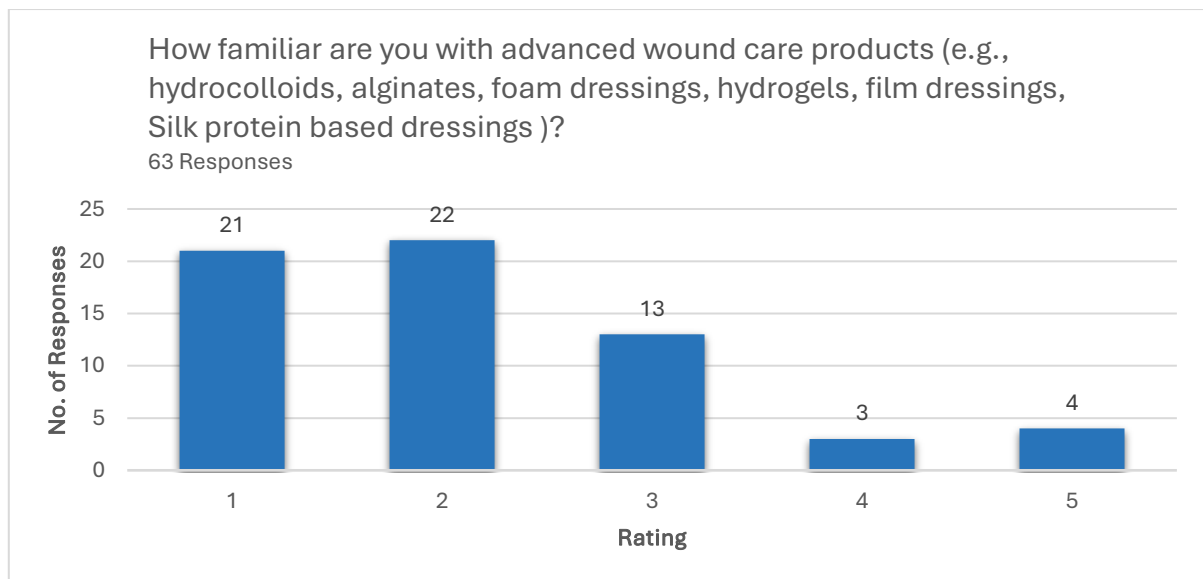
Out of 63, 20 are not preferred advance woundcare products over conventional Dressings means there are some people in the Indian market who are relying on conventional dressings for wound healing by making them aware of advance woundcare products we can make them to use or preferred to advance woundcare products.



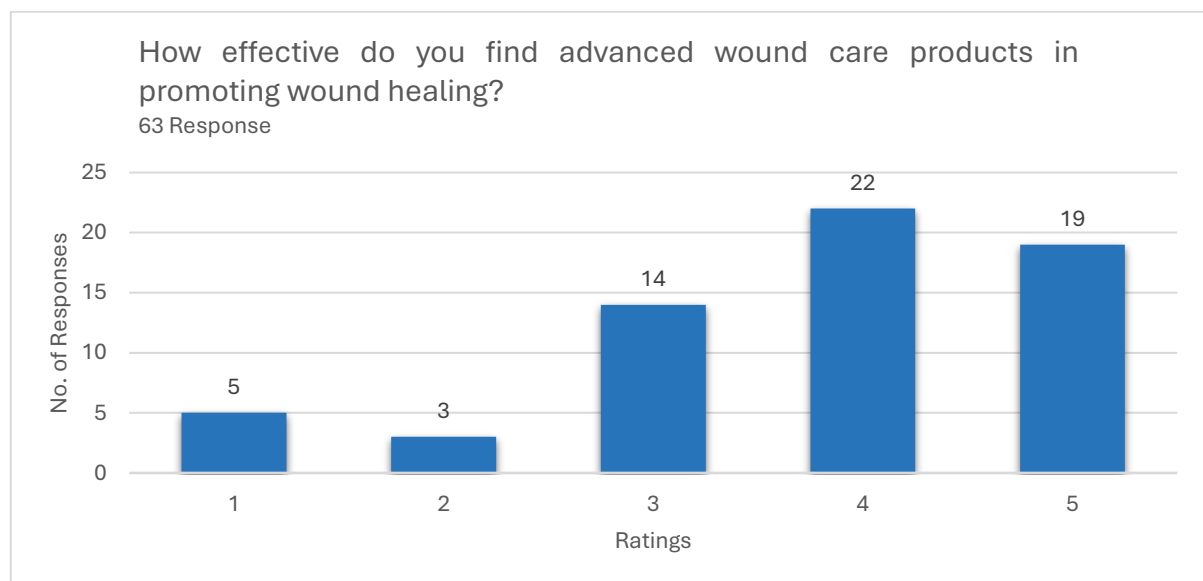
As per this Questionnaire, it is completely showing that people actually think that advance woundcare products play an important role in wound healing.



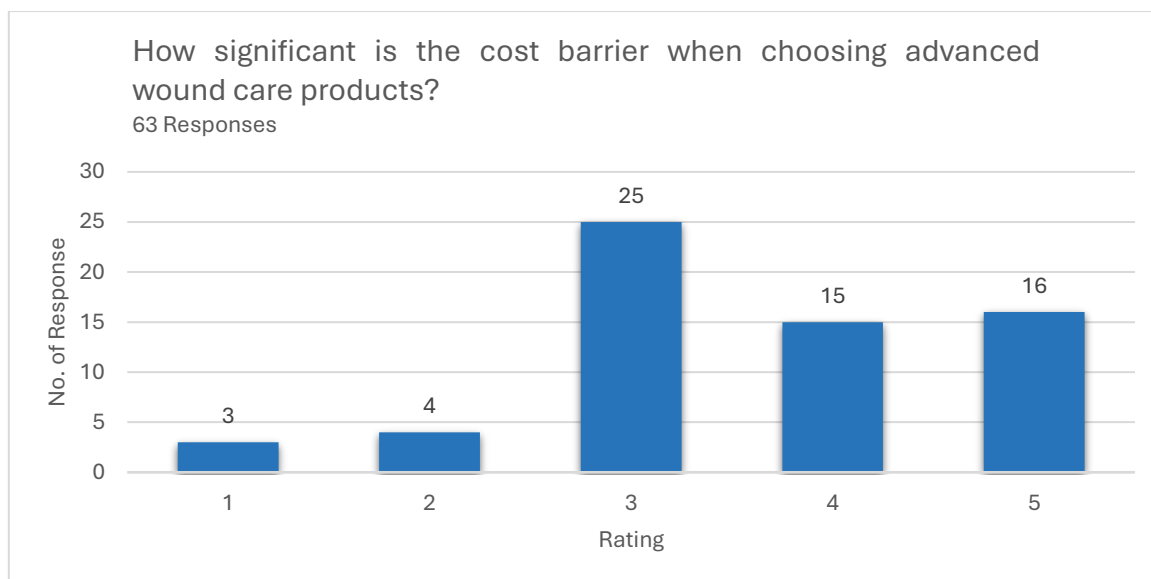
This is one of the important things to understand because we all know that India is to rely on overseas countries to import advance wound care products into India. High-end technology advance wound care products are imported from the countries like USA, Germany, and Japan. As per this Questionnaire, 77% people think India is dependent on import of advance woundcare products.



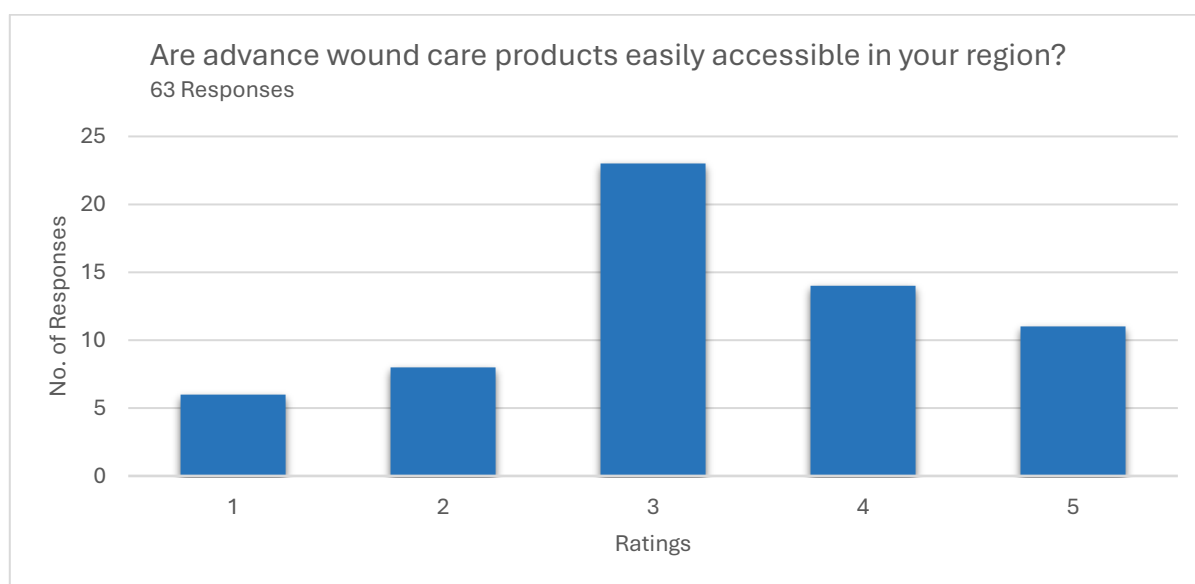
Out of 63 responses, we can see 56 respondents means majority of respondents are not much aware about the advance wound care dressings/products.



The survey indicates that 68% (43 out of 63) of respondents rated advanced wound care products as highly effective (4 or 5) in promoting wound healing, highlighting their significant impact.

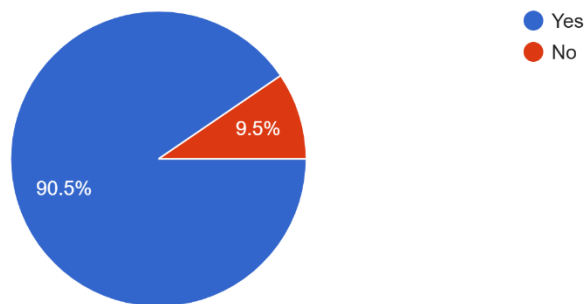


The survey shows that 57% (36 out of 63) of respondents consider cost a significant barrier when choosing advanced wound care products, indicating financial constraints.



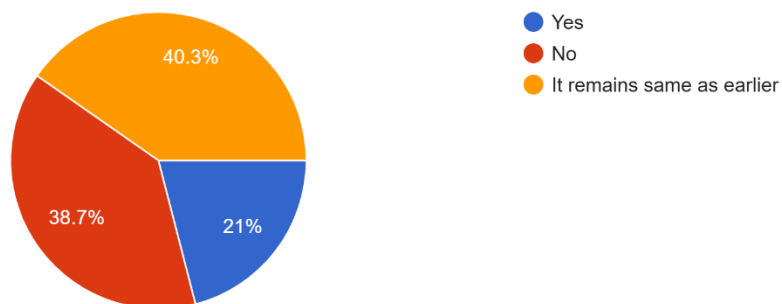
The survey shows 76% of respondents rated accessibility of advanced wound care products as moderate to high (3-5), while 22% reported low accessibility, highlighting regional disparities.

Do you think that advance woundcare products reduces the burden of healthcare workers?
63 responses



Almost 90.5% is agreed with this thing that the use of advance woundcare products actually reduces the burden on healthcare workers.

Has there any problem in the availability of advance woundcare products, post covid-19?
62 responses



As per this Questionnaire, 38.7% of people voted that there is no issue with the availability of advance woundcare products, post covid-19 while 40.3% people voted that it remains same as earlier.

Chapter- 5: Conclusion

Through the years, the diagnosis and treatment of patients with chronic and acute wounds have continuously improved thanks to the use of technology. The incorporation of innovative technologies in wound care has transformed the sector, offering better patient outcomes and higher living standards. AWC products, including hydrocolloids, hydrogels, alginates, and foam dressings, are designed to maintain a moist wound environment, promote faster healing, and reduce the risk of infection.

The survey presents the effectiveness of advanced wound care products, with 68% of respondents rating them as highly effective in promoting wound healing. These products are particularly beneficial in managing complex wounds, such as DFU, pressure ulcers, and surgical wounds, where traditional wound care methods may fall short.

Despite these advancements, the survey also give away significant challenges. Cost, Accessibility are the major barriers, with 27% of respondents rating it as a high cost concern. and 22% reporting low accessibility, particularly in rural regions. These findings underline the demand for more affordable and accessible wound care solutions, especially in unmerited areas.

Opportunities for growth in the advanced wound care market are substantial, driven by government initiatives, private sector investments, and increasing awareness about wound care. Continued innovation, coupled with efforts to address cost and accessibility barriers, will be crucial in expanding the reach and impact of advanced wound care products in India. By focusing on these areas, the healthcare sector can further improve patient outcomes and quality of life.

Chapter- 6: Recommendations and Suggestions

- Higher the accessibility and affordability of the advance woundcare products are absent.
It was discovered that the new advanced woundcare technology products lacked in accessing and affording for the poor patients.
- Describe the medical and paramedical staff's training.
The government as well as the company personels has to update the medical and paramedical staff's for the training because lack of training on new technologies and medical equipments leads to severe adverse effects.
- Permit the Medical Technology Advisory Board (MTAB) to identify the technique and priority advance woundcare products that are required due to the prevalence of illnesses.
In terms of healthcare spending as a proportion of GDP, India behind other industrialised nations.
- The current policy is being followed in its enforcement is below satisfactory level so it should also be noted.

Chapter-7: Limitations of Study

- There is a chance that the replies provided by the respondents may be biased.
- The analysis uses actual data, not projections.
- There was a limited amount of time which affected the accuracy.
- Only 10 doctors and 50 industry experts were involved in the study.
- The study was conducted in Jaipur only.

References

1. Wu SC, Marston W, Armstrong DG. Wound care: the role of advanced wound-healing technologies. *Journal of the American Podiatric Medical Association*. 2010 Sep 1;100(5):385-94.
2. Borda, L. J., Macquhae, F. E., & Kirsner, R. S. (2016). Wound dressings: a comprehensive review. *Current Dermatology Reports*, 5, 287-297.
3. Gonzalez, A. C. D. O., Costa, T. F., Andrade, Z. D. A., & Medrado, A. R. A. P. (2016). Wound healing-A literature review. *Anais brasileiros de dermatologia*, 91, 614-620.
4. Jones, V., Grey, J. E., & Harding, K. G. (2006). Wound dressings. *Bmj*, 332(7544), 777-780.
5. Thomas, S. (2000). Alginate dressings in surgery and wound management--Part 1. *Journal of Wound Care*, 9(2), 56-60.
6. Walker, R. M., Gillespie, B. M., Thalib, L., Higgins, N. S., & Whitty, J. A. (2017). Foam dressings for treating pressure ulcers. *Cochrane Database of Systematic Reviews*, (10).
7. Francesko, A., Petkova, P., & Tzanov, T. (2018). Hydrogel dressings for advanced wound management. *Current medicinal chemistry*, 25(41), 5782-5797.
8. Tanaka, A., Nagate, T., & Matsuda, H. (2005). Acceleration of wound healing by gelatin film dressings with epidermal growth factor. *Journal of veterinary medical science*, 67(9), 909-913.
9. Patil, P. P., Reagan, M. R., & Bohara, R. A. (2020). Silk fibroin and silk-based biomaterial derivatives for ideal wound dressings. *International journal of biological macromolecules*, 164, 4613-4627.
10. Farokhi, M., Mottaghitalab, F., Fatahi, Y., Khademhosseini, A., & Kaplan, D. L. (2018). Overview of silk fibroin use in wound dressings. *Trends in biotechnology*, 36(9), 907-922.
11. MarketsandMarkets. (2020). Advanced Wound Care Market by Product, Application, End User - Global Forecast to 2025.
12. Boulton, A. J., Vileikyte, L., Ragnarson-Tennvall, G., & Apelqvist, J. (2005). The global burden of diabetic foot disease. *The Lancet*, 366(9498), 1719-1724.
13. Bolton, L. L., Girolami, S., Corbett, L., & van Rijswijk, L. (2014). The Association for the Advancement of Wound Care (AAWC) venous and pressure ulcer guidelines. *Ostomy Wound Manage*, 60(11), 24-66.

14. Jha, K. K., Raj, A., Bishnoi, H., Raj, M., & Thakur, V. (2023). Chronic Wound Healing: A Review of Current Management and Treatments. *Asian Journal of Pharmaceutical Research and Development*, 11(3), 95-102.
15. Mazuz, R. (2019). Wound Care in the Developing World-Gaps, Opportunities, and Realities. *Current Dermatology Reports*, 8(4), 199-207.