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PUBLIC AWARENESS AND FEEDBACK ON SCALP COOLING DEVICES FOR CHEMOTHERAPY-INDUCED ALOPECIA IN SOUTHERN INDIA: IMPLICATIONS FOR MEDICAL DEVICE INNOVATION

GRIFFITH COLLEGE DUBLIN

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MSc. in Medical Device Technology and Business

Innopharma labs and the faculty of science

Griffith College Dublin

Dissertation Supervisor: Patricia Mooney

Meghana Jiji Johnson

May 2025

CANDIDATE DECLARATION

I hereby declare that the dissertation entitled "**PUBLIC AWARENESS AND FEEDBACK ON SCALP COOLING DEVICES FOR CHEMOTHERAPY-INDUCED ALOPECIA IN SOUTHERN INDIA: IMPLICATIONS FOR MEDICAL DEVICE INNOVATION**" is submitted in partial fulfilment of MSc in Medical Device Technology and Business is my original piece of work and due acknowledgment is given, where the reference is made to others work. I also affirm that I have not plagiarised anybody else's work, either partially or entirely, including other students.

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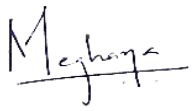
Candidate signature: 

Supervisor Name: Patricia Mooney

Date:11/05/2025

Supervisor Signature:

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MEGHANA JIJI JOHNSON

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List of Abbreviations

CIA	Chemotherapy-Induced Alopecia
DNA	Deoxyribonucleic Acid
FDA	Food And Drug Administration
HFs	Hair Follicles
HIV	Human Immunodeficiency Viruses
LMICs	Low And Middle-Income Countries
PCIA	Persistent Chemotherapy-Induced Alopecia
PSCS	Paxman Scalp Cooling System
QOL	Quality Of Life
SC	Scalp Cooling
3D	3 Dimensional
UK	United Kingdom

ABSTRACT

Chemotherapy-induced alopecia is a common and psychologically distressing side effect of cancer treatment, with a major influence on patients' quality of life. Studies have shown that scalp cooling devices have the potential to reduce chemotherapy-related hair loss. This study aims to examine public awareness, attitudes, and willingness to use scalp cooling devices in Southern India, while also addressing cultural, economic, and informational barriers. It also seeks feedback on potential device improvements to enhance accessibility and acceptance in oncology care. Motivated by a clear knowledge gap surrounding the use of scalp cooling in Southern India, this study employed a mixed-methods approach to collect both quantitative and qualitative data. A survey was distributed, focusing general population, including healthcare professionals, and individuals affected by cancer. Descriptive statistical analysis and visualisation were performed using Microsoft Excel and Minitab, while thematic analysis was used to analyse open-ended responses and identify recommendations from participants. Key findings indicate that public awareness of scalp cooling devices in Southern India is low, with many respondents hearing about the technology for the first time during the survey. However, after being informed, a majority expressed positive attitudes and interest in the potential emotional benefits of reducing hair loss during chemotherapy. Participants identified high cost, limited access to information, and discomfort with the device design as key barriers to adoption. Also, suggested that increasing affordability through subsidies or insurance, expanding local access, and providing clearer information on effectiveness and safety could improve adoption. The study highlights the need for awareness campaigns, training programs for healthcare providers, and the provision of financial assistance programs to improve access and adoption of these devices. By addressing the notable gap in understanding regarding the awareness and use of scalp cooling devices in Southern India, this study enhances regional knowledge, offers practical recommendations for healthcare providers, policymakers, and manufacturers, and lays the groundwork for future studies on medical device adoption in India and comparable settings.

Keywords: *chemotherapy-induced alopecia, scalp cooling devices, public awareness, adoption barriers, healthcare professionals, Southern India, mixed-methods research, medical device adoption, cost barriers, cultural perceptions.*

CHAPTER- 1

1. Introduction

Chemotherapy-induced alopecia (CIA) is one of the most distressing side effects of cancer treatment, significantly affecting patients' emotional and social well-being. Scalp cooling devices have emerged as an effective method to reduce CIA by minimising hair loss during chemotherapy. However, despite their proven efficacy, public awareness and acceptance of these devices remain limited, particularly in Southern India. This dissertation, titled "Public Awareness and Feedback on Scalp Cooling Devices for Chemotherapy-Induced Alopecia in Southern India: Implications for Medical Device Innovation," aims to assess this knowledge gap by evaluating public perceptions and identifying barriers to adopting scalp cooling technology in this region.

1.1. Purpose of the Study

The primary objective of this study is to assess the current level of awareness and understanding of scalp cooling devices among the general public in Southern India. Additionally, it investigates perceptions, attitudes, and willingness to adopt these devices while identifying cultural, economic, and informational barriers. By collecting feedback, this research aims to provide insights that can inform future innovations in scalp cooling technology, making it more acceptable and accessible for oncology-supportive care.

1.2.Background

Cancer remains a major public health challenge in India, with distinct regional patterns in its incidence. In 2022, India recorded approximately 1.46 million new cancer cases, with a crude rate of 100.4 per 100,000 population, and this number is expected to rise by 12.8% by 2025 (Sathishkumar *et al.*, 2022). Among the many side effects of cancer treatment, CIA is one of the most distressing for patients. Research suggests that 58.66% of Indian cancer patients, particularly those undergoing treatment for breast cancer, experience significant emotional distress due to hair loss (Jagadish *et al.*, 2023). The fear of losing hair can sometimes be so overwhelming that patients consider refusing or delaying chemotherapy, which can have severe consequences for their health (Bajpai and Chandrasekharan, 2021).

To address this issue, scalp cooling devices have emerged as an effective method to reduce or prevent hair loss caused by chemotherapy. These devices work by lowering the temperature of the scalp, which in turn reduces blood flow to the hair follicles. This process minimises the exposure of hair follicles to chemotherapy drugs, helping patients retain their hair (Rugo *et al.*, 2017). Currently, two major scalp cooling systems are used in India, the Paxman Scalp Cooling System (PSCS) and the Eva Scalp Cooling System. A recent study conducted in western India

with 91 female breast cancer patients reported that the PSCS was 81% effective in preventing chemotherapy-induced hair loss among the participants (Mekha *et al.*, 2024).

While research from western India has demonstrated the effectiveness of these devices, data specific to southern India is limited. Additionally, many cancer patients and healthcare providers are still unfamiliar with this technology. The lack of awareness, along with economic and cultural barriers, may prevent patients from accessing these devices, even when they are available (Bajpai *et al.*, 2020).

Moreover, studies conducted in Mumbai and Western India highlight barriers such as high costs (₹3,000–₹5,000 per session), lack of insurance coverage, cultural stigma surrounding hair loss, and limited promotion by healthcare providers hinder their adoption (Bajpai and Chandrasekharan, 2021; Mekha *et al.*, 2024).

More research is needed to evaluate public awareness, identify adoption barriers, and gather feedback on scalp cooling devices, especially in southern India. Understanding public perception can help healthcare professionals and policymakers create targeted awareness campaigns, understand barriers and design culturally appropriate strategies to improve access. This study aims to aid in filling the knowledge gap and contribute to advancements in chemotherapy-induced alopecia management.

1.3.Significance and Justification of the Study

This study is important because it aims to evaluate awareness among people in southern India about scalp cooling devices, which can help prevent chemotherapy-induced hair loss. CIA is one of the most upsetting side effects of cancer treatment. Cancer patients undergoing chemotherapy often face multiple challenges, including physical discomfort, emotional distress, and social stigma due to CIA. While scalp cooling devices have been shown to effectively reduce hair loss (Rugo *et al.*, 2017; Contreras Molina *et al.*, 2024), the adoption of scalp cooling devices in Southern India seems limited, potentially due to a lack of awareness.

The significance of this study lies in its potential to improve patient support by understanding public perception and identifying challenges to adoption. With rising cancer rates in India, addressing CIA through accessible, supportive care can enhance patient well-being. Through the distribution of the survey, this study helps raise awareness about the potential benefits and availability of scalp cooling devices, informing patients, healthcare providers, and the wider community, particularly those who may not have been previously aware of this option, to support the emotional well-being of the people affected by cancer. The findings could also encourage

greater adoption of scalp cooling devices, ultimately enhancing patient care and support during chemotherapy.

1.4. Research Aim and Objectives

Aim

To evaluate public awareness and feedback on scalp cooling devices in Southern India and to explore implications for medical device innovation.

Objectives

- To assess the level of awareness and understanding of scalp cooling devices among the general public in southern India.
- To evaluate the perceptions, attitudes, and willingness of the general public toward the adoption of scalp-cooling devices.
- To identify barriers (such as cultural, economic, and informational) that make it difficult for people in Southern India to access or accept scalp cooling devices.
- To explore potential modifications or improvements to scalp cooling devices based on public feedback, aiming to increase their acceptability and usage among the general population.

1.5. Research Questions

a. Awareness: What is the current level of public awareness and understanding of scalp cooling devices in Southern India?
b. Perceptions and Attitudes: How do public perceptions and attitudes influence the willingness to adopt scalp cooling devices?
c. Barriers: What cultural, economic, and informational barriers prevent wider acceptance and usage of scalp cooling devices in this region?
d. Innovation: What modifications or improvements, based on public feedback, can be made to enhance the design and functionality of scalp cooling devices for better adoption in Southern India?

1.6.Structure of the Dissertation

The dissertation consists of the following chapters:

- Chapter 1: Introduction- This chapter provides an overview of the study, including its background, purpose, significance, and research objectives. It highlights the need to assess public awareness and feedback on scalp-cooling devices for chemotherapy-induced alopecia in Southern India.
- Chapter 2: Literature Review- This section presents an extensive review of existing research on chemotherapy-induced alopecia, scalp cooling technology, and factors influencing its adoption. It explores awareness levels, cultural perceptions, economic barriers, and opportunities for medical device innovation.
- Chapter 3: Methodology- This chapter outlines the research design, data collection methods, and analytical techniques used in the study. It describes how primary data was gathered from the general public in Southern India.
- Chapter 4: Findings and Discussion- This section presents the study's findings and interprets them in the context of existing literature. It examines awareness levels, public perceptions, barriers to adoption, and suggestions for improving scalp cooling devices.
- Chapter 5: Conclusion and Recommendations- The final chapter summarises key findings and discusses their implications for medical device innovation and public health initiatives. It provides recommendations to enhance awareness, accessibility, and acceptance of scalp cooling technology in Southern India.

CHAPTER- 2

2. Literature Review

2.1. Chemotherapy-Induced Alopecia (CIA) and Its Psychological Impact

2.1.1. Definition and causes of CIA

CIA is a common and distressing side effect of cancer treatment caused by the cytotoxic effects of chemotherapy drugs on hair follicles (HFs). These drugs target rapidly dividing cells, including HFs keratinocyte stem cells, leading to apoptosis, DNA damage, and epithelial-mesenchymal transition. This disrupts the normal cycling and growth of HF, resulting in hair loss. In some cases, hair loss can be persistent, that is, persistent CIA (pCIA), which is a long-term or permanent form of hair loss associated with certain chemotherapy agents, particularly taxanes like docetaxel and paclitaxel.

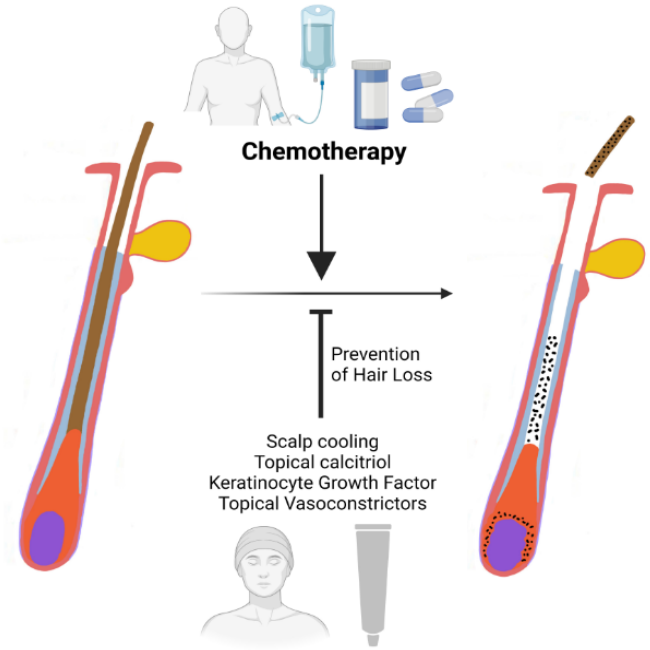

Figure 1:Methods to prevent CIA (Wikramanayake et al.*, 2023)*

For example, a UK-based study involving 383 breast cancer patients reported pCIA in 23.3% of those treated with docetaxel (out of 245 patients) and 10.1% of those treated with paclitaxel (out of 138 patients). Similarly, a study conducted in Korea with 61 breast cancer patients found pCIA rates of 39.5% at 6 months and 42.3% at 3 years post-treatment (Wikramanayake *et al.*, 2023). Given the impact of CIA on cancer patients, including the risk of persistent hair loss even after treatment, it is important to prioritise the prevention of CIA. This also highlighted that scalp

cooling is the most effective strategy to prevent CIA in patients with solid tumours receiving certain chemotherapy regimens. Using FDA-cleared scalp cooling systems, it reported high patient compliance and a mean success rate of 50–70%. (Wikramanayake *et al.*, 2023). These findings highlight the need for effective strategies to mitigate CIA, especially in regions like Southern India, where awareness and access to preventive measures such as scalp cooling devices remain limited.

2.1.2. Psychological and Emotional Distress Associated with Hair Loss During Chemotherapy

Hair loss during chemotherapy significantly impacts patients' psychological well-being, as it affects their self-esteem, body image, sexuality, and overall quality of life (QoL). Hair is often viewed as a symbol of health, beauty, and identity across cultures, making its loss particularly distressing. Patients undergoing CIA may experience feelings of vulnerability, grief, and social stigma due to their altered appearance. The visibility of alopecia also serves as a constant reminder of their illness, further exacerbating emotional distress (Blair, 2024). A study involving 91 breast cancer patients in western India reported that 32 participants discontinued the use of the scalp cooling system, with hair loss cited as the primary reason for withdrawal (Mekha *et al.*, 2024). While wigs and headscarves offer temporary relief, scalp cooling remains underutilised, possibly due to limited awareness.

2.1.3. CIA Affects Patient Adherence to Chemotherapy

The fear or experience of the CIA can significantly impact patients' decisions about undergoing treatment. Hair loss is often seen as one of the most distressing side effects of cancer therapy, with some patients, particularly younger women, delaying or refusing potentially life-saving chemotherapy to preserve their appearance. Effective CIA prevention strategies are therefore crucial not only for improving treatment adherence but also for easing the psychological burden of hair loss (Blair, 2024). A study on breast cancer patients reported that scalp cooling significantly reduced the risk of CIA by up to 43%, comparing both automated and non-automated delivery systems (Contreras Molina *et al.*, 2024). While scalp cooling shows promise for improving adherence, its adoption remains limited, possibly due to factors such as low awareness and accessibility.

2.1.4. The Psychological Benefits of Hair Retention

Retaining hair during chemotherapy offers substantial psychological benefits by preserving patients' self-image and reducing feelings of vulnerability associated with hair loss. Scalp cooling systems have been identified as an effective method for preventing CIA in patients undergoing

certain chemotherapy regimens for solid tumours. Scalp cooling has demonstrated success rates ranging from 50–70%, along with high patient compliance due to its ability to maintain hair coverage during therapy. However, it is not suitable for all patients, such as those with hematological malignancies, and accessibility remains a challenge in some healthcare settings. Despite these limitations, scalp cooling remains a promising intervention for enhancing psychological well-being by enabling hair retention during chemotherapy (Wikramanayake *et al.*, 2023).

2.2. Scalp Cooling Technology: Mechanism and Effectiveness

Scalp cooling devices work by reducing blood flow to the hair follicles during chemotherapy, thereby minimising the exposure of hair follicles to cytotoxic drugs (Rugo *et al.*, 2017). A meta-analysis by Contreras Molina et al. (2024) found that scalp cooling significantly reduces the incidence of severe CIA, demonstrating a 43% relative risk reduction compared to non-cooling controls (Contreras Molina *et al.*, 2024). Similarly, A prospective cohort study by Rugo et al. (2017) demonstrated that 66.3% of patients using scalp cooling devices retained more than 50% of their hair, compared to 0% in the control group. The study showed a significant benefit of scalp cooling in preventing chemotherapy-induced alopecia for patients receiving non-anthracycline taxane-based chemotherapy (Rugo *et al.*, 2017).

2.2.1. Explanation of How Scalp Cooling Devices Work

Scalp cooling devices function by leveraging targeted hypothermia to protect hair follicles from the cytotoxic effects of chemotherapy, thereby reducing CIA. The mechanism of action involves three primary physiological processes: vasoconstriction, metabolic suppression, and cell cycle arrest. Cooling the scalp to temperatures within 22°C induces vasoconstriction, which reduces blood flow to the scalp and limits the delivery of chemotherapy drugs to hair follicles. This significantly decreases the exposure of rapidly dividing matrix keratinocytes, the cells most vulnerable to cytotoxic damage. Additionally, cooling suppresses metabolic activity within follicular cells, making them less susceptible to damage from cell cycle-specific chemotherapeutic agents such as taxanes and anthracyclines. Furthermore, scalp cooling prolongs the telogen (resting) phase of the hair cycle, temporarily halting mitotic activity in hair follicle cells during peak chemotherapy exposure (Dunnill *et al.*, 2018).

2.2.2. Different Types of Scalp Cooling Systems

Scalp cooling systems can be broadly categorized into manual cold caps and mechanized refrigerated systems, each with distinct mechanisms and operational characteristics. Manual cold

caps, such as gel caps, rely on being pre-frozen using dry ice or freezers and require frequent replacement, typically every 20 to 30 minutes, to maintain low temperatures. These caps are not FDA-regulated and are labour-intensive, as they necessitate constant monitoring and cap changes during chemotherapy sessions. In contrast, mechanised systems like the Paxman or DigniCap devices utilise a refrigeration unit to circulate coolant through a silicone cap, maintaining a consistent scalp temperature without manual intervention. Clinical protocols typically involve pre-cooling for 30 minutes before chemotherapy administration, continuous cooling during treatment, and post-infusion cooling for up to 90 minutes to counteract peak drug concentrations in the scalp. Mechanised systems are FDA-cleared and offer greater convenience and comfort as they eliminate the need for mid-treatment adjustments. The continuous cooling provided by these systems ensures precise temperature control, which is critical for effective vasoconstriction and reduced follicular drug uptake, thereby enhancing their efficacy compared to manual methods. Studies highlight that mechanised systems achieve higher success rates in preventing CIA, particularly in patients receiving taxane-based regimens, due to their ability to maintain optimal scalp temperatures throughout treatment (Unver *et al.*, 2022a).

2.2.3. Clinical Evidence Supporting the Effectiveness of Scalp Cooling

Scalp cooling is a clinically validated intervention to mitigate chemotherapy-induced alopecia (CIA), with efficacy varying based on patient characteristics, chemotherapy regimens, and cooling parameters. A 2024 study found that 53% of patients avoided noticeable hair loss with scalp cooling, emphasising the importance of individualised patient selection and confirming its safety without increased scalp metastasis risk (Schaffrin-Nabe *et al.*, 2024).

Moreover, effectiveness also depends on chemotherapy regimens. The SCALP trial reported 46.2% overall hair retention, with taxane-based treatments achieving 64.6% success, while anthracycline regimens showed lower rates of 24.1% after four cycles and 15.6% when followed by taxanes. Weekly paclitaxel demonstrated a 100% retention rate (Nangia, 2018). A study on Paxman scalp cooling showed 43% hair preservation during anthracycline treatment, with no grade 2 alopecia at 24 weeks post-treatment and improved hair regrowth exceeding baseline levels (Goldfarb *et al.*, 2023).

Also, technical factors such as cooling temperature and duration are critical. Cooling initiated 30 minutes before infusion and maintained for 90 minutes post-infusion achieved a 50.5% success rate, with subcutaneous temperatures below 18°C improving outcomes. Individual variability in scalp structure and physiological responses also influences efficacy (Silva *et al.*, 2020).

While scalp cooling is effective for many patients, particularly those on taxane-based regimens, its success is influenced by chemotherapy type, patient-specific factors, and socioeconomic barriers. Addressing these limitations through advancements in device design and accessibility could improve outcomes and adoption globally.

2.2.4. Success Rates and Limitations from Global and Indian Studies

Scalp cooling has proven effective in reducing CIA, with efficacy influenced by chemotherapy regimens, patient characteristics, and cooling parameters. A systematic review reported a 43% success rate in preventing significant hair loss among breast cancer patients undergoing anthracycline-based chemotherapy using the DigniCap system, with higher retention rates observed in taxane-based regimens (Munzone *et al.*, 2019).

A study on the Paxman Scalp Cooling System (PSCS) found that 26.7% of patients experienced no alopecia after chemotherapy, and 85.7% exhibited significant hair regrowth within 12 weeks post-treatment. However, limitations such as discomfort during cooling, reduced efficacy with anthracyclines, and financial constraints remain barriers to adoption (Kinoshita *et al.*, 2019).

While scalp cooling is particularly effective for taxane-based regimens, its success depends on patient-specific factors and socioeconomic barriers. Although advancements in device design could improve effectiveness, the impact on accessibility may require additional considerations, such as cost and availability, to ensure broader use.

2.3. Public Awareness and Perceptions of Scalp Cooling in India

Public awareness of scalp cooling devices remains critically low in India compared to Western countries. While studies like Bajpai et al. (2020) demonstrated 56.3% hair retention efficacy in Indian patients undergoing scalp cooling, they did not explore awareness levels, highlighting the need for further research into public and patient knowledge regarding these technologies (Bajpai *et al.*, 2020). Likewise, a Retrospective Cohort Study by Mekha et al. (2024) provides data on Indian patients using the Paxman Scalp Cooling Device, revealing 35.2% discontinuation rates, driven partly by poor awareness and cost barriers (Mekha *et al.*, 2024). Also, A REF 2021 Impact Case Study noted awareness increased marginally from 9% to 25% among Indian patients between 2016–2020, attributed to clinician-led online demonstrations (Unver and Kagioglou, 2021).

The lack of awareness can be attributed to limited marketing, inadequate patient education, and cultural stigma surrounding cancer and hair loss. In India, where cancer is often associated with fear and shame, patients may be reluctant to explore supportive care options like scalp

cooling. Furthermore, healthcare providers may not prioritise discussions about CIA due to the focus on life-saving treatments. Increasing awareness through public health campaigns, patient education programs, and healthcare provider training is essential to address this gap. However, the effectiveness of such interventions in the Indian context remains understudied, highlighting a critical research gap.

2.3.1. Global Awareness and Acceptance of Scalp Cooling

Scalp cooling has gained significant global recognition as an effective method for reducing CIA. Currently, continuous cooling devices are the most commonly used worldwide, though their adoption varies significantly across countries (Figure 2).

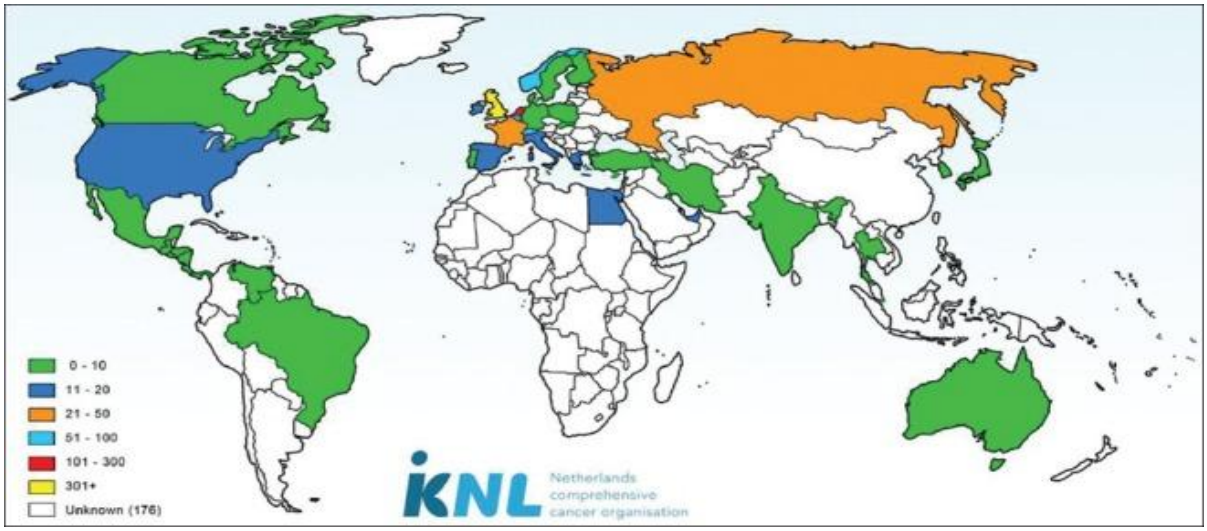

Figure 2:Global count of scalp cooling machines as of December 2014 (Peerbooms et al.*, 2015a)*

The PSCS has significantly advanced global access to chemotherapy-induced alopecia (CIA) prevention since its launch in 2017. The redesigned cooling cap, which received FDA clearance in the United States and Shonin approval in Japan, introduced a more efficient manufacturing process that reduced production costs and increased availability in 59 countries worldwide. Before 2016, only manual caps, which lacked FDA approval, were available in the U.S. The introduction of the PSCS marked a turning point, with the National Comprehensive Cancer Network® (NCCN) subsequently updating its Clinical Practice Guidelines for breast cancer (Version 1.2019) and ovarian cancer (Version 1.2020) to include scalp cooling as a Category 2a recommendation (Unver *et al.*, 2022a). Over 1,000 U.S. clinics and 46 states now offer scalp cooling, with 19,893 patients undergoing 127,437 treatments between 2021–2023 (Lagmay-Fuentes *et al.*, 2024). These updates reflect the growing clinical acceptance of scalp cooling as an effective intervention to reduce CIA.

In Western countries, its adoption has been supported by strong clinical evidence and regulatory approvals. For instance, a randomised controlled trial by Nangia et al. demonstrated that 50.5% of patients using the Paxman scalp cooling system experienced ≤50% hair loss compared to 0% in the control group, highlighting its efficacy in mitigating CIA during taxane- and anthracycline-based chemotherapy regimens. Similarly, a meta-analysis by Rugo et al. confirmed the effectiveness of scalp cooling across ten randomised controlled trials, with a relative risk reduction for CIA of 0.54 (95% CI: 0.46–0.63), further solidifying its role in oncology care (Silva *et al.*, 2020). In Japan, a multicentre trial reported that 85.7% of patients experienced significant hair volume recovery within 12 weeks post-chemotherapy when scalp cooling was used, showcasing its utility even in Asian populations (Kinoshita *et al.*, 2019). These findings have led to the integration of scalp cooling into national oncology guidelines in several countries, including the United States and Japan.

2.3.2. Public Awareness in Western Countries vs. India

In Western nations, scalp cooling has been well-integrated into cancer care, though public awareness remains limited. A Dutch study revealed that 73% of patients were unfamiliar with scalp cooling before their cancer diagnosis, despite its widespread availability in hospitals. This lack of awareness has been attributed to insufficient information provided by medical professionals, over 33% of oncologists and nurses reported inadequate knowledge to inform patients about the effectiveness and safety of scalp cooling (Peerbooms *et al.*, 2015a). However, once informed, acceptance rates are high. For example, a prospective study demonstrated that the DigniCap system prevented significant hair loss in 43% of patients undergoing chemotherapy, i.e., out of 131 patients evaluated in the study, 56 successfully prevented hair loss, with tolerability rated positively by most participants (Munzone *et al.*, 2019). Scalp cooling is considered to have potential psychosocial benefits, such as supporting emotional well-being and social confidence during treatment.

In India, public awareness about scalp cooling is still emerging. A randomised controlled trial conducted at Tata Memorial Hospital found that many patients were unaware of scalp cooling as an option to mitigate CIA. The study highlighted the efficacy of the PSCS in reducing hair loss among breast cancer patients undergoing chemotherapy. However, financial constraints and limited accessibility remain significant barriers to adoption (Bajpai *et al.*, 2020; Mekha *et al.*, 2024). Another study noted that while Indian patients expressed interest in preserving their hair during chemotherapy, cultural factors, intolerance to its side effects, and a lack of widespread information hindered the uptake of scalp cooling technologies (Saad *et al.*, 2018).

2.3.3. Awareness and Misconceptions About Scalp Cooling

Awareness of scalp cooling in India is limited, and misconceptions about its efficacy and safety hinder its adoption. A multi-centre study on the PSCS demonstrated reduced chemotherapy-induced alopecia (CIA) and confirmed its safety, with mild side effects such as headaches and scalp discomfort (Mekha *et al.*, 2024). However, the study did not assess awareness levels or patient perceptions, leaving gaps in understanding public views on this technology.

Misconceptions about scalp cooling include concerns about reduced chemotherapy effectiveness due to vasoconstriction, a myth debunked by studies showing that scalp cooling primarily limits drug exposure to hair follicles without affecting systemic outcomes (Dunnill *et al.*, 2020). Another misconception is discomfort during use, though side effects like headaches are generally mild and manageable. A meta-analysis found that while patients reported mild discomfort, the benefits of hair preservation outweighed these issues (Shen *et al.*, 2021). Additionally, some believe scalp cooling is effective only for specific drugs or cancers, but evidence shows success across various regimens, with higher efficacy for taxane-based treatments compared to anthracycline-based ones (Kinoshita *et al.*, 2019). Addressing these challenges through educational initiatives and dispelling myths can significantly enhance the adoption of scalp cooling technologies in India.

2.3.4. Role of Healthcare Providers in Educating Patients About Scalp Cooling

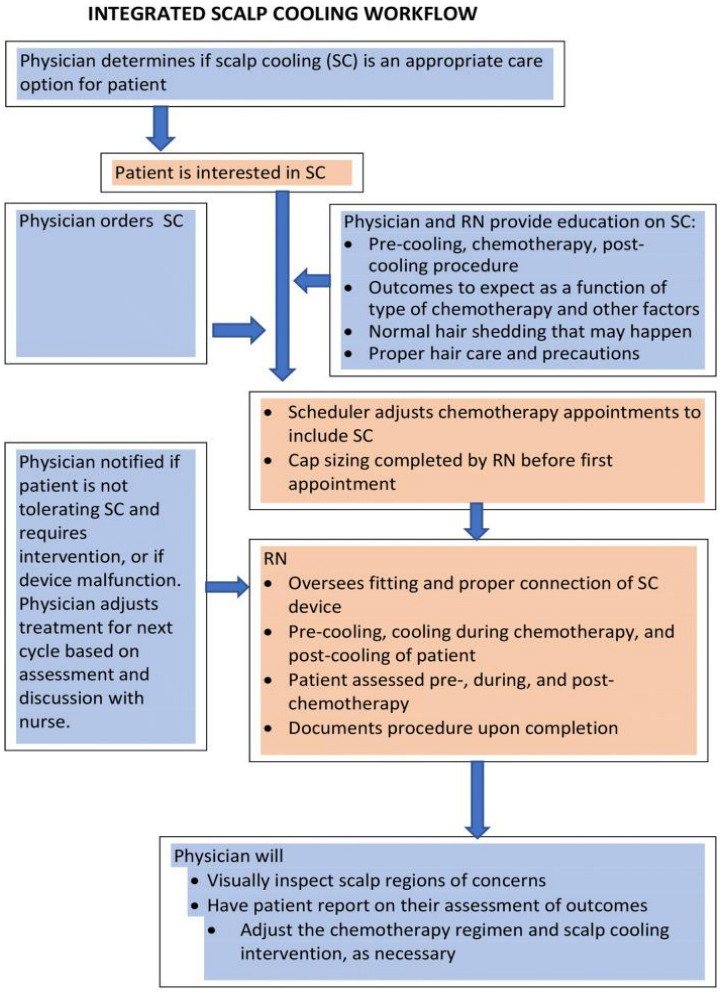

Figure 3:Incorporating physicians and registered nurses into the scalp cooling care workflow for managing chemotherapy-induced alopecia (Peterson et al.*, 2020).*

Effective patient education involves collaboration among physicians, nurses, and oncology teams to explain procedures, dispel misconceptions, and ensure protocol adherence. Physicians assess patient eligibility, set realistic expectations, and provide evidence-based information on efficacy, while nurses guide patients through practical aspects like cap fitting and managing side effects (Peterson *et al.*, 2020). Healthcare providers may contribute to improving awareness and understanding of scalp cooling.

A common misconception is that scalp cooling reduces chemotherapy efficacy by limiting drug delivery to the scalp. However, studies, including a 2020 meta-analysis, confirm that scalp cooling does not compromise systemic chemotherapy outcomes as it primarily reduces drug uptake in hair follicles. Providers are encouraged to use decision aid tools to counsel patients on success rates, which vary by chemotherapy regimen (Kate *et al.*, 2020).

Training programs for healthcare providers are essential to standardise patient education. Structured training on scalp cooling protocols improves patient adherence and satisfaction. Nurse-led interventions have been shown to significantly boost patient confidence in using scalp cooling systems (Heery, 2022).

While cost remains a challenge in India, proactive counselling by healthcare teams can help patients weigh the psychological benefits of hair preservation against logistical and economic constraints.

2.4. Barriers to the Adoption of Scalp Cooling Devices

The high cost of scalp cooling devices remains a significant barrier, particularly in low- and middle-income countries (LMICs) like India. Mekha et al. (2024) reported that in Western India, scalp cooling costs range from ₹3,000 to ₹5,000 (USD 50–75) per cycle, with no health insurance coverage. Among 91 patients in the study, 32 discontinued scalp cooling. Although financial concerns were cited, the study did not specify how many stopped due to cost. The primary reason for discontinuation was hair loss, reported by 62.5% of patients (Mekha *et al.*, 2024).

Additionally, Landeiro et al. (2023) noted that up to 8% of women may decline chemotherapy due to the fear of losing their hair, emphasising the emotional impact of hair loss during treatment (Landeiro *et al.*, 2023). Cost-related challenges are particularly evident in LMICs, where healthcare resources may be limited. While existing research acknowledges the absence of health insurance coverage and the financial burden on patients, there is limited data on affordable alternatives and financing mechanisms for these regions. Strategies such as public-private partnerships and government subsidies could help reduce costs and increase accessibility, though further investigation is needed to assess their feasibility within the Indian context.

2.4.1. Economic Factors: Costs, Insurance Coverage, and Affordability Issues

Scalp cooling devices are associated with significant costs, which can be prohibitive for many patients. The price for a full course of scalp cooling therapy ranges from $1,500 to $3,000, depending on the type of device and chemotherapy duration. Insurance coverage for scalp cooling remains inconsistent, with some private insurers offering partial reimbursement while others deny coverage altogether. Nonprofit organisations such as Cap & Conquer™ have emerged to provide financial assistance, but this solution is not sustainable in the long term (Novice *et al.*, 2024). Economic evaluations suggest that scalp cooling is cost-effective under certain healthcare systems, such as the Spanish National Healthcare System, but upfront costs remain a barrier in countries with less comprehensive insurance models (Infante-Ventura *et al.*, 2022)

2.4.2. Cultural Barriers: Social Stigma of Cancer and Hair Loss

CIA is a highly visible side effect of cancer treatment that carries significant cultural and social stigma, particularly for women. Hair loss due to chemotherapy is often seen as a marker of illness, leading to stigmatisation and social isolation. Women undergoing treatment frequently report feeling unattractive and being perceived as sick or dying. This stigma is amplified by societal expectations regarding appearance, which emphasise hair as a symbol of vitality and beauty (Coe *et al.*, 2013) (Blair, 2024).

The stigma associated with the CIA varies across cultures but is universally significant. In Western societies, it's often linked to the stereotypical image of the "bald cancer patient," which can alienate individuals who do not conform to this image or choose to disguise their hair loss. For example, women treated for breast cancer in the UK reported feeling stigmatised both for having cancer and for being visibly different due to alopecia (Trusson and Pilnick, 2017). While in non-Western contexts, it can be even more pronounced. For example, in Malawi, hair loss is interpreted as a sign of an incurable illness or HIV infection (Watt *et al.*, 2023). In Indian culture, where hair holds significant symbolic value for femininity and social identity, women undergoing chemotherapy often experience heightened distress due to their altered appearance (Blair, 2024).

The psychological impact of the CIA is profound, with women reporting feelings of shame, fear, and loss of self-identity. For younger women, particularly in college environments, the stigma can lead to ostracization and identity crises (Blair, 2024). While some women may embrace their baldness as a "badge of honour," others experience severe emotional distress due to heightened stigma consciousness (Knapp *et al.*, 2014). Addressing CIA requires both medical solutions and broader societal efforts to challenge stigmatising attitudes toward visible signs of illness

2.4.3. Informational Barriers: Lack of Awareness and Limited Promotion by Healthcare Professionals

A critical barrier to scalp cooling adoption is the lack of awareness among patients and inconsistent promotion by healthcare professionals. Studies reveal that 73% of patients were unaware of scalp cooling (SC) before their cancer diagnosis, highlighting gaps in patient education. Even when SC is available, healthcare providers often fail to discuss it due to insufficient knowledge about its efficacy, safety, or logistical requirements. For instance, 33% of medical oncologists and nurses in Dutch hospitals reported inadequate understanding of SC's effectiveness, and 43% lacked confidence in explaining safety protocols (Peerbooms *et al.*, 2015a).

Provider familiarity significantly influences patient access, 2022 survey found that oncology providers who recently read SC literature or worked at facilities with SC devices were 3–4 times more likely to discuss it with patients (Novice *et al.*, 2022). Conversely, providers unfamiliar with SC cited doubts about efficacy and time constraints as reasons for not offering it (Peerbooms *et al.*, 2015a). This inconsistency perpetuates a cycle where patients remain uninformed, and underutilised SC machines exacerbate disparities in care.

The absence of standardised guidelines for SC counselling leads to fragmented communication and implementation challenges. While SC is FDA-approved for reducing CIA in solid tumours, its delivery requires an integrated effort by healthcare teams. Peterson et al. (2020) emphasise the need for identifying eligible patients, educating them on SC procedures, and setting realistic outcome expectations. Logistical challenges, such as coordinating additional chair time for pre- and post-cooling phases and managing nursing staff efforts, further complicate implementation. Improved interdisciplinary collaboration and institutional support are essential for equitable patient access and optimising SC benefits (Peterson *et al.*, 2020).

2.4.4. Challenges in the Accessibility and Availability of Scalp Cooling Devices

Scalp cooling devices face challenges in accessibility and availability in India due to logistical, financial, and organisational barriers. Incorporating scalp cooling into chemotherapy sessions increases the total duration by 30 minutes pre-treatment and 90 minutes post-treatment, straining hospital resources, especially in overburdened facilities lacking dedicated spaces for scalp cooling. Proposed solutions include setting up separate scalp cooling areas near daycare units (Bajpai and Chandrasekharan, 2021).

The high cost of scalp cooling systems further limits their adoption, as these devices are expensive to purchase and maintain, making them inaccessible for smaller clinics or hospitals. Scalp cooling is often perceived as a cosmetic intervention rather than a medical necessity, excluding it from government insurance schemes and resulting in substantial out-of-pocket expenses for patients, particularly those from economically disadvantaged populations (Bajpai and Chandrasekharan, 2021).

Implementing scalp cooling programs also requires trained nursing staff for proper cap fitting and monitoring during treatment. Busy oncology centers often lack the personnel or time to provide this support effectively, and training nurses adds to their workload, potentially delaying chemotherapy administration for other patients (Bajpai and Chandrasekharan, 2021).

Addressing these barriers requires improvements in healthcare infrastructure, enhanced training programs for medical staff, and policy changes to include scalp cooling under insurance coverage.

2.5. Innovations and Potential Modifications in Scalp Cooling Technology

The study by S. Mane et al. (2019), conducted in India, highlights the potential of localised innovation in developing cost-effective scalp cooling systems. Although the research does not specifically focus on Southern India, its context within the Indian healthcare and manufacturing environment emphasises the importance of validating such innovations in diverse regional settings to ensure they align with local socioeconomic and environmental realities. Broader findings from the literature further support the need for culturally appropriate and affordable scalp cooling devices tailored to the Indian context. Innovations such as portable cooling systems, reusable cooling caps, and low-cost materials could significantly improve accessibility across varied populations (S. Mane *et al.*, 2019).

While several studies have explored the technical aspects of scalp-cooling devices, there is limited research on user feedback and cultural adaptation. Future studies should focus on co-designing scalp cooling devices with input from patients, healthcare providers, and the general public in India. Additionally, the development of scalable and cost-effective solutions for LMICs should be prioritised.

2.5.1. Technological Advancements in Scalp Cooling

Scalp cooling technology has evolved significantly since the 1970s, transitioning from ice packs and gel caps to modern machine-based systems that provide continuous coolant flow using refrigeration units and silicone caps. These advancements ensure stable scalp temperatures, improving both efficacy and patient comfort while reducing risks like frostbite associated with manual devices (Unver *et al.*, 2022a).

The Paxman Scalp Cooling System (PSCS) exemplifies these innovations, incorporating flexible silicone caps tailored to diverse cranial anatomies through 3D (3 Dimensional) laser scanning and anthropometric data. Advanced manufacturing techniques, such as 3D laser sintering, have reduced production costs and enabled iterative design improvements. These features enhance scalp contact, ensuring even temperature distribution and reducing bald patches (Unver *et al.*, 2022a).

Recent studies have explored lower cooling temperatures for improved outcomes. For example, a Memorial Sloan Kettering study evaluated PSCS at -7.5°C and -10°C for anthracycline chemotherapy patients, finding that 53% experienced grade 1 alopecia at week eight. While cooler

temperatures were tolerable and safe, hair preservation outcomes varied, highlighting the need for further optimisation of cooling parameters (Goldfarb *et al.*, 2023).

These advancements significantly improve the quality of life for chemotherapy patients by reducing hair loss-related psychological distress. Continued innovation in scalp cooling technology will likely enhance its efficacy and accessibility for broader patient populations.

2.5.2. Patient-Centred Innovations: Improving Comfort and Usability

Scalp cooling technology has undergone patient-centred innovations to enhance comfort, usability, and treatment experience. Comfort improvements include medical-grade silicone caps that are softer, flexible, non-allergenic, and antibacterial, reducing discomfort during long treatment sessions. A study reported that 87% of patients found the cap's weight comfortable, while 89% tolerated the coldness. However, chin strap comfort remains an area for improvement, with 53% of respondents providing negative feedback (Unver *et al.*, 2022a).

Usability enhancements include simplified size selection and ergonomic designs for easier application. Compared to earlier models, the PSCS showed a 25% increase in positive feedback on ease of use. Patient feedback also emphasised the need for sideburn cooling coverage, which 70% agreed would improve their experience. Iterative design processes have continuously improved usability and comfort parameters (Unver *et al.*, 2022a).

These innovations enhance physical comfort while positively impacting emotional well-being, empowering patients to choose scalp cooling as a treatment option to mitigate CIA, leading to improved emotional stability and quality of life during cancer treatment (Unver *et al.*, 2022a).

2.5.3. Potential for Cost Reduction Through Localised Manufacturing

Localised manufacturing has emerged as a key strategy for reducing the costs associated with scalp cooling technology, particularly through innovations in production methods and materials. The development of the PSCS demonstrates how advanced manufacturing techniques can significantly lower production costs while maintaining quality and efficacy. A study by Unver et al. (2022) highlighted the use of 3D laser sintering and twin-sheet silicone thermoforming as revolutionary methods for producing the PSCS caps. These techniques allowed for rapid tooling and iterative design modifications, which were essential for meeting medical testing requirements and adapting the product to global markets. By implementing these methods at a UK-based silicone manufacturer, Paxman was able to reduce tooling costs and increase production rates, making scalp cooling technology more accessible globally (Unver *et al.*, 2022a).

Cost-effectiveness analyses have further supported the overall economic viability of scalp cooling technology. For instance, while not directly linked to localised manufacturing, A study by van den Hurk et al. (2014) demonstrated that doubling the usage of scalp cooling machines in hospitals reduced equipment costs per session from €24 to €12, significantly lowering overall costs for healthcare providers. Additionally, societal savings were estimated at €269 per scalp-cooled patient due to reduced reliance on wigs and head covers. These findings highlight how increased machine utilisation can improve cost-effectiveness, making scalp cooling a viable option for broader patient populations (van den Hurk *et al.*, 2014).

2.5.4. Studies on Personalised Scalp Cooling Solutions

Personalised scalp cooling solutions aim to optimise CIA prevention by tailoring systems to individual patient needs. A study by Unver et al. used anthropometric data and 3D laser scanning to design caps that fit diverse head shapes, improving scalp contact and reducing bald patches caused by uneven cooling. Advanced techniques like silicone thermoforming enhanced heat conductivity and treatment efficacy, while enabling scalable production for mass customisation (Unver *et al.*, 2022a).

Another study explored a framework for mass customisation using cranial anthropometry and additive manufacturing to produce 3D-printed wearable heat exchangers. Close-fitting caps achieved success rates above 80%, highlighting the importance of extensive cranial data collection and iterative design involving healthcare professionals. This approach represents a shift toward Industry 4.0 practices in medical device manufacturing (Binder *et al.*, 2024).

These studies collectively highlight how personalised approaches, whether through cranial data customisation or advanced manufacturing techniques, can improve the efficacy and accessibility of scalp cooling technology for CIA prevention.

2.6. Literature Gaps

- Limited Data from Southern India: Most studies on scalp cooling devices have been conducted in Western countries, with a limited focus on southern India.
- Cultural Adaptation: There is insufficient research on how cultural factors influence the acceptance and use of scalp-cooling devices in India.
- Economic Feasibility: Few studies have explored cost-effective solutions for making scalp cooling devices accessible in LMICs.
- Public Awareness: The lack of literature assessing public and healthcare providers' awareness of scalp cooling devices in Southern India remains a significant research gap.

Despite the proven efficacy of scalp cooling devices in preventing CIA, several critical research gaps hinder their adoption in Southern India. Awareness levels remain limited, with studies reporting only a marginal increase from 9% to 25% between 2016–2020 nationally (Unver and Kagioglou, 2021), but no specific data are available for Southern India.

Furthermore, perceptions and attitudes toward these devices are poorly understood, particularly within a cultural context where hair loss carries significant stigma and emotional distress (Bajpai and Chandrasekharan, 2021; Blair, 2024). Economic barriers such as high costs (₹3,000–₹5,000 per cycle) and lack of insurance coverage further exacerbate accessibility challenges (Mekha *et al.*, 2024). Although studies such as Mekha et al. (2024) report a high efficacy rate of up to 81% for preventing hair loss during chemotherapy in Western India (Mekha *et al.*, 2024), there is a lack of region-specific data for Southern India. While the clinical effectiveness of scalp cooling devices is well-established in Western countries, limited research exists on their use in diverse populations, including India. Therefore, future studies should explore the efficacy and adoption challenges of these devices within India's economic and cultural context, helping to address current gaps in the literature.

Additionally, user feedback on device comfort and usability is limited despite reports highlighting discomfort due to cap fit or cold sensation (Unver *et al.*, 2022a). Public health campaigns aimed at increasing awareness have shown promise globally but remain understudied within the Indian context (Peterson *et al.*, 2020). Cultural adaptation is another overlooked area, as societal attitudes toward hair loss significantly influence acceptance rates (Bajpai and Chandrasekharan, 2021; Blair, 2024).

Lastly, economic feasibility studies exploring cost-effective solutions such as public-private partnerships or government subsidies are scarce despite their potential to improve accessibility in LMICs like India (Mekha *et al.*, 2024). Lastly, localised manufacturing studies, such as S. Mane et al. (2019), highlight cost-effective solutions but lack validation for Southern India's environmental and cultural realities. This gap underscores the need for co-designed devices that integrate patient feedback and regional affordability metrics (S. Mane *et al.*, 2019). Addressing these gaps will be crucial for enhancing awareness, accessibility, and acceptability of scalp cooling devices in Southern India while informing broader medical device innovation strategies.

2.7. Conceptual Framework

This study follows a clear path to understand how awareness among the general public, including healthcare professionals and people affected by cancer, affects perceptions, identifies barriers, and

informs improvements in medical device innovation, specifically for scalp cooling devices used for chemotherapy-induced hair loss.

First, the framework looks at how much general public know about chemotherapy induced alopecia and scalp cooling technologies. It also explores where people get their information from and how cultural and societal factors shape this awareness.

Next, it examines how people feel and think about scalp cooling devices, whether they believe they are effective, safe, and necessary. This includes emotional responses, especially how hair loss affects self-image and identity. The study looks at how willing patients are to use these devices and how willing they are to recommend them to their peer.

These perceptions help identify barriers to using scalp cooling devices, such as the cost, cultural attitudes, lack of access, and challenges within the healthcare system, like limited availability in oncology care.

Finally, the framework focuses on identifying improvements in the device based on feedback from the public. Suggestions include making the devices more affordable, culturally appropriate, and easier to access. The study also emphasises the importance of educating people and creating policies to increase awareness and acceptance of the technology.

Overall, this study aims to better understand how the involvement of general public including healthcare professionals and people affected by cancer, can directly influence the development and spread of patient-friendly medical technologies.

Figure 4: Conceptual Framework

2.8.Summary

The literature review highlights the significant impact of chemotherapy-induced alopecia (CIA) on patients' psychological well-being and treatment adherence. It emphasises the importance of

effective interventions, such as scalp cooling devices, which have demonstrated promising results in preventing hair loss during chemotherapy. While scalp cooling technology has advanced significantly, offering improved efficacy and comfort, its adoption remains limited due to barriers such as high costs, lack of awareness, cultural stigma, and accessibility challenges, particularly in regions like Southern India.

Despite the proven benefits of scalp cooling, several gaps remain in the literature. These include limited research on its effectiveness in diverse populations, insufficient exploration of cultural factors influencing acceptance, and a lack of affordable solutions tailored to low- and middle-income countries. Public awareness campaigns and healthcare provider education are essential to bridge informational gaps and improve patient access to this technology. Additionally, innovations in localised manufacturing and patient-centred designs could further enhance affordability and usability.

Overall, addressing these gaps through targeted research, policy changes, and culturally sensitive interventions is crucial for improving the adoption of scalp cooling devices. This would not only reduce the psychological burden of the CIA but also enhance the quality of life for chemotherapy patients globally, with a particular focus on underserved regions like Southern India.

CHAPTER- 3

3. Research Methodology

3.1.Introduction

This chapter outlines the research methodology used to explore the awareness, perceptions, and feedback on scalp cooling devices used to prevent chemotherapy-induced alopecia (CIA) among residents of Southern India. The study adopts a pragmatic philosophical approach, enabling the use of both quantitative and qualitative data to gain a nuanced understanding of public attitudes and barriers to the adoption of these devices. This section includes a detailed explanation of the research strategy, data collection through Microsoft Forms, participant selection using screening questions, ethical considerations, and data analysis methods.

This approach enables the collection of insights from a diverse group of participants by targeting the general adult population (18 and above). By relying solely on primary data, the study aims to present a variety of real-world perspectives that contribute to a deeper understanding of public awareness and attitudes toward scalp cooling devices used during chemotherapy.

3.2.Research Philosophy

Research philosophy is a key factor in shaping how a study is designed, how data is collected, and how findings are interpreted. This study adopts a pragmatic research philosophy, which emphasises flexibility and practical outcomes. Pragmatism is especially well-suited for real-world issues like public awareness and acceptance of scalp cooling devices used to reduce CIA. It focuses on “what works” to address research questions effectively (Holtrop and Glasgow, 2020).

In this study, the pragmatic approach supports a mixed-method design that includes both quantitative and qualitative elements. It values both quantitative and qualitative data, making it suitable for understanding the public’s awareness, perceptions, and feedback on scalp cooling devices used during chemotherapy. This allows the research to capture not only measurable facts, such as how many people are aware of these devices, but also personal views and experiences.

The research aims to explore public perspectives, identify patterns, and gather meaningful insights from a diverse group of participants. By combining structured questions with open-ended responses, this approach strives for a balanced and realistic understanding of the topic. It also makes the findings more relevant and applicable to real-life contexts from both quantitative and qualitative data, which allows for a richer, clearer interpretation of public awareness, perceptions, and barriers, especially in a culturally diverse region like Southern India.

3.3. Research Onion

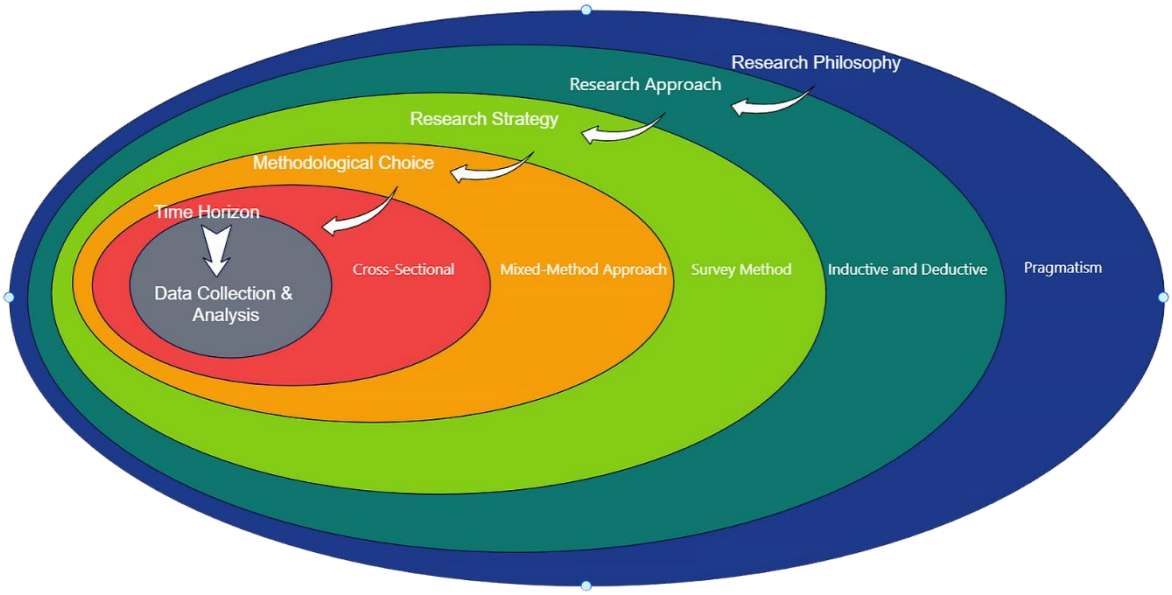

Figure 5:Research Onion

3.3.1. Approach: Mixed (Inductive and Deductive)

The study primarily uses an inductive approach to explore awareness, perceptions, barriers, and potential improvements related to scalp cooling devices in Southern India, with insights drawn from both quantitative and qualitative data. For one research question, a hypothesis will be tested using a deductive approach, applying statistical methods to analyse relationships between variables. This mixed approach allows for both data-driven insights and hypothesis testing, drawing on diverse participant groups for comprehensive analysis.

3.3.2. Strategy: Survey

The research uses a survey strategy to gather standardised data from a broad audience across Southern India (Kerala, Tamil Nadu, and Karnataka). This survey focuses on the general public, including individuals affected by cancer and healthcare professionals. Conducted via Microsoft Forms, the survey includes multiple-choice, Likert-scale, and open-ended questions, facilitating a deeper understanding of public perceptions and experiences.

3.3.3. Choices: Mixed-Method Approach

This research utilises a mixed-method (quantitative + qualitative) approach, enabling a more holistic understanding of the topic. While quantitative data offers measurable insights into awareness levels, attitudes, and trends, qualitative responses add depth by capturing personal experiences, cultural perspectives, and recommendations.

This multi-method approach is aligned with the pragmatic research philosophy, which encourages the use of various methods to address complex research questions effectively. The integration of open-ended questions within the survey allows for a thematic analysis of subjective feedback, enriching the statistical findings with real-world insights.

3.3.4. Time Horizon: Cross-Sectional

A cross-sectional time horizon is adopted in this study, where data is collected at a single point in time. This design is appropriate for understanding the current state of awareness, perceptions, and barriers related to scalp cooling devices among the target population.

3.3.5. Techniques and Procedures: Data Collection and Data Analysis

Data for this research will be collected using a structured online survey created in Microsoft Forms. The survey is designed to gather both quantitative and qualitative data from adults aged 18 and above residing in Southern India, including Kerala, Tamil Nadu, and Karnataka. The questionnaire includes multiple-choice, Likert-scale, and open-ended questions to explore awareness, perceptions, and feedback regarding scalp cooling devices used during chemotherapy. Screening questions will be used to differentiate between the general public, with distinctions made between sub-populations such as individuals affected by cancer (patients, survivors, or their close relations), and healthcare professionals. This enables a more nuanced understanding of participant perspectives while ensuring the inclusion of diverse experiences.

Participants will be recruited online through platforms like LinkedIn, Facebook, WhatsApp, and the researcher’s networks, ensuring broader reach and voluntary participation. The survey consists of multiple-choice, Likert scale, and open-ended questions. The combination of these question types allowed for both quantitative and qualitative data collection. The multiple-choice and Likert scale questions provided measurable data on participants' levels of awareness, perceptions, and attitudes toward scalp cooling devices, while the open-ended questions offered more in-depth insights into barriers, cultural beliefs, and potential improvements for the devices. By employing this mixed-method approach, the research captured both broad trends and nuanced individual

responses, facilitating a comprehensive understanding of the factors influencing the adoption of scalp cooling devices.

To ensure diversity in the sample, responses from participants across the different states of Southern India were prioritised. However, responses from participants outside the geographical scope, such as Andhra Pradesh and Telangana, were also considered if received during the data collection phase, contributing to broader regional insight.

The survey emphasises ethical compliance: Participants are presented with a clear explanation of the study's purpose and must provide informed consent before proceeding. No personally identifiable information is collected, ensuring confidentiality and anonymity. Participants are free to skip questions or withdraw at any point, and the survey design avoids distressing language to minimise emotional discomfort, particularly for those impacted by cancer.

Quantitative responses will be analysed using descriptive statistics. Comparative analysis across states will highlight regional patterns, with bar and pie charts used for visualisation. Chi-square tests in Minitab will assess associations between barriers and acceptance. Qualitative open-ended responses will undergo thematic analysis. This mixed-method approach aligns with the study's pragmatic philosophy and ensures a deeper understanding of public awareness and feedback on scalp cooling devices in Southern India.

3.4.Study Participants

For this study on public awareness and feedback regarding scalp cooling devices used during chemotherapy-induced alopecia, the participant selection strategy has been carefully developed to ensure a diverse and relevant participant group. The focus is on collecting responses primarily from Southern India, with an emphasis on Tamil Nadu, Karnataka, and Kerala, where the researcher has direct access to the population through established personal and professional networks. Additionally, responses from Andhra Pradesh and Telangana, which are also a part of southern India, will be considered if they are received during the data collection phase, contributing to broader regional insight.

The survey will be distributed via Microsoft Forms, enabling easy access and broad distribution. The survey was shared through online platforms such as LinkedIn, Facebook, WhatsApp, and professional networks. These platforms allowed the researcher to reach a wide range of participants, including the general public, individuals affected by cancer, and healthcare professionals. This online approach allows for accessible, cost-effective participation and enables outreach to individuals across different demographic and geographic backgrounds.

The inclusion criteria for the study require participants to be adults aged 18 and above residing in the southern part of India. Within the survey, the primary target group is the general population, Screening questions help identify two important subgroups: Participants who indicate personal experience with cancer and participants who have a professional background in healthcare, who will provide additional insights relevant to the research topic. There is no fixed number of responses required from these groups, but their input will add value to the study. This approach ensures a balanced representation of diverse experiences while keeping the study flexible based on participation rates.

Conversely, responses will be excluded if the participant does not meet the minimum age requirement, resides outside the intended geographical scope, or fails to complete the screening questions accurately. Additionally, any responses lacking sufficient information will be omitted to maintain the quality and reliability of the data.

3.5.Sample Size Calculation

The sample size required to conduct this study was estimated using the standard formula for calculating sample size in a finite population.

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

Figure 6:Formula for sample size calculation

According to the official census data available from the National Portal of India, the combined population above 18 years of age in the focus states is as follows:

Kerala: 2,99,33,106

Karnataka: 5,39,34,264

Tamil Nadu: 6,47,23,198

Total adult population (18 and above): 14,85,90,568

This population represents the core target group for the study.

Considering the time constraints of the study, a confidence level of 95% and a margin of error of 6% were chosen for the calculation. Based on these inputs, the estimated minimum number of participants required for the study is 267.

To calculate the required sample size, the following parameters were used:

N is the population size (14,85,90,568)

Z is the Z-value (for a 95% confidence level, Z = 1.96)

p is the estimated proportion of the population that has the attribute of interest (set at 0.5 for maximum variability)

E is the margin of error (6%, or 0.06)

This sample size ensures a reasonable balance between statistical validity and feasibility, allowing the study to capture diverse perspectives from the adult population in Kerala, Karnataka, and Tamil Nadu. If responses are also received from Andhra Pradesh and Telangana, they will be considered during the analysis, but the focus will remain on the core three states. After data cleansing, a total of 267 valid responses were retained for analysis. However, due to the voluntary nature of participation, some respondents chose to skip certain questions. Therefore, the number of responses for specific questions may be lower in certain cases.

3.6. Data Analysis

This section outlines the specific analytical approaches applied to each of the four research questions, aligning with the corresponding research objectives. The analysis was conducted using a combination of descriptive statistics, inferential statistics, and qualitative techniques, based on the nature of the data collected through the mixed-methods survey. Each section below is dedicated to a single research question, describing the key variables, the method of analysis, the tools used, and the visualisation strategy employed to interpret the data.

Data cleaning was performed through Microsoft Excel to exclude responses which were not useful for this analysis. This included excluding data without consent, correcting spellings and standardising inconsistent responses (e.g., state names and Likert-scale wording variations), and trimming unnecessary whitespace. Multiple select responses were split into binary-coded columns for statistical testing, and missing or irrelevant responses, like NA, not used, or blank entries in open-ended fields, were excluded or marked accordingly. The final dataset was structured to support descriptive, and chi-square analyses relevant to the research objectives.

3.6.1. Research Question A: Awareness

Research Question: What is the current level of public awareness and understanding of scalp cooling devices in Southern India?

Related Objective: To assess the level of awareness and understanding of scalp cooling devices among the general public in Southern India.

Key Variables:

- Awareness level
- Confidence in understanding
- Initial Awareness Source
- State of residence

Analysis Method: Descriptive statistics will be used to assess the frequency and distribution of awareness levels and confidence in understanding. This will include mean, median, and standard deviation scores where applicable.

Visualisation:

- Bar charts and pie charts will be used to depict awareness levels and confidence in understanding by state.
- If response numbers per state are small, the data will be normalised using percentages to provide a fair comparison across different regions.

Tool Used: Excel, Minitab (Descriptive Statistics)

Analytical Purpose: This analysis will help identify state-level awareness patterns and explore relationships between awareness and confidence in understanding scalp cooling devices.

3.6.2. Research Question B: Perceptions and Attitudes

Research Question: How do public perceptions and attitudes influence the willingness to adopt scalp cooling devices?

Related Objective: To evaluate the perceptions, attitudes, and willingness of the general public toward the adoption of scalp-cooling devices.

Key Variables:

- Willingness to adopt
- Belief in effectiveness
- Emotional importance of hair
- Healthcare Professionals' Role in Adoption

Analysis Method: Descriptive statistics will be employed to explore trends in perceptions and attitudes toward scalp cooling devices. The frequency and percentage distributions of Likert scale responses will be analysed to understand how each variable may be influencing willingness to adopt.

Visualisation:

- Bar charts and pie charts will represent the distribution of responses.
- Normalisation through percentages will be used in cases where participant numbers are low.

Tool Used: Excel, Minitab (Descriptive Statistics)

Analytical Purpose: The aim is to reveal which psychological factors (such as belief in effectiveness or emotional importance of hair) play a role in shaping public willingness to adopt scalp cooling technology.

3.6.3. Research Question C: Barriers

Research Question: What cultural, economic, and informational barriers prevent wider acceptance and usage of scalp cooling devices in this region?

Related Objective: To identify barriers (such as cultural, economic, and informational) that make it difficult for people in Southern India to access or accept scalp cooling devices.

Key Variables:

- Perceived Cultural Barriers
- Perceived Economic Barriers
- Informational Awareness Barrier
- Influencing Factors for Adoption

Analysis Method: A descriptive analysis will be performed, which include a frequency table to identify the most common reason for all the multi select questions that gives insights related to cultural, economic, and informational barriers.

The Chi-square test will be used to determine the statistical association between one of the barrier categories and the level of acceptance of scalp cooling devices.

The following hypothesis will test the willingness to adopt the device against cultural barriers.

- Null Hypothesis: Perception of cultural beliefs as a barrier does not influence willingness to adopt scalp cooling.
- Alternative Hypothesis: Perception of cultural beliefs as a barrier does influence willingness to adopt scalp cooling.

Visualisation: Bar charts and pie charts will represent the distribution of responses.

Tool Used: Excel, Minitab (Chi-Square Test)

Analytical Purpose: This analysis will help in understanding the relationships between key barriers and acceptance levels, offering insights into how various socio-cultural and economic contexts may inhibit the adoption of scalp cooling technology.

3.6.4. Research Question D: Innovation

Research Question: What modifications or improvements, based on public feedback, can be made to enhance the design and functionality of scalp cooling devices for better adoption in Southern India?

Related Objective: To explore potential modifications or improvements to scalp cooling devices based on public feedback, aiming to increase their acceptability and usage among the general population.

Key Variables:

- Preference for local access
- Information Requirements for Adoption

Analysis Method: Descriptive statistics will be used to analyse the multiple-choice questions, to assess the key variables. Thematic Analysis will be conducted on open-ended survey responses to identify recurring themes, suggestions, and recommendations regarding device modifications.

Visualisation: Bar charts and pie charts will represent the distribution of responses for multiple-choice questions. A Word Cloud will be generated to visually represent the most frequently mentioned words and concepts in public feedback.

Tool Used: Excel, Minitab (Descriptive Statistics), Wordclouds.com (for Word Cloud Visualisation)

Analytical Purpose: This analysis aims to derive qualitative insights from the public to inform design and functional enhancements that can improve the acceptability and usability of scalp cooling devices in Southern India.

3.7. Ethical consideration

Ethical considerations are a critical aspect of this research study, ensuring that the participants' rights, privacy, and well-being are protected throughout the data collection process. The primary ethical principles adhered to in this study include informed consent, confidentiality, voluntary participation, and the right to withdraw from the research at any stage without penalty.

Informed Consent: Participants were provided with a detailed overview of the study directly within the survey itself. This included an explanation of the purpose of the study, the voluntary nature of participation, and the expected time commitment. This approach ensured that participants were fully informed about the research before agreeing to participate. To formalise their consent, participants were asked to confirm their understanding and agreement through a consent checkbox system within the Microsoft Form, where they could indicate their willingness to participate in the study.

CHAPTER- 4

4. Findings and Analysis

4.1. Overview

This chapter presents findings from the primary data and analyses four key areas: public awareness, perceptions, barriers to adoption, and suggestions for improving scalp cooling devices in Southern India, with comparisons to existing literature to identify similarities and gaps.

4.2.Public Awareness and Understanding of the Scalp Cooling Device

4.2.1. Awareness level

This section examines Awareness Level, where respondents were asked if they had heard of scalp cooling devices used during chemotherapy. Among 268 respondents, 33% were aware of the devices, while 67% were not.

Awareness	**Count(Percentage)**
Aware	88(33%)
Not Aware	180(67%)
Total	**268**

Table 1:Awareness Among Respondents

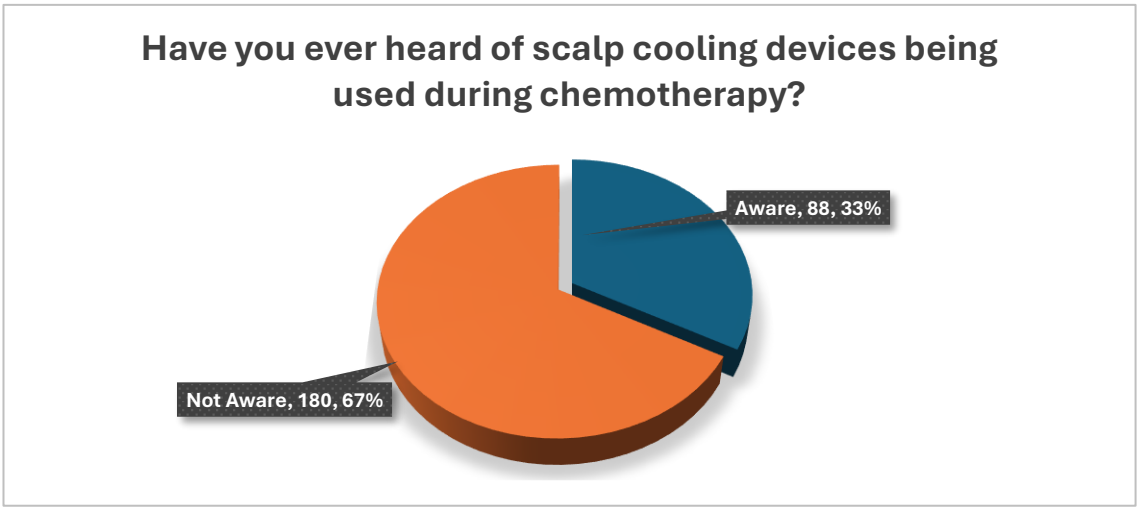

Figure 7:Awareness Among Respondents

Furthermore, to assess familiarity with the technology before any influence from the survey content itself, respondents were asked: “Before taking this survey, were you aware of scalp cooling devices being used to prevent chemotherapy-induced hair loss?”. The findings revealed

that prior awareness remained relatively low, only 35% reported being aware of scalp cooling devices, while the majority, 65%, indicated they had no prior knowledge.

Prior Awareness	Count(Percentage)
Aware	94(35%)
Not Aware	173(65%)
Total	**267**

Table 2:Prior-Survey Awareness Among Respondents

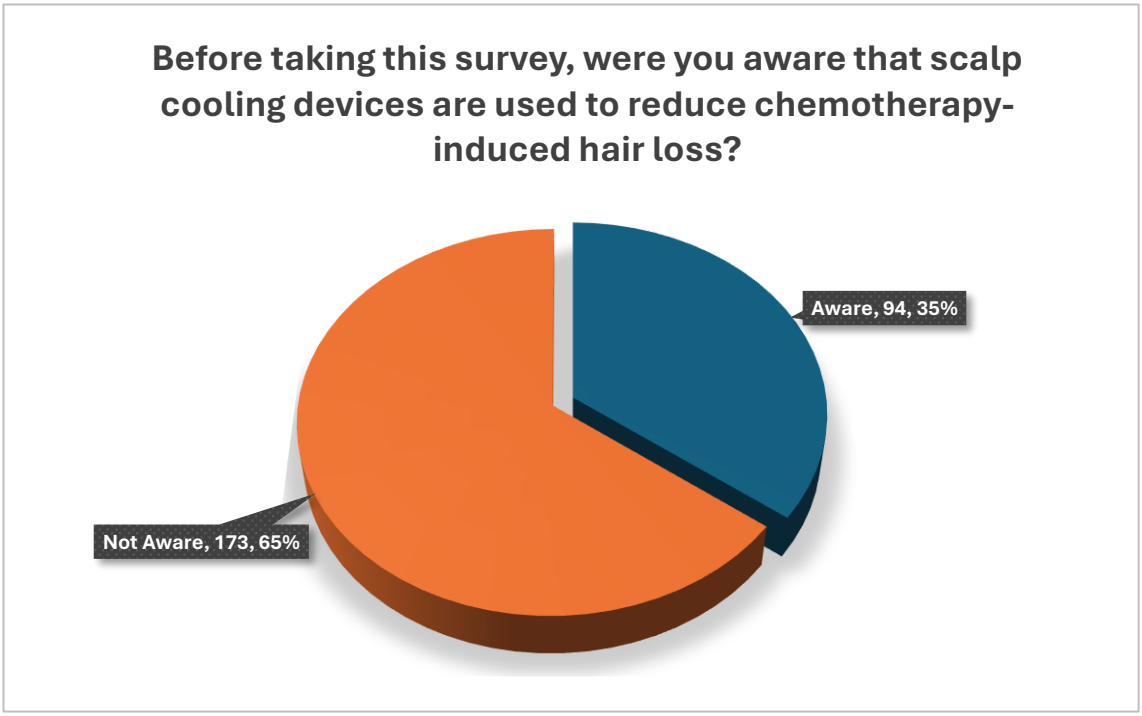

Figure 8:Prior-Survey Awareness Among Respondents

Both questions indicate a pattern of limited public awareness regarding scalp cooling devices in Southern India.

The survey data also offers insights into how individuals across Southern India perceive their self-reported awareness levels of scalp cooling devices.

Self-rated Awareness	Count(Percentage)
Extremely aware	3(1.12%)
Very aware	10(3.73%
Moderately aware	40(14.93%)
Slightly aware	86(32.09%)
Not aware at all	129(48.13%)
Grand Total	**268**

Table 3:Self-Rated Awareness Among Respondents

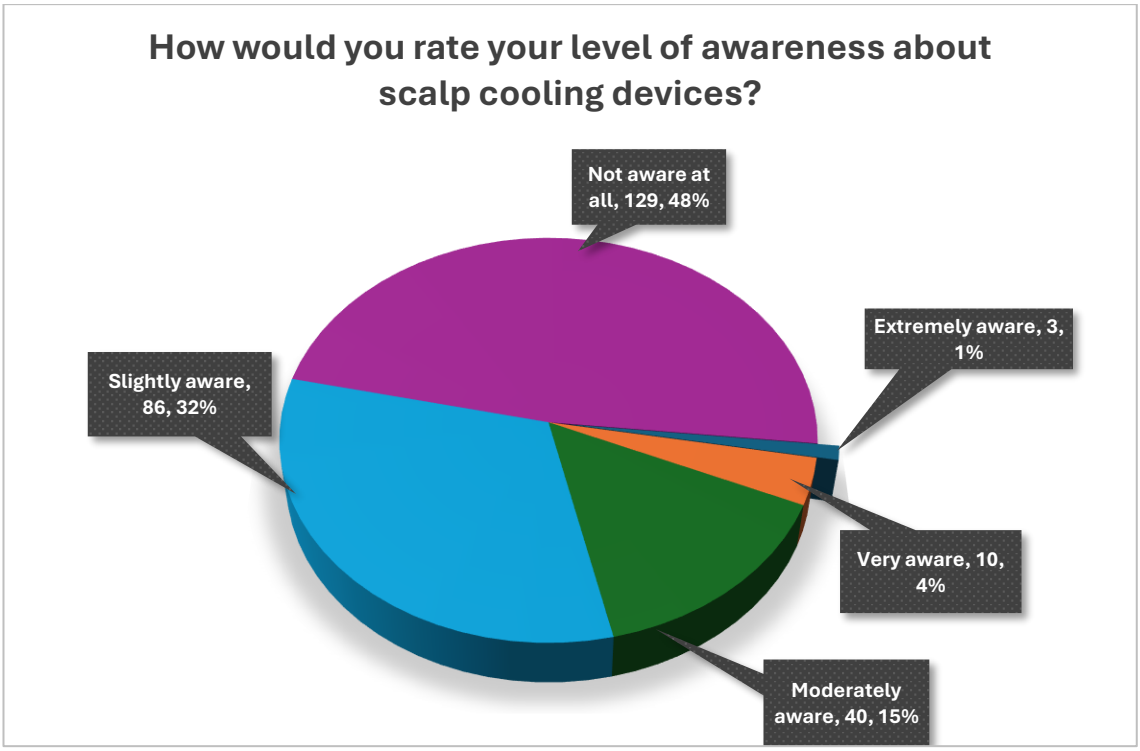

Figure 9:Self-Rated Awareness Among Respondents

In response to the question, "How would you rate your level of awareness about scalp cooling devices?", nearly half of the respondents (48.1%) reported being "Not aware at all," The combined total for those considering themselves "Very aware" or "Extremely aware" was only 4.8%.

These findings highlight a significant awareness gap and underscore the low level of public awareness regarding scalp cooling devices.

To further analyse self-reported awareness, responses to this Likert scale question were coded numerically for statistical analysis:

Likert Scale Options	Assigned Value
Not aware at all	1
Slightly aware	2
Moderately aware	3
Very aware	4
Extremely aware	5

Table 4:Coded Likert Scale Responses for Awareness Level

These values were entered into Microsoft Excel, where the SWITCH function was utilised to assign numerical values to each text-based response.

After coding, the following descriptive statistics were calculated:

Metrics	Score
Mean	1.776
Median	2
Mode	1

Table 5:Mean, median, and mode of respondents' self-reported awareness

The mean score of 1.776 suggests that, on average, respondents rated themselves between "Not aware at all" and "Slightly aware." The median score of 2 indicates that at least half rated themselves at or below "Slightly aware." The mode value of 1 show that "Not aware at all" was the most common response, reinforcing the low public awareness of scalp cooling devices. This numeric analysis supports earlier findings from the visual representation.

These findings help address a gap highlighted in the literature review by Bajpai et al. (2020) and Mekha et al. (2024), whose studies mainly focused on the effectiveness of scalp cooling among Indian patients but did not directly assess public awareness levels. Although they discussed challenges related to study discontinuation by participants, where low awareness could be a contributing factor, this aspect was not fully explored in their research (Bajpai *et al.*, 2020; Mekha *et al.*, 2024).

The findings from this survey confirm that low awareness is a significant issue and emphasise the need for broadening awareness campaigns and public education regarding scalp cooling devices in India.

State-level Awareness

The data on awareness, segmented by state, highlights regional differences in public knowledge of scalp cooling devices:

State	Not Aware	Aware	Total(Percentage)
Kerala	123(69%)	55(31%)	178(66.4%)
Karnataka	26(68%)	12(32%)	38(14.2%)
Tamil Nadu	20(54%)	17(46%)	37(13.8%)
Andhra Pradesh	5(71%)	2(29%)	7(2.6%)
Telangana	6(75%)	2(25%)	8(3.0%)
Total	**180**	**88**	**268**

Table 6:Awareness by State Among Respondents

In Kerala, 31% of respondents reported being aware of scalp cooling devices. In Tamil Nadu, 46% of respondents indicated awareness. In Karnataka, 32% of respondents were aware, while in Andhra Pradesh, only 29% were aware. Telangana recorded the lowest level of awareness, with

only 25% of respondents reporting awareness. The figures highlight significant regional variation, with Tamil Nadu showing the highest awareness rate among respondents.

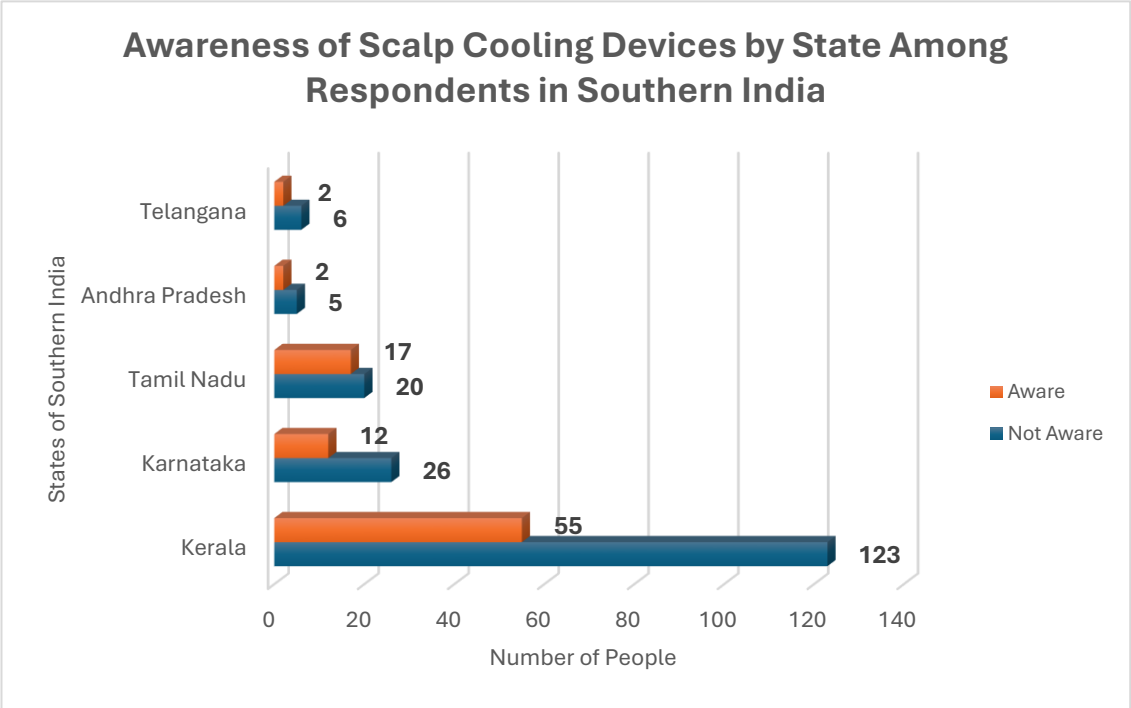

Figure 10:Awareness by State Among Respondents

These regional variations suggest that factors such as healthcare infrastructure, patient education, and access to information may influence public awareness. This is similar to the findings of Unver and Kagioglou (2021), who noted that increases in awareness in India were often linked to clinician-led interventions (Unver and Kagioglou, 2021). Despite minor differences, the data shows overall low public awareness, highlighting the need for broader, region-specific health education initiatives in Southern India.

Awareness of Respondents with Personal or Indirect Experience of Cancer

This section evaluates the level of awareness of scalp cooling devices among individuals who have either personally experienced cancer or have been indirectly impacted through a family member, close friend, or no personal experience.

Impacted Respondents	Aware	Not Aware	Total(Percentage)
A family member has/had cancer	41(32.5%)	85(67.5%)	126(45.65%)
No personal experience	38(30.4%)	87(69.6%)	125(45.29%)
A close friend has/had cancer	10(47.6%)	11(52.4%)	21(7.61%)
I have/had cancer	3(75%)	1(25%)	4(1.45%)
Total	**92**	**184**	**276**

Table 7:Awareness of Respondents Impacted by Cancer

Analysis shows notable differences in familiarity with scalp cooling devices. Awareness was highest (75%) among those with personal cancer experience, suggesting a strong link between a strong link between direct exposure to cancer treatment and knowledge of supportive interventions. Among those with a close friend affected, 47.6% were aware, indicating a moderate level of awareness likely influenced by shared experiences or conversations about treatment.

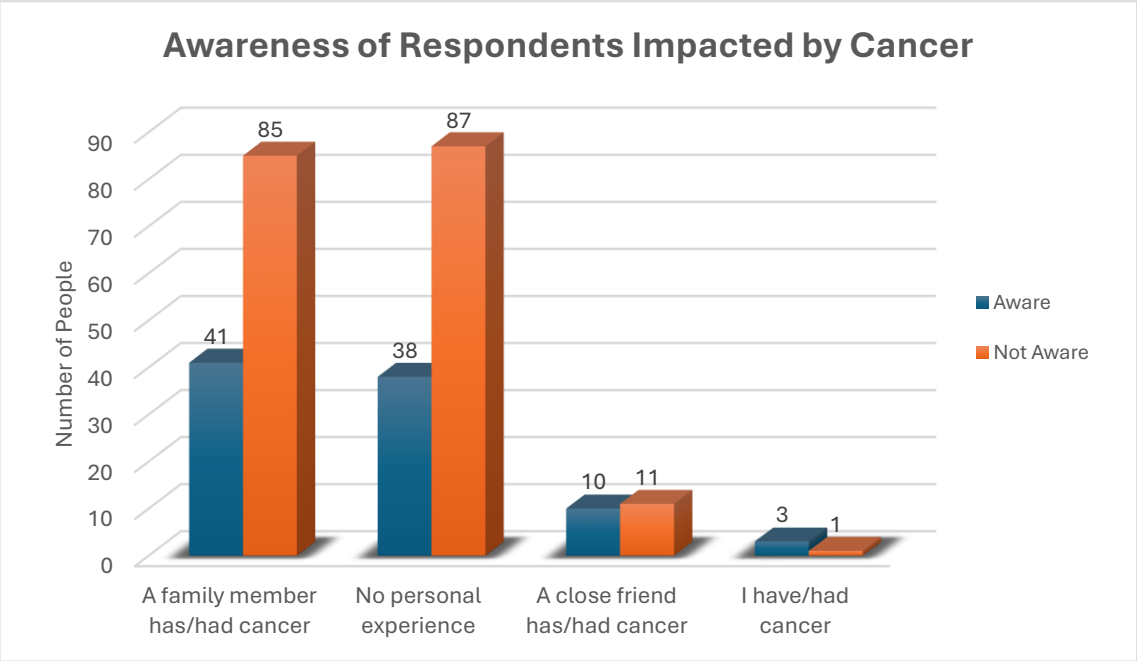

Figure 11:Awareness of Respondents Impacted by Cancer

Only marginally lower than those with a family member impacted by cancer, 32.5% of respondents with a family member affected by cancer reported awareness, compared to 30.4% of respondents with no personal experience of cancer. This similarity is interesting, suggesting that proximity to the disease does not always result in knowledge of specific therapeutic options. However, those with no personal experience of cancer had the lowest awareness level (30.4%), suggesting limited reach of information about scalp cooling beyond cancer-impacted circles.

Awareness of Healthcare Professionals

The data also explores the level of awareness of healthcare professionals about scalp cooling devices.

Profession of Respondents	Awareness Level		Total (Percentage)
	Aware	Not Aware	
Healthcare Professional	75(44.9%)	92(55.1%)	167(62.3%)
Non-Healthcare Professional	13(12.9%)	88(87.1%)	101(37.7%)
Total	**88**	**180**	**268**

Table 8:Awareness Among Healthcare and Non-Healthcare Professionals

The analysis compares the awareness of scalp cooling devices among healthcare professionals and non-healthcare professionals. Among 167 healthcare professionals, 44.9% reported awareness, while 55.1% did not. Among the 101 non-healthcare professional respondents, only 12.9% reported awareness, and 87.1% reported no awareness. These results indicate that healthcare professionals show a significantly higher level of awareness compared to non-healthcare professionals regarding scalp cooling devices.

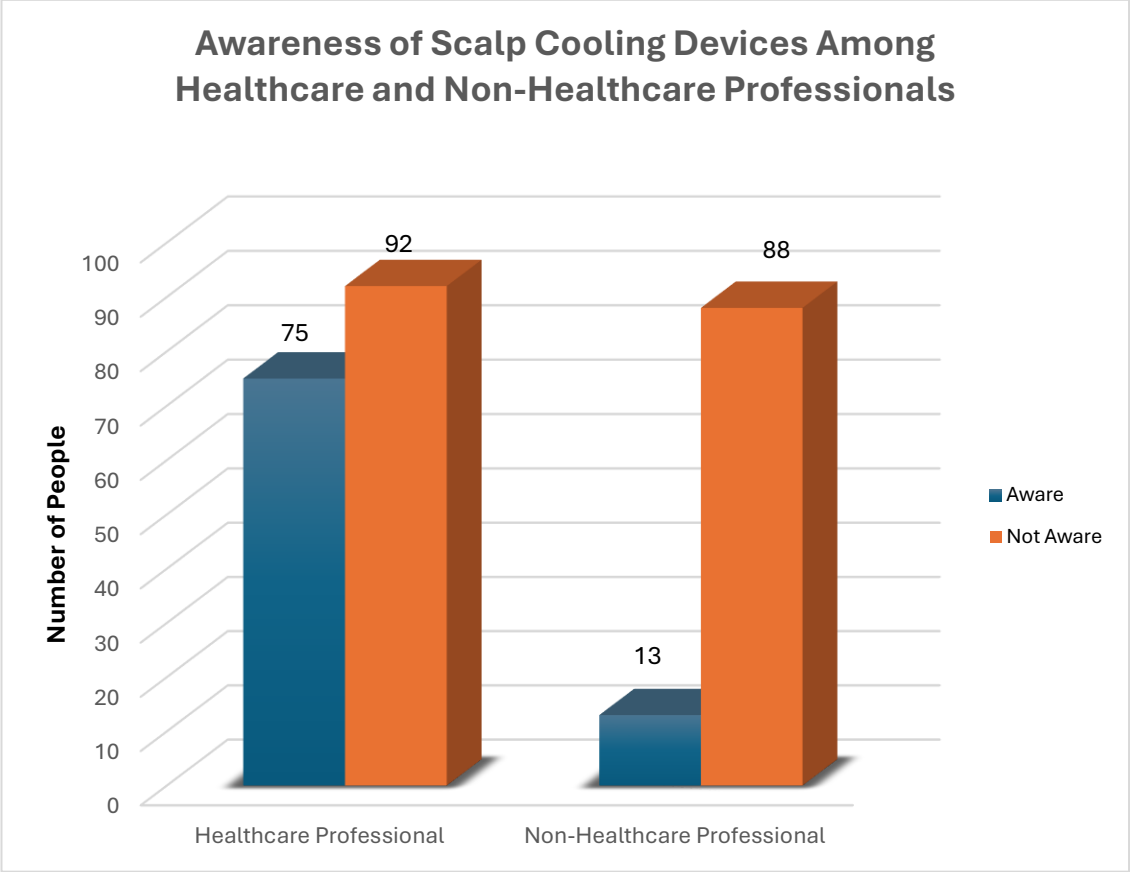

Figure 12:Awareness Among Healthcare and Non-Healthcare Professionals

This finding is consistent with the literature, which highlights the important role of healthcare providers in being informed about treatment options such as scalp cooling devices (Peterson *et al.*, 2020). While this data reflects awareness rather than direct influence, increasing healthcare professionals' awareness could help promote broader patient education and adoption of scalp cooling.

4.2.2. Confidence in Understanding

This section examines Confidence in Understanding, where respondents were asked how confident they felt about understanding how scalp cooling devices work.

Breakdown of Confidence Levels

The distribution of confidence levels among the respondents is as follows:

Confidence Level	Count(Percentage)
Extremely confident	7(3%)
Very confident	27(10%)
Moderately confident	80(30%)
Slightly confident	80(30%)
Not confident at all	71(27%)
Total	**265**

Table 9:Confidence Level Among Respondents

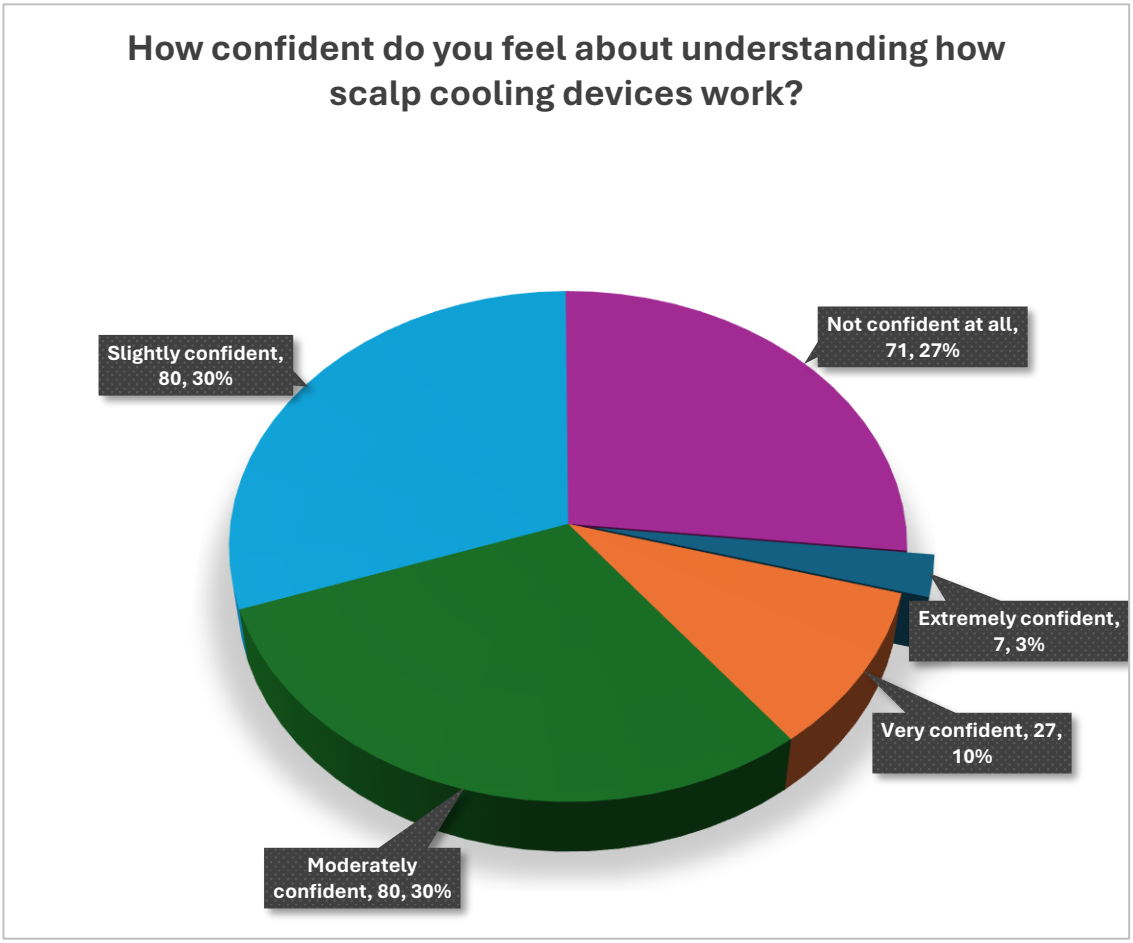

Figure 13:Confidence Level Among Respondents

Survey results show varied confidence levels in understanding scalp cooling devices, with 30% reporting moderate and slight confidence, and 27% not confident at all. These findings indicate that while some awareness exists, understanding is limited, revealing a clear knowledge gap. To support analysis, Likert scale responses were coded numerically for statistical analysis:

Likert Scale Options	Assigned Value
Not confident at all	1
Slightly confident	2

Moderately confident	3
Very confident	4
Extremely confident	5

Table 10:Coded Likert Scale Responses for Confidence Level

These responses were coded using Microsoft Excel's SWITCH function to ensure consistency in data entry. After coding, the following descriptive statistics were calculated:

Metrics	Score
Mean	2.302
Median	2
Mode	2, 3

Table 11:Mean, median, and mode of respondents' self-reported confidence level

The mean score of 2.30 indicates that respondents, on average, feel between 'Slightly confident' and 'Moderately confident' about their understanding of scalp cooling devices. The median score of 2 shows that at least half rated their confidence as 'Slightly confident' or lower. The mode values of 2 and 3 highlight that most selected 'Slightly confident' or 'Moderately confident,' suggesting that while some feel somewhat confident, many still lack strong confidence in their understanding.

Confidence Levels Among Healthcare Professionals vs. Non-Healthcare Professionals

The survey also explored differences in confidence between healthcare professionals and the general public:

Confidence Level	Healthcare professionals	Non-Healthcare Professional	Total
Extremely confident	5(3.0%)	2(2.0%)	7(2.6%)
Very confident	17(10.2%)	10(10.2%)	27(10.2%)
Moderately confident	51(30.5%)	29(29.6%)	80(30.2%)
Slightly confident	48(28.7%)	32(32.7%)	80(30.2%)
Not confident at all	46(27.5%)	25(25.5%)	71(26.8%)
Total	**167**	**98**	**265**

Table 12:Confidence Level Among Healthcare and Non-Healthcare Professionals

Among non-healthcare professionals, 58.2% reported either slight or no confidence in understanding scalp cooling devices. Similarly, 56.2% of healthcare professionals also fell into these two lowest confidence categories, indicating that uncertainty is common even within the medical field. While healthcare professionals demonstrated comparatively higher levels of

moderate to high confidence (30.5% moderately confident, 10.2% very confident), a substantial proportion still lacked confidence, highlighting the need for better education.

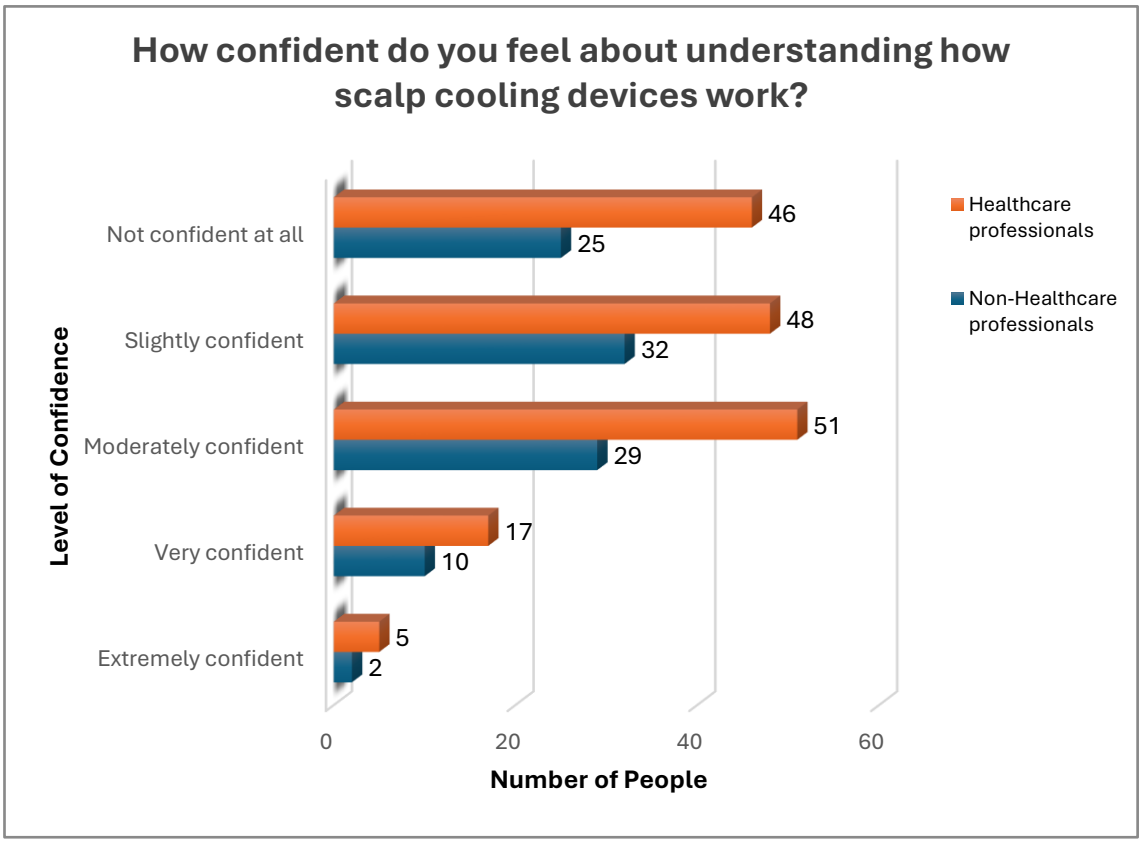

Figure 14*:Confidence Level Among Healthcare and Non-Healthcare Professionals*

These findings align with earlier research showing limited awareness of scalp cooling. For instance, Unver and Kagioglou (2021) noted a modest increase in awareness among Indian patients (from 9% to 25%), primarily driven by clinician-led initiatives (Unver and Kagioglou, 2021). However, this study extends their findings by showing that the majority of respondents, including healthcare professionals, reported low to moderate confidence in understanding how scalp cooling works. This suggests that while clinical efficacy is established, public and professional knowledge remains limited. Furthermore, the findings also align with the literature suggesting that healthcare providers play a crucial role in patient education (Peterson *et al.*, 2020). The moderate confidence levels reported by healthcare professionals in this study indicate the need for further training to address these knowledge gaps.

4.2.3. Initial Awareness Source

This section examines Sources of Awareness, revealing that awareness primarily stems from social interactions, healthcare professionals, and social media platforms.

Source	Count(Percentage)
Family/friends	48(22.4%)
Healthcare professionals	73(34.0%)
Social media	62(28.8%)
TV or news articles	32(14.9%)
Total	**215(100%)**

Table 13:Initial Awareness Source Among Respondents

Healthcare professionals were the most common source, reported by 34.0% of respondents. Social media followed at 28.8%, while 22.4% cited family and friends. TV and news media were mentioned by 14.9%, indicating a lesser role for traditional media.

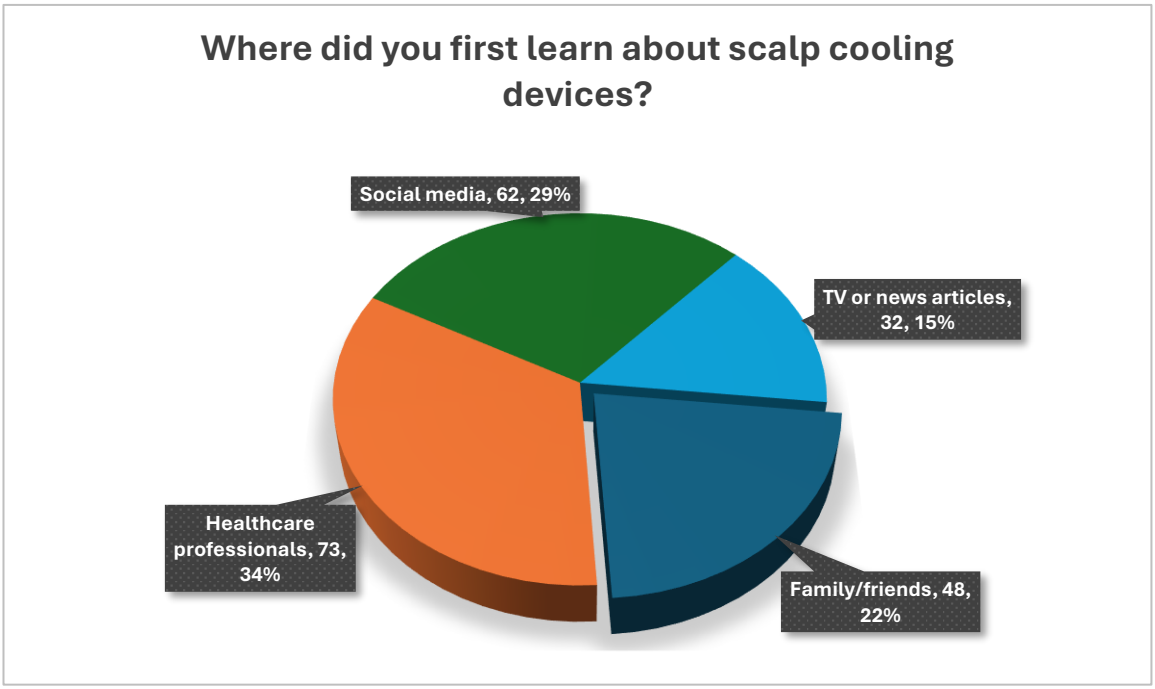

Figure 15:Initial Awareness Source Among Respondents

Healthcare professionals, as the primary source of information, play a key role in educating patients about treatments like scalp cooling. However, the findings suggest there is room for improvement in patient education and counselling, as not all patients appear to be adequately informed. This result is consistent with the literature review, which emphasised the role of healthcare professionals in patient education (Peterson *et al.*, 2020) but also highlighted gaps in healthcare workers' knowledge about scalp cooling, pointing to a need for enhanced training (Unver and Kagioglou, 2021).

In contrast, sources like social media (28.8%), family and friends (22.4%), and TV & news media (14.9%) were identified by respondents but not emphasised in the literature. The growing role of

social media highlights a shift toward digital health communication, while the limited impact of traditional media suggests opportunities for targeted awareness campaigns.

4.3. Public Perceptions and Willingness to Adopt Scalp Cooling Devices

4.3.1. Willingness to Adopt

Participants were asked would they consider using a scalp cooling device if they were to undergo chemotherapy. The results indicated a generally positive attitude towards scalp cooling, with the majority either willing or potentially open to using such devices.

Willingness to Adopt	Count(Percentage)
Yes	104(38.95%)
Maybe	113(42.32%)
Unsure	40(14.98%)
No	10(3.75%)
Total	**267(100%)**

Table 14:Willingness to Adopt

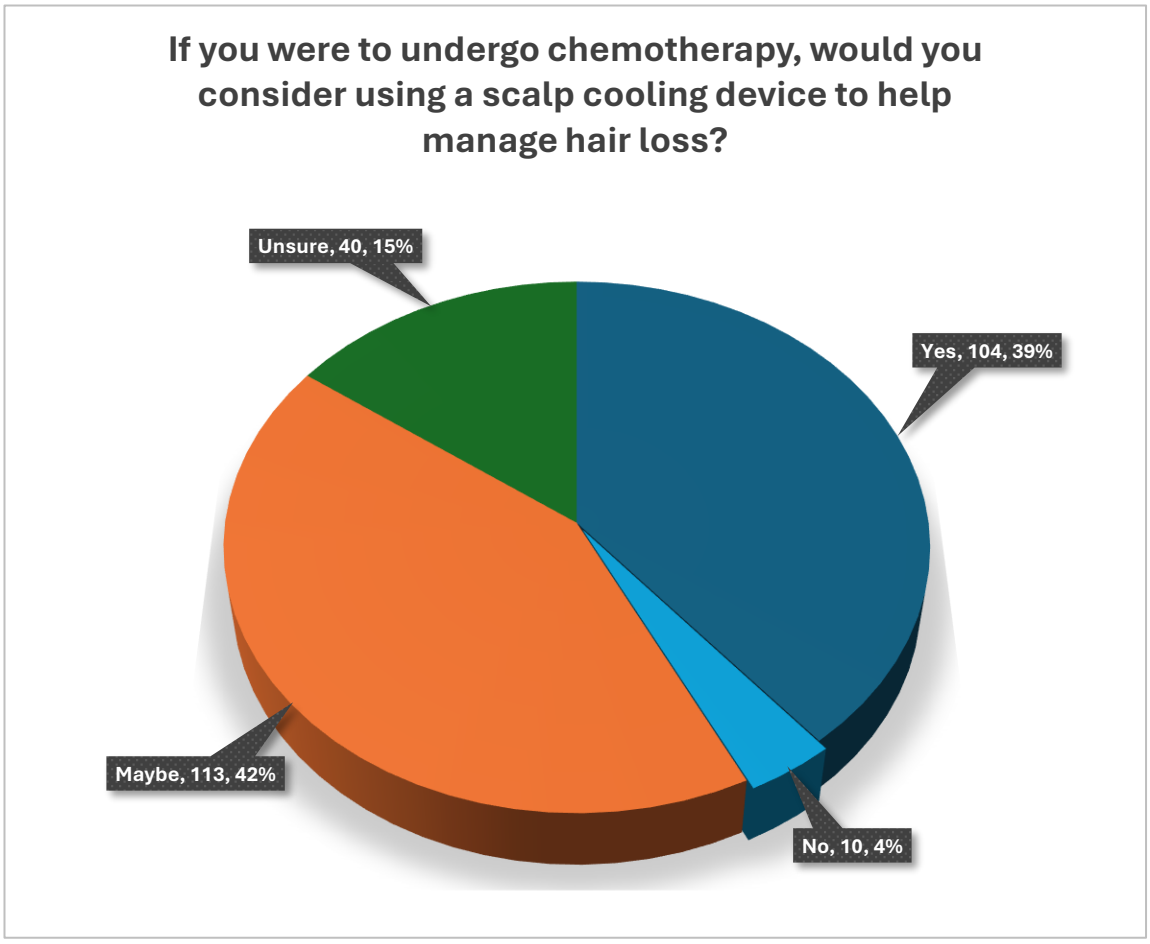

Figure 16:Willingness to Adopt

Among the 267 respondents:

- 42% selected “Maybe”, suggesting a considerable openness to the concept
- 39% responded “Yes”, indicating a firm willingness to adopt scalp cooling.
- Only a small proportion were “Unsure” (15%), and a minimal number said “No” (4%).

These findings align partially with Munzone et al. (2019), where patients expressed a positive response once scalp cooling was explained, indicating that exposure to information plays a significant role in shaping attitudes (Munzone *et al.*, 2019). Similarly, the Dutch study cited in Peerbooms et al. (2015) reported that while initial awareness was low, acceptance improved significantly post-counselling (Peerbooms *et al.*, 2015a), a trend mirrored here by the high “Maybe” response.

Willingness to Adopt by State

Willingness to adopt varied across different states in Southern India. Kerala had the highest number of respondents expressing definite willingness (42%).

State	Yes	Maybe	Unsure	No	Total
Kerala	74(41.8%)	70(39.5%)	25(14.1%)	8(4.5%)	**177**
Karnataka	17(44.7%)	12(31.6%)	8(21.1%)	1(2.6%)	**38**
Tamil Nadu	7(18.9%)	23(62.2%)	6(16.2%)	1(2.7%)	**37**
Andhra Pradesh	4(57.1%)	2(28.6%)	1(14.3%)	0(0.0%)	**7**
Telangana	2(25.0%)	6(75.0%)	0(0.0%)	0(0.0%)	**8**
Total	**104**	**113**	**40**	**10**	**267**

Table 15:Willingness to Adopt by State

In Tamil Nadu, over 60% of participants selected “Maybe”, the highest among all regions, highlighting greater hesitation or a need for more information before commitment. In contrast, Karnataka and Andhra Pradesh showed higher willingness, with “Yes” responses exceeding 44%.

These regional variations could reflect disparities in awareness and public health communication. For example, Kerala’s higher willingness may be attributed to better healthcare infrastructure and patient education, aligning with Unver and Kagioglou (2021), who observed an increase in awareness through clinician-led outreach (Unver and Kagioglou, 2021).

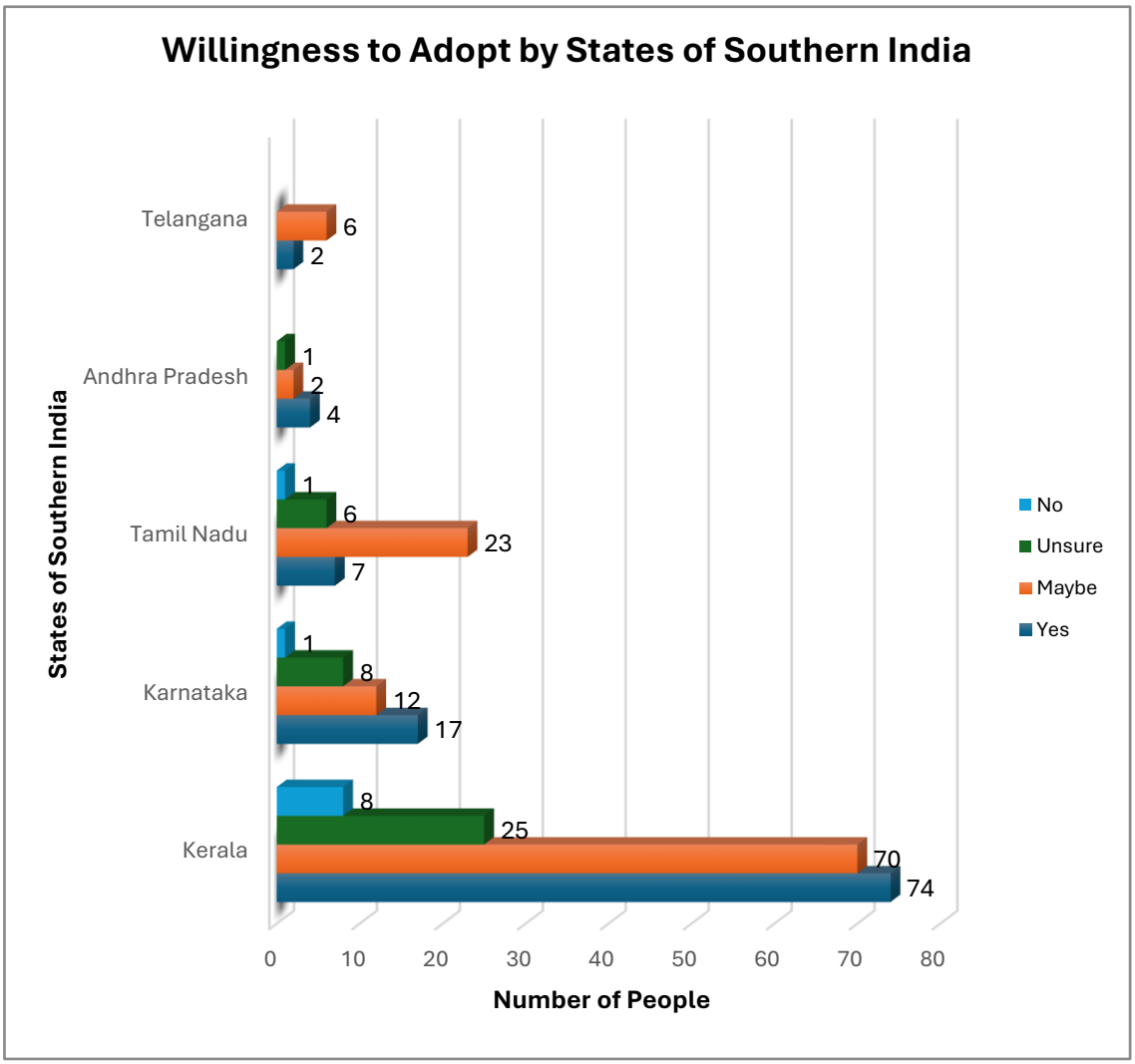

Figure 17:Willingness to Adopt by State

4.3.2. Belief in the effectiveness

Participants were asked how effective they believe scalp cooling devices are in preventing hair loss during chemotherapy. The findings are presented in the table below.

Perceived Effectiveness	Count(Percentage)
Very effective	40(15.09%)
Moderately effective	81(30.57%)
Slightly effective	46(17.36%)
Unsure	94(35.47%)
Not effective at all	4(1.51%)
Total	**265(100%)**

Table 16:Perceived Effectiveness

The respondents expressed uncertainty about the effectiveness of scalp cooling devices, with 35.1% selecting "Unsure", making it the most common response. This suggests a widespread lack of awareness or clarity regarding the device's functionality. This aligns with previous research in the Indian context, such as Mekha et al. (2024), who observed high discontinuation rates from their study, partly due to limited understanding of how the device works (Mekha *et al.*, 2024).

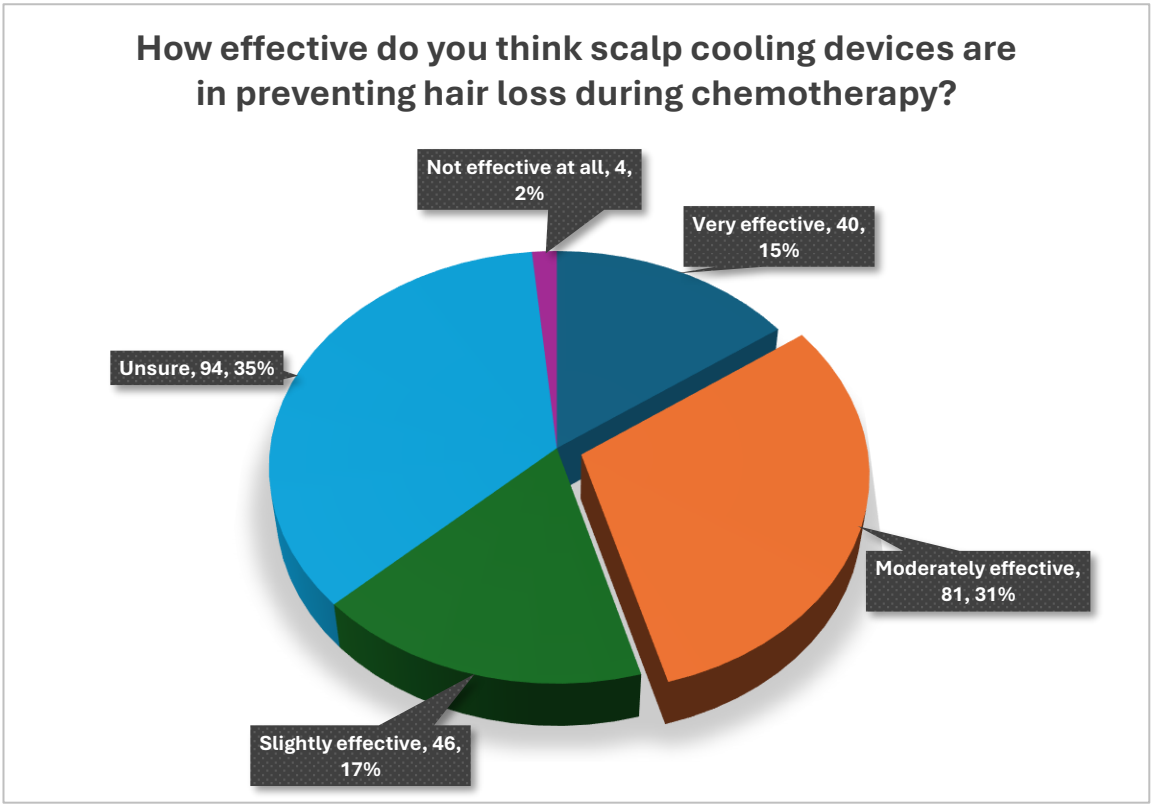

Figure 18:Perceived Effectiveness

Only 14.9% of participants believed the device is "Very effective", and 30.2% viewed it as "Moderately effective". These values indicate that while some confidence in the device exists, it is not dominant. This pattern contrasts with findings from more established markets. For example, Unver et al. (2022) highlighted broader acceptance in countries like the U.S. and Japan, where scalp cooling is more frequently discussed and recommended (Unver *et al.*, 2022a).

In terms of minimal trust, only 1.5% of participants felt the device is "Not effective at all", showing that outright rejection of the technology is rare.

Perceptions by Healthcare Background

To understand how opinions differ between healthcare professionals and the general public, responses were grouped based on whether or not the participant works in healthcare.

Perceived Effectiveness	Healthcare Professionals	Non-Healthcare Professionals	Total
Very effective	27(16.2%)	13(13.3%)	40
Moderately effective	59(35.3%)	22(22.4%)	81
Slightly effective	26(15.6%)	20(20.4%)	46
Unsure	52(31.1%)	42(42.9%)	94
Not effective at all	3(1.8%)	1(1.0%)	4
Total	**167**	**98**	**265**

Table 17:Perceived Effectiveness by Profession

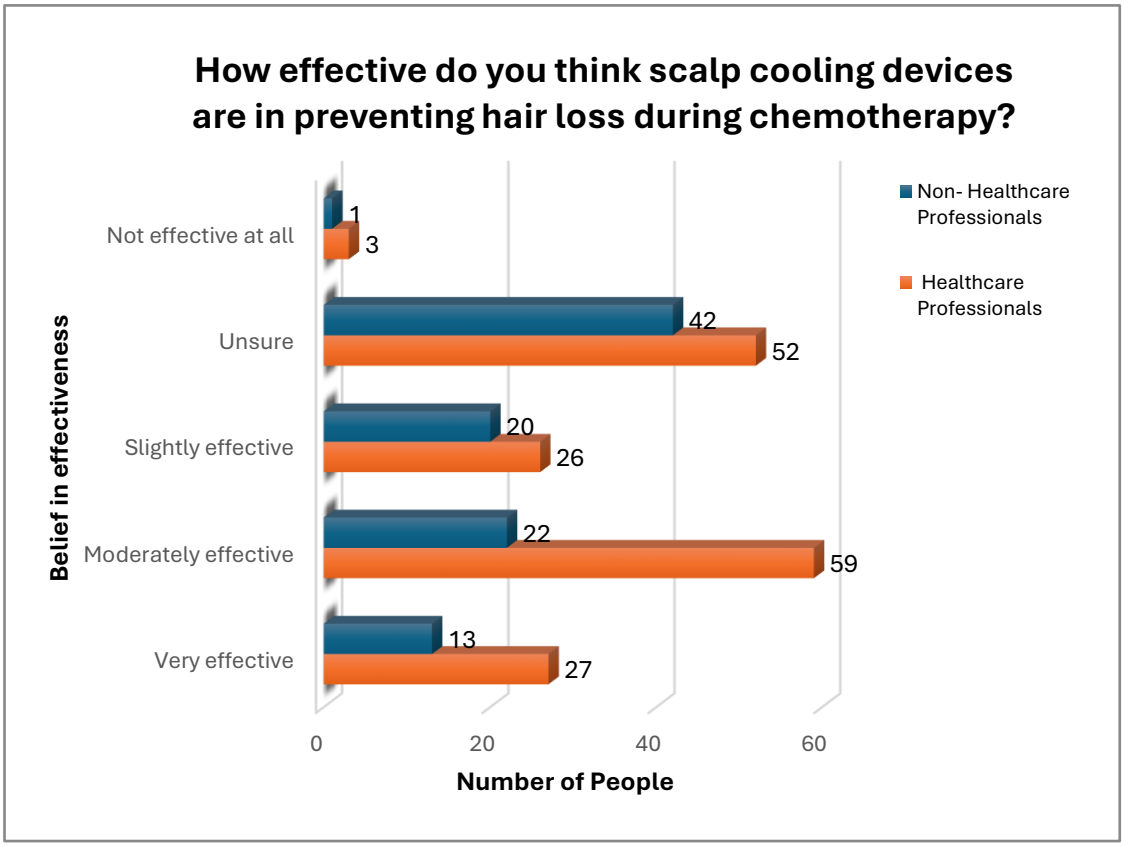

Figure 19:Perceived Effectiveness by Profession

The comparison reveals a trend: healthcare professionals were more likely to view scalp cooling as effective, with 51.5% rating it "Moderately" or "Very effective" compared to 35.7% of non-healthcare participants. Additionally, uncertainty was higher among non-healthcare respondents (42.9%) than among healthcare professionals (31.1%).

This pattern supports previous findings by Peerbooms et al. (2015), who noted that even in more developed countries, awareness gaps existed but were narrower among medically trained individuals (Peerbooms *et al.*, 2015a). Despite this, the continued presence of uncertainty even among healthcare professionals suggests a need for targeted training and awareness efforts.

4.3.3. Emotional Importance of Hair Preservation

Participants were asked to rate the emotional importance of hair preservation during chemotherapy. A clear majority (66.8%) found it emotionally significant, with 43.4% rating it "Very important" and 23.4% "Extremely important." In contrast, only 2.6% said it was "Not important at all," while 14.0% chose "Slightly important" and 16.6% "Moderately important."

Emotional Importance of Hair Preservation	Count(Percentage)
Extremely important	62(23.4%)
Very important	115(43.4%)
Moderately important	44(16.6%)
Slightly important	37(14.0%)
Not important at all	7(2.6%)
Total	**265(100%)**

Table 18:Emotional Importance of Hair Preservation

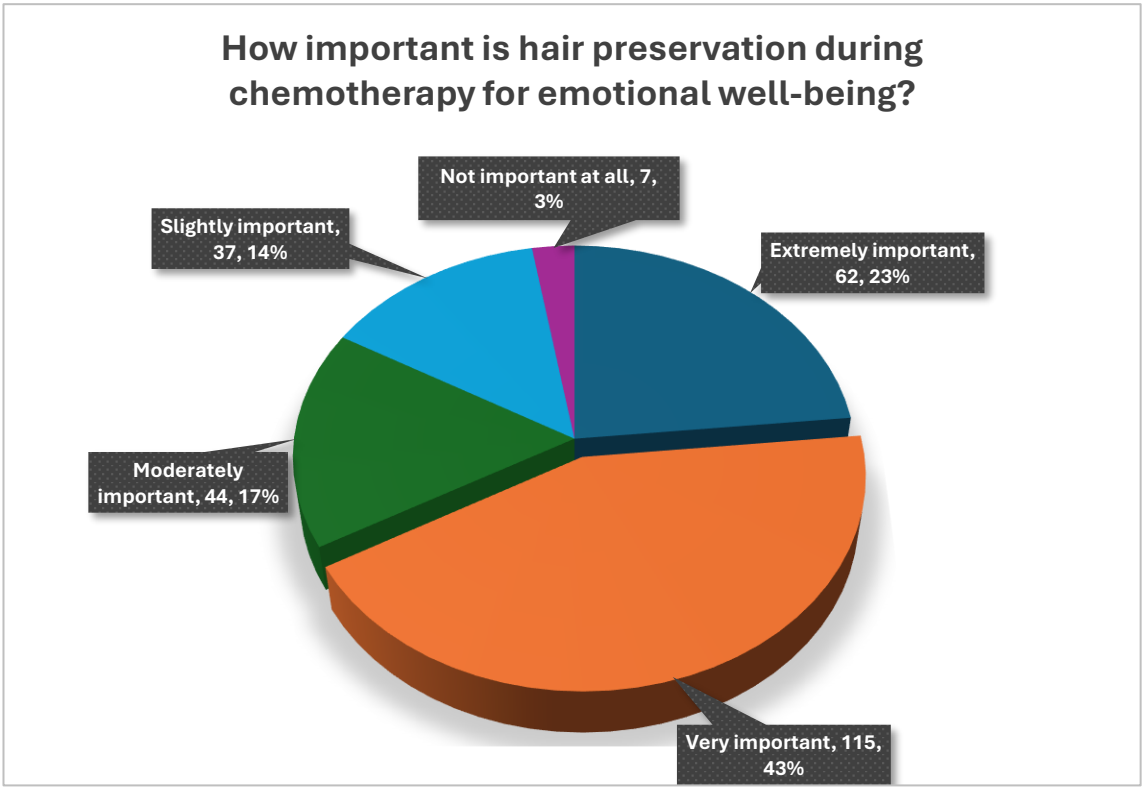

Figure 20:Emotional Importance of Hair Preservation

Importance of Hair Preservation for Emotional Well-Being by State

To explore state-level trends, responses were compared by region. Kerala accounted for the largest proportion of responses (66%), but all five states provided valuable insights into varying emotional attitudes.

States	Emotional Importance of Hair Preservation					
	Extremely important	Very important	Moderately important	Slightly important	Not important at all	Total
Kerala	43(24.6%)	72(41.1%)	31(17.7%)	23(13.1%)	6(3.4%)	175
Karnataka	7(18.4%)	22(57.9%)	4(10.5%)	5(13.2%)	0(0.0%)	38
Tamil Nadu	8(21.6%)	18(48.6%)	7(18.9%)	3(8.1%)	1(2.7%)	37
Andhra Pradesh	2(28.6%)	2(28.6%)	2(28.6%)	1(14.3%)	0(0.0%)	7
Telangana	2(25.0%)	1(12.5%)	0 (0.0%)	5(62.5%)	0(0.0%)	8
Total	**62(23.4%)**	**115(43.4%)**	**44(16.6%)**	**37(14.0%)**	**7(2.6%)**	**265**

Table 19:Emotional Importance of Hair Preservation by State

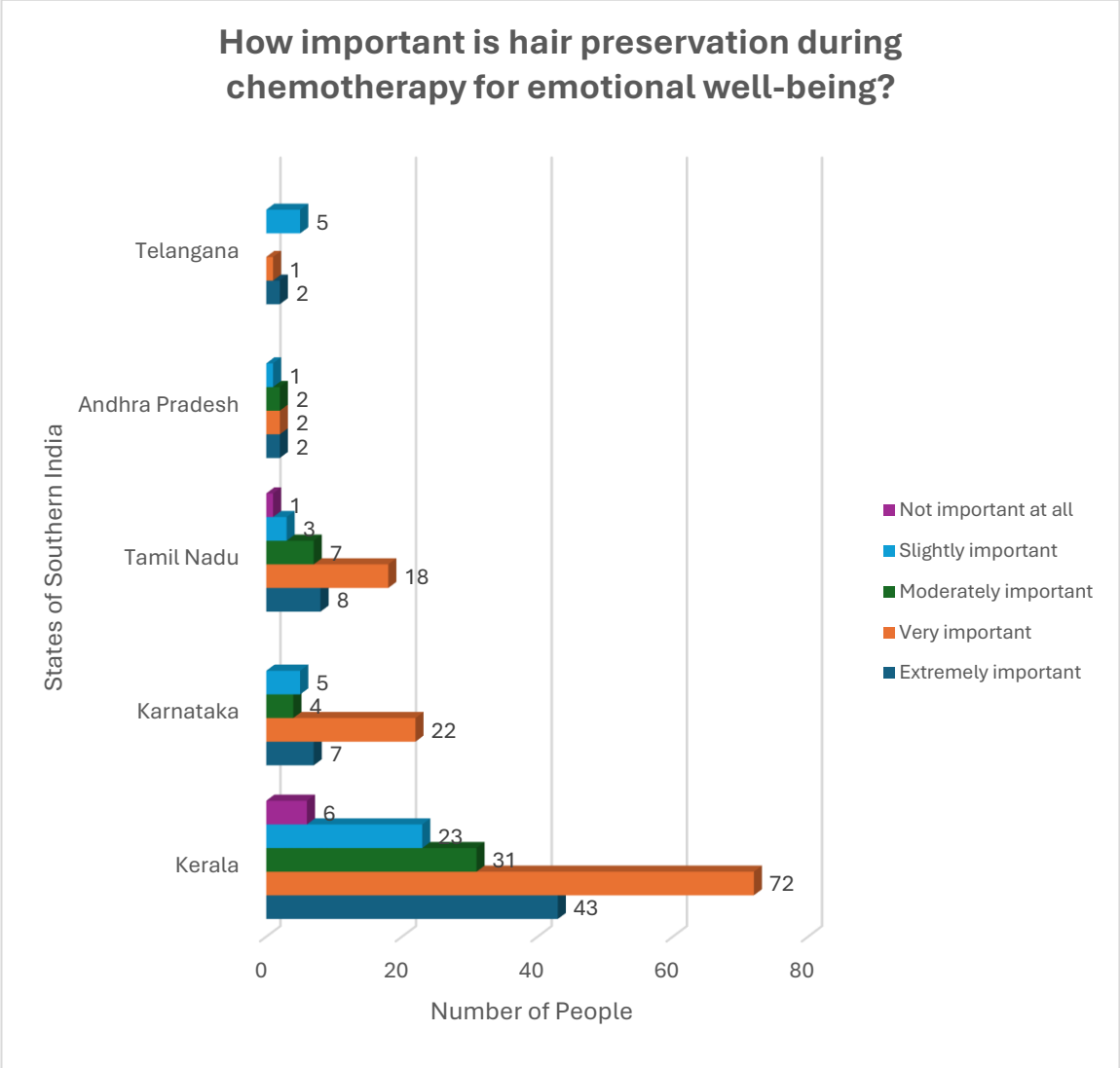

Figure 21:Emotional Importance of Hair Preservation by State

- Kerala, the most represented state, closely reflects the overall trend, with 65.7% marking hair preservation as “Very” or “Extremely important”.
- Karnataka showed even stronger prioritisation, with 76.3% selecting the top two emotional importance categories.

- Tamil Nadu also exhibited high emotional concern, with 70.2% considering hair preservation "Very" or "Extremely important".
- Telangana stood out, with 62.5% rating it as only "Slightly important," suggesting possible regional differences in awareness or cultural perception.

These results suggest that in most Southern Indian states surveyed, hair retention during chemotherapy is potentially linked to emotional well-being. However, the degree of importance may vary regionally and would require further research with a larger sample. This emotional importance aligns well with Indian studies. For instance, Bajpai et al. (2020) noted the psychological burden caused by chemotherapy-induced alopecia (CIA) and reported high patient interest in hair-preserving technologies, although awareness was not directly measured (Bajpai *et al.*, 2020). Likewise, Mekha et al. (2024) cited unmet emotional expectations as one reason for the discontinuation in their study (Mekha *et al.*, 2024).

Globally, findings are consistent with international studies such as Munzone et al. (2019) and Kinoshita et al. (2019), which demonstrated that patients in Western and Asian populations perceived significant emotional benefits from scalp cooling. These studies further support the argument that hair preservation is universally tied to emotional well-being and that awareness and education play a vital role in its adoption (Munzone *et al.*, 2019; Kinoshita *et al.*, 2019).

4.3.4. Healthcare Professionals' Role in Adoption

To assess public attitudes regarding the involvement of healthcare professionals in promoting scalp cooling devices, participants were asked whether they believe healthcare professionals should play an important role in recommending and explaining these devices to chemotherapy patients.

Healthcare Professionals' Role in Adoption	**Count(Percentage)**
Yes	211(79.9%)
Maybe	47(17.8%)
No	6(2.3%)
Total	**264(100%)**

Table 20:Role of Healthcare Professionals in Recommending Scalp Cooling Devices

Out of 264 respondents, 80% agreed that healthcare professionals should play a key role in recommending and explaining scalp cooling, while 17.8% were unsure and 2.3% disagreed. This highlights a strong consensus that healthcare professionals are considered key facilitators in adopting this technology.

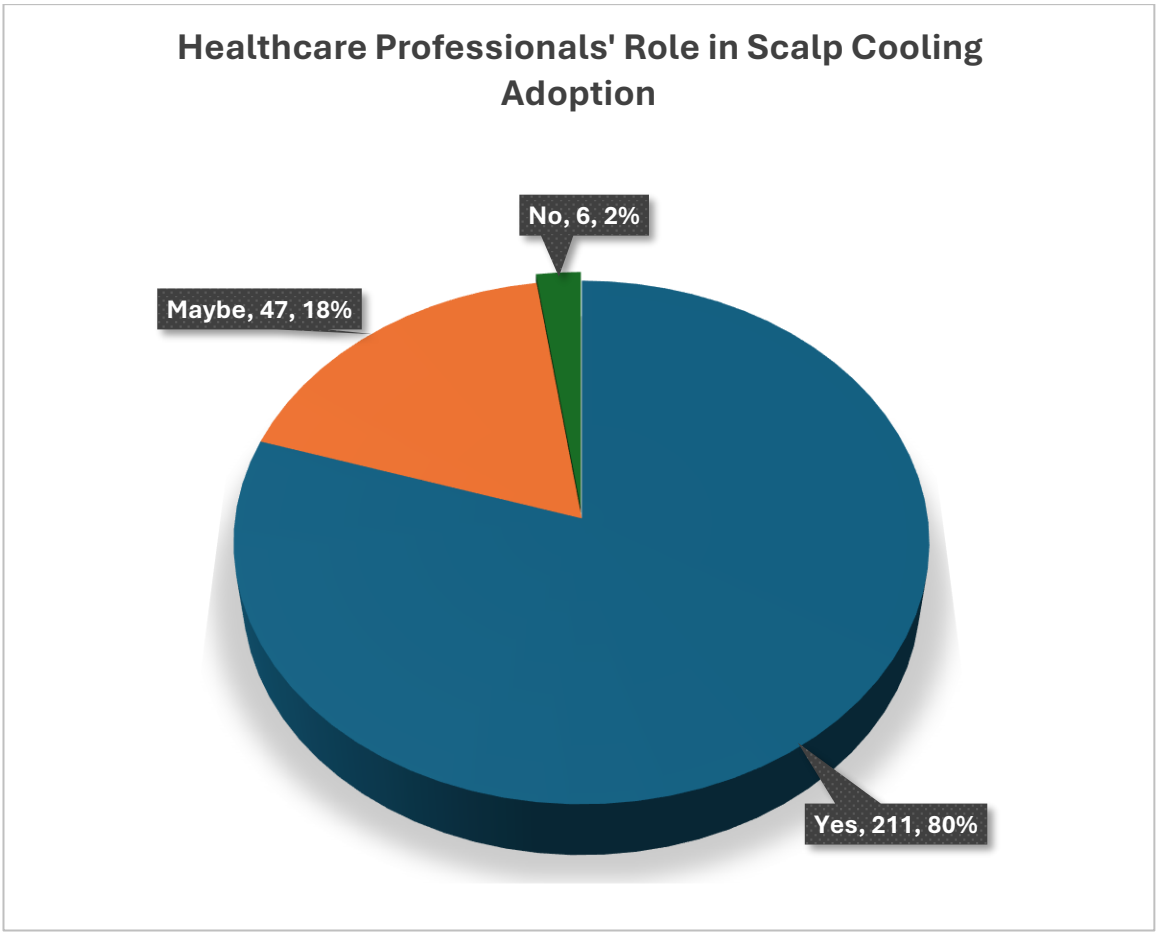

Figure 22:Role of Healthcare Professionals in Recommending Scalp Cooling Devices

A breakdown by professional background

Profession of Respondents	Healthcare Professionals' Role in Adoption			
	Yes	Maybe	No	Total
Healthcare Professional	132(79.5%)	30(18.1%)	4(2.4%)	166
Non-Healthcare Professional	79(80.6%)	17(17.3%)	2(2.0%)	98

Table 21:Role of Healthcare Professionals in Recommending Scalp Cooling Devices by Profession

Both groups exhibited similar trends, with approximately 80% agreement that healthcare professionals should take an active role in scalp cooling education and recommendation. The negligible proportion of participants who disagreed (2.3% overall) suggests a strong consensus on the importance of clinical involvement in adoption.

These findings align with literature highlighting the essential role of healthcare professionals in promoting scalp cooling. Peterson et al. (2020) emphasised that clinicians, particularly physicians and nurses, are key in educating patients, managing expectations, and boosting adherence (Peterson *et al.*, 2020). Unver and Kagioglou (2021) found that clinician-led initiatives in India increased public awareness of scalp cooling from 9% to 25% over four years (Unver and

Kagioglou, 2021). Similarly, Peerbooms et al. (2015) reported that patient acceptance of scalp cooling in the Netherlands rose significantly when informed by healthcare professionals, reinforcing the importance of clinical involvement (Peerbooms *et al.*, 2015a).

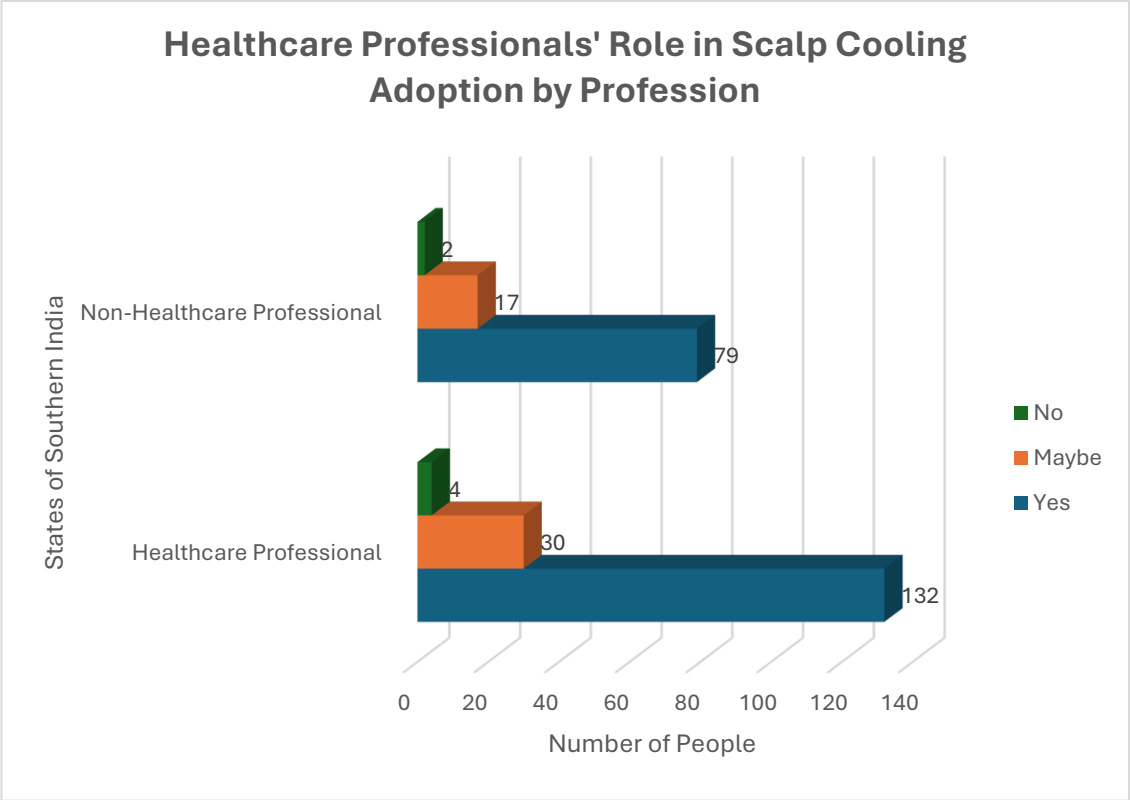

Figure 23:Role of Healthcare Professionals in Recommending Scalp Cooling Devices by Profession

4.4. Barriers to Adoption of Scalp Cooling Devices in Southern India

4.4.1. Perceived Cultural Barriers

Participants were asked whether they believed cultural beliefs or perceptions could act as a barrier to using scalp cooling devices during chemotherapy. Of the 261 respondents, 43% responded "Yes," while 57% said "No".

Perception of Cultural Beliefs as a Barrier	Count(Percentage)
Yes	112(42.91%)
No	149(57.09%)
Total	**261(100%)**

Table 22:Perception of Cultural Beliefs as a Barrier

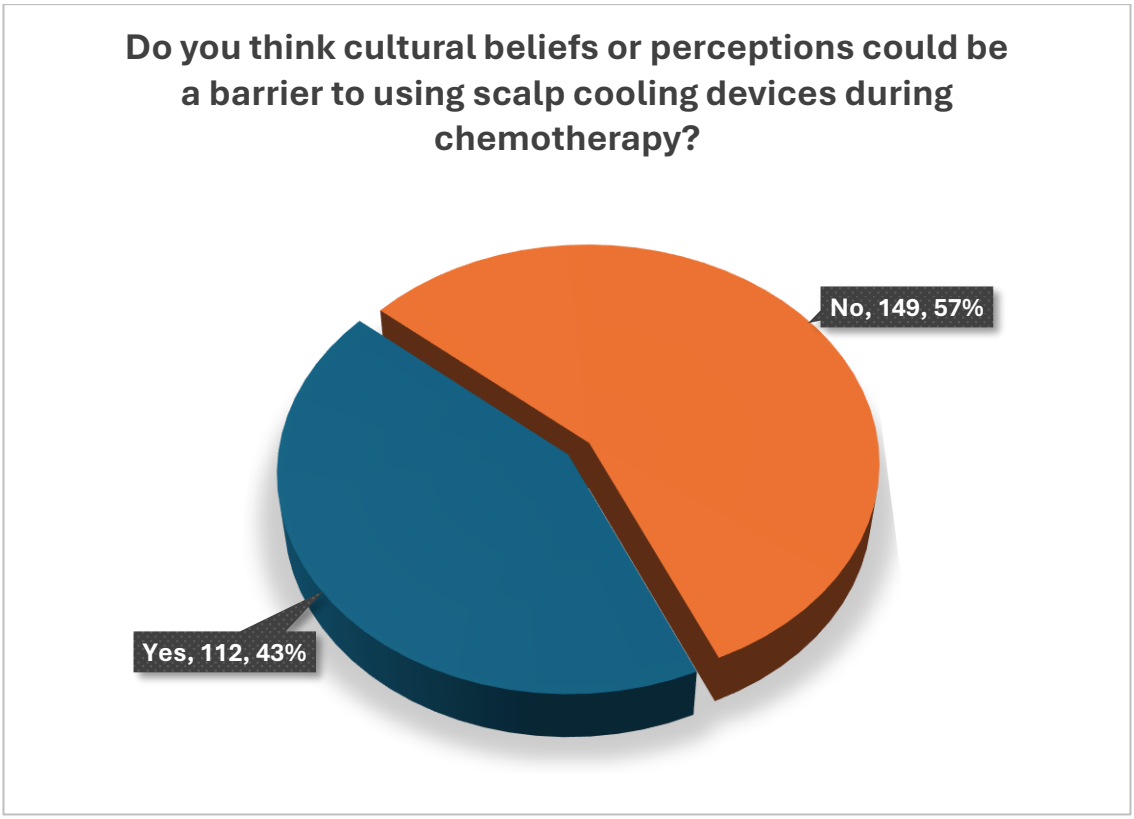

Figure 24:Perception of Cultural Beliefs as a Barrier

Hypothesis Testing: Influence of Cultural Beliefs on Adoption Willingness

To test the relationship between cultural beliefs as a perceived barrier and willingness to adopt scalp cooling, a Chi-square test was conducted. The null and alternative hypotheses were defined as follows:

- Null Hypothesis (H_0): Perception of cultural beliefs as a barrier does not influence willingness to adopt scalp cooling.
- Alternative Hypothesis (H_1): Perception of cultural beliefs as a barrier does influence willingness to adopt scalp cooling.

Results: P-Value = **0.705**

Chi-Square Test

	Chi-Square	DF	P-Value
Pearson	0.698	2	0.705

Figure 25: Calculation of the Chi-Square test

The p-value of 0.705 is much higher than the commonly used significance level of 0.05. Therefore, failed to reject the null hypothesis. This suggests that cultural beliefs do not significantly influence the willingness to adopt scalp cooling devices, as there is no strong evidence supporting them as a barrier in the surveyed population.

The current findings suggest that although some respondents recognise cultural beliefs as a barrier, this perception does not appear to influence decision-making behaviour directly.

Perceived Extent of Cultural Influence

Respondents were also asked to what extent they believed cultural views in Southern India influence people's acceptance of scalp cooling devices

Influence of Cultural Views on Acceptance	Count(Percentage)
Extremely	7(2.66%)
Very much	42(15.97%)
Moderately	85(32.32%)
Slightly	55(20.91%)
Not at all	74(28.14%)
Total	**263(100%)**

Table 23:Influence of Cultural Views on Acceptance

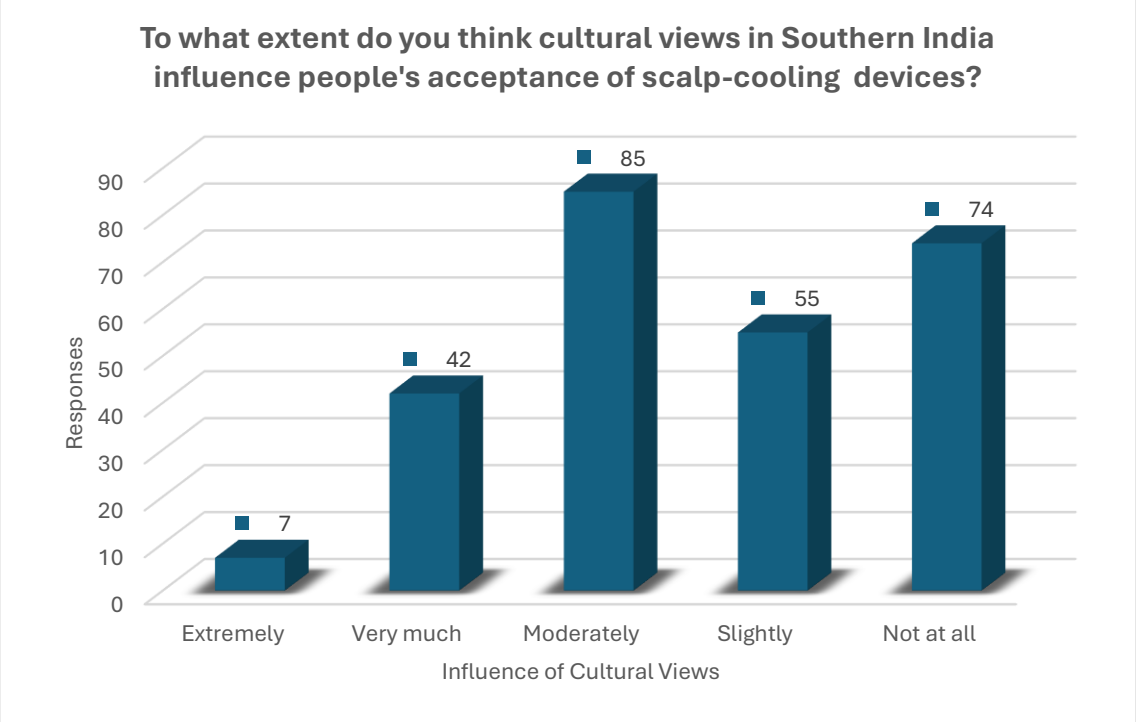

Figure 26:Influence of Cultural Views on Acceptance

While approximately 19% of respondents believed cultural views influence acceptance to a high degree ("Extremely" or "Very much"), a larger portion (53%) believed the influence is moderate to slight. These findings show that cultural norms might have some influence, but they are not seen as the main deciding factor.

This partly matches what the literature says about the social and symbolic importance of hair in Indian culture (Blair, 2024). However, it also suggests that attitudes may be changing, possibly due to more awareness or people making their own health choices. While this literature was focused on cancer patients, this survey includes the general public, which might explain the difference in how much influence people think culture has.

Specific Cultural Beliefs Influencing Scalp Cooling Use

Participants identified specific cultural beliefs or perceptions that might discourage the use of scalp cooling devices. Multiple responses were allowed.

Specific Cultural Beliefs Discouraging Use	Count(Percentage)
Limited discussion or awareness of hair preservation in certain communities	98(26.92%)
Viewing hair loss as a natural part of the cancer journey or a symbol of strength	82(22.53%)
Family or societal pressure to focus only on life-saving treatments	80(21.98%)
Belief that medical devices should only be used for life-saving treatments	54(14.84%)
Religious or spiritual beliefs influencing decisions about medical treatments	50(13.74%)
Total	**364(100%)**

Table 24:Specific Cultural Beliefs Discouraging Use

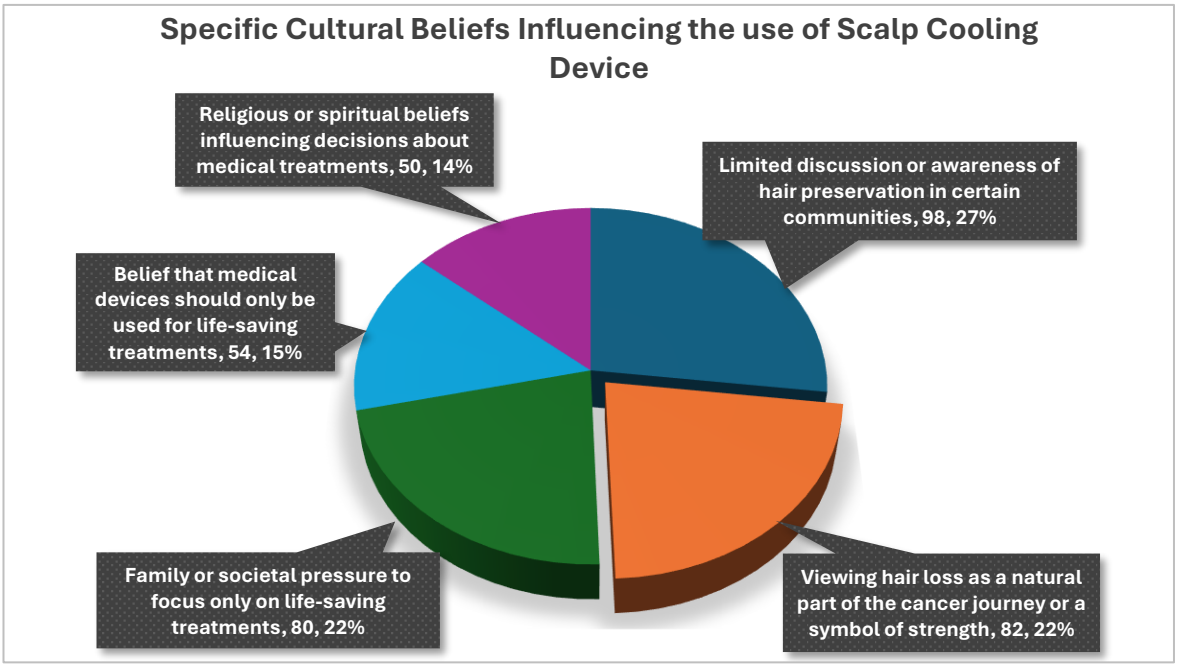

Figure 27:Specific Cultural Beliefs Discouraging Use

The most commonly selected belief, limited discussion or awareness of hair preservation, highlights a key informational barrier, aligning with Peerbooms et al. (2015), who noted limited knowledge among healthcare professionals (Peerbooms *et al.*, 2015b). Other common responses, such as viewing hair loss as natural or prioritising life-saving treatments, reflect cultural norms cited by Blair (2024), where survival often takes precedence over appearance (Blair, 2024). Religious and spiritual beliefs were least cited, suggesting they are less influential barriers in Southern India, unlike in other LMICs such as Malawi, as noted by (Watt *et al.*, 2023).

4.4.2. Perceived Economic Barriers

Participants were asked whether they believed cost plays a role, 94% of participants agreed it influences the decision to use scalp cooling devices, while only 6% disagreed. This strongly suggests that economic factors are widely perceived as relevant to treatment choices in the Southern Indian context.

Perceived Influence of Cost on Usage	Count(Percentage)
Yes	245(93.9%)
No	16(6.1%)
Total	**261(100%)**

Table 25:Perceived Influence of Cost on Usage

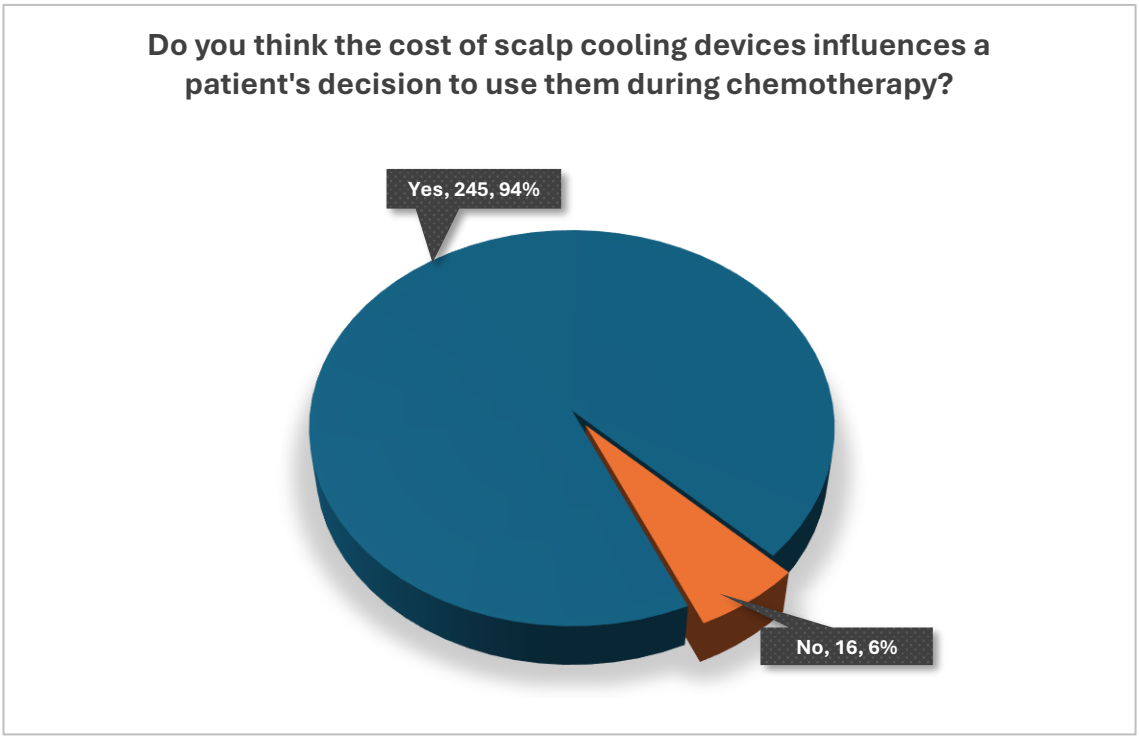

Figure 28:Perceived Influence of Cost on Usage

This result directly supports findings from Mekha et al. (2024) and Novice et al. (2024), which identify affordability and lack of insurance as major barriers in India and other low- and middle-income countries (LMICs). In particular, Mekha et al. observed that 32 of 91 patients discontinued scalp cooling, with cost being one of the reasons, although not always explicitly quantified (Mekha *et al.*, 2024).

Extent to which Cost Influences Decisions

When asked about the extent to which cost influences decisions, over one-third (43.9%) of respondents selected either *"Very much"* or *"Extremely"*, and another 39% chose *"Moderately"*. This suggests that while the influence of cost is not universally severe, it is consistently present for most.

Extent to Which Cost Influences Decisions	Count(Percentage)
Extremely	23(8.8%)
Very much	92(35.1%)
Moderately	102(38.9%)
Slightly	26(9.9%)
Not at all	19(7.3%)
Total	**262(100%)**

Table 26:Extent to which Cost Influences Decisions

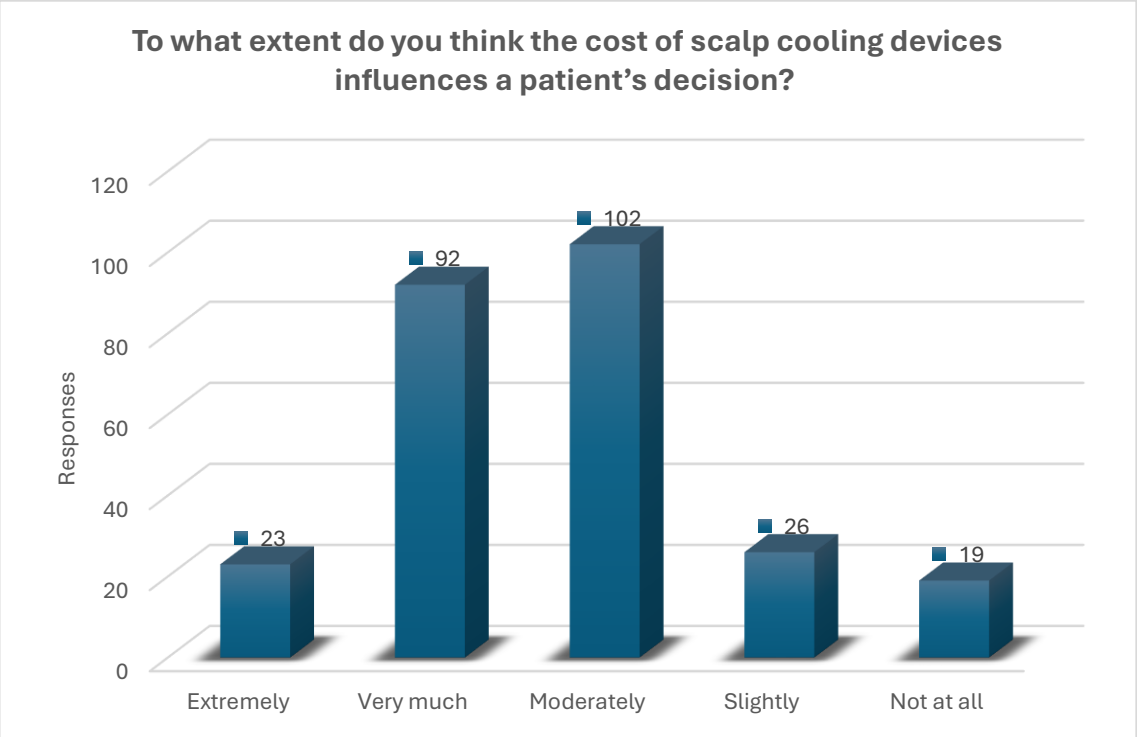

Figure 29:Extent to which Cost Influences Decisions

These results echo findings by Infante-Ventura et al. (2022), who noted that while scalp cooling is cost-effective in some healthcare systems, upfront costs remain a significant deterrent in regions with less robust insurance models (Infante-Ventura *et al.*, 2022).

Specific Economic Barriers Influencing Adoption

Respondents identified several cost-related barriers, with the most common being competing financial priorities during treatment (23%), high upfront cost (22%), and lack of insurance coverage (21%). These findings highlight the complex economic pressures faced during cancer care, involving both direct costs and broader financial trade-offs.

Perceived Cost barriers to adoption	Count(Percentage)
Competing financial priorities during cancer treatment	141(23.3%)
High upfront cost of the device/treatment	134(22.2%)
Lack of insurance coverage or reimbursement options	129(21.4%)
Ongoing maintenance or session-based costs	117(19.4%)
Uncertainty about cost-effectiveness compared to benefits	83(13.7%)
Total	**604(100%)**

Table 27:Perceived Cost Barriers to Adoption

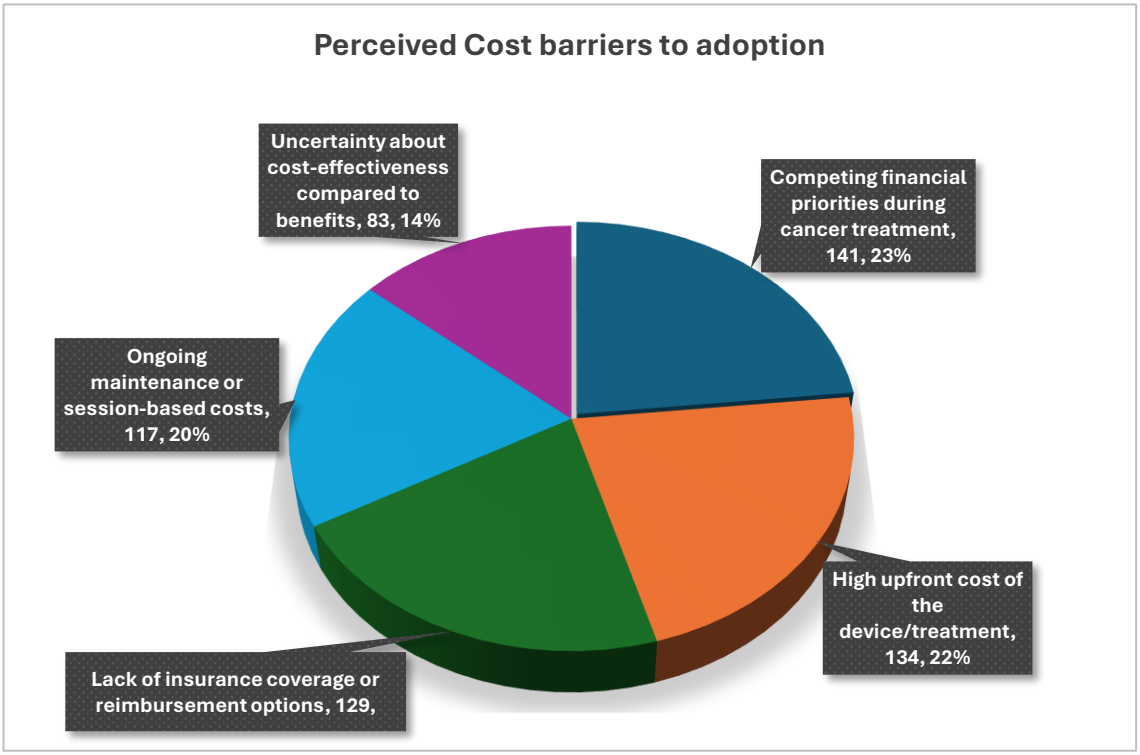

Figure 30:Perceived Cost Barriers to Adoption

These findings are strongly aligned with the literature, where Bajpai and Chandrasekharan (2021) described scalp cooling as often being excluded from government insurance schemes in India.

This exclusion leads to high out-of-pocket payments, particularly challenging for patients with limited financial resources (Bajpai and Chandrasekharan, 2021).

4.4.3. Informational Awareness Barrier

An overwhelming 95% of participants identified a lack of awareness as a barrier to using scalp cooling devices during chemotherapy, with only 5% disagreeing. This aligns with findings from Peerbooms et al. (2015), who noted that limited knowledge among patients and healthcare professionals hinders the adoption of scalp cooling (Peerbooms *et al.*, 2015b).

Perception of Lack of Awareness as a Barrier	Count(Percentage)
Yes	251(95.1%)
No	13(4.9%)
Total	**264(100%)**

Table 28:Perception of Lack of Awareness as a Barrier

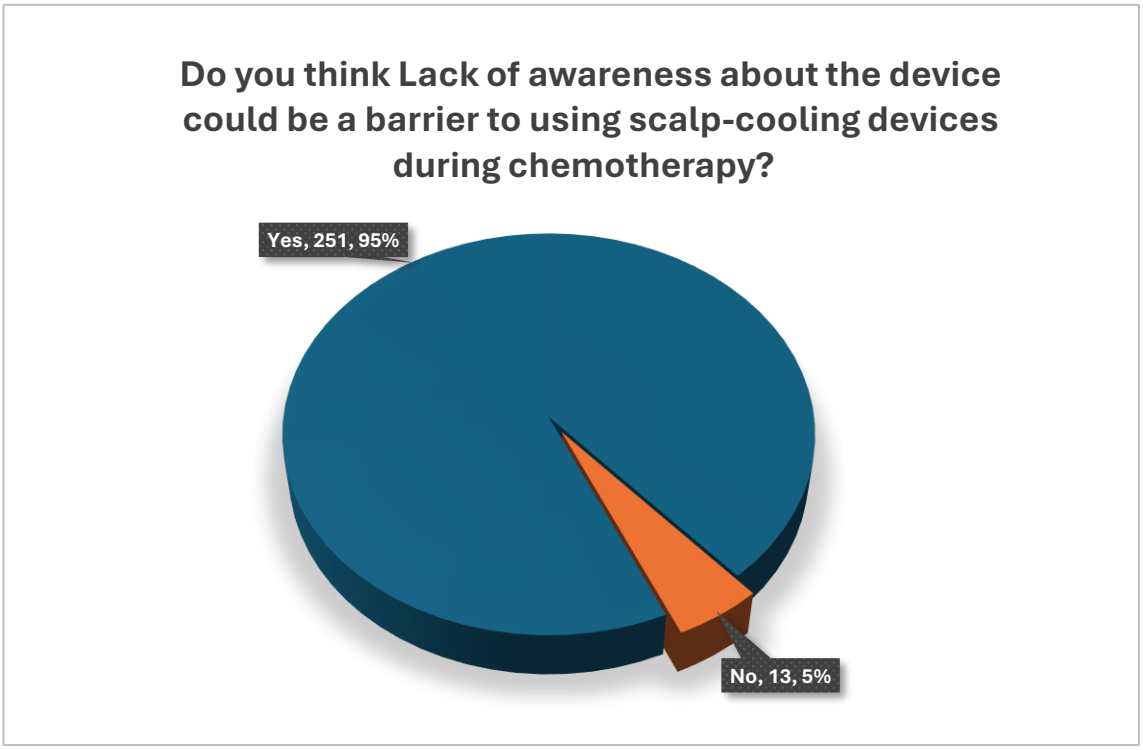

Figure 31:Perception of Lack of Awareness as a Barrier

Preferred Methods of Raising Awareness

When asked about effective ways to raise awareness, most respondents cited social media and online platforms (44%) and healthcare professional-led campaigns (41%), while only 14% preferred word of mouth. This highlights the key role of healthcare providers and the growing influence of digital platforms in spreading awareness.

Preferred Methods of Raising Awareness	Count(Percentage)
Information campaigns through healthcare professionals	106(40.9%)
Social media and online platforms	115(44.4%)
Word of mouth from patients or their families	37(14.3%)
Total	258(100%)

Table 29:Preferred Methods for Raising Awareness

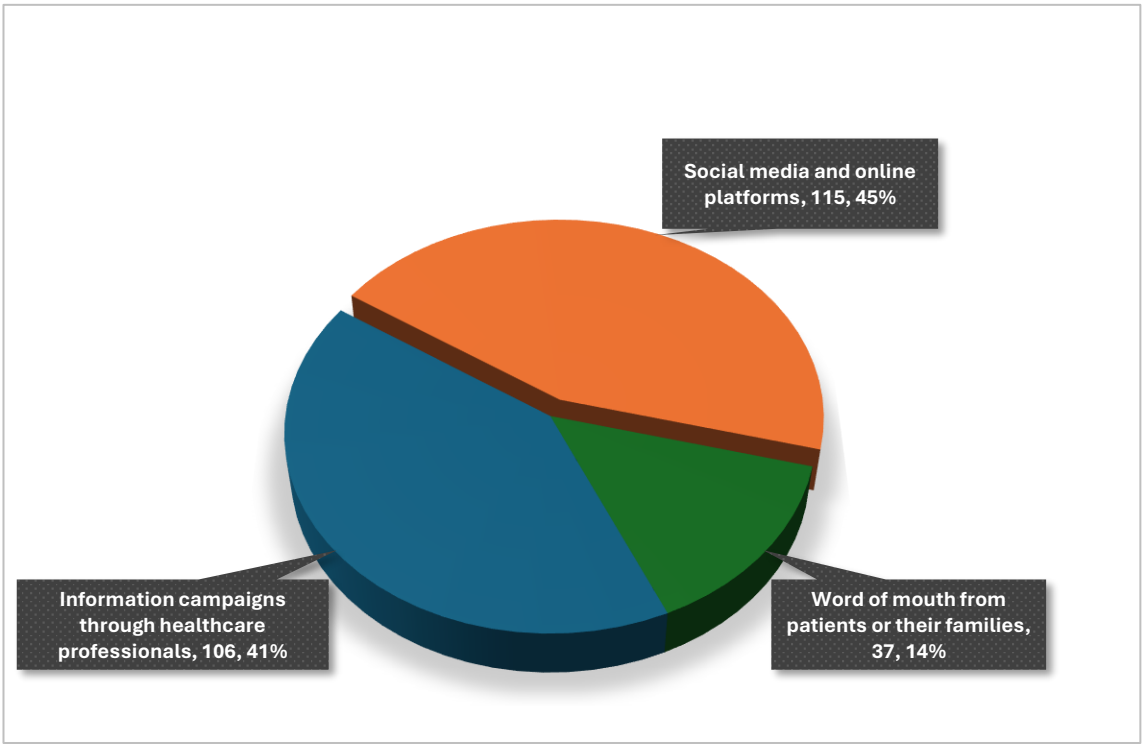

Figure 32:Preferred Methods for Raising Awareness

4.4.4. Influencing Factors for Adoption

Participants were asked how uncomfortable they might feel using a visible or noticeable scalp-cooling device during chemotherapy.

Extent of Perceived Discomfort with Visible Scalp Cooling Devices	Count(Percentage)
Extremely	8(3.1%)
Very much	27(10.4%)
Moderately	137(52.9%)
Slightly	63(24.3%)
Not at all	24(9.3%)
Total	**259(100%)**

Table 30:Perceived Discomfort with Visible Scalp Cooling Devices

The responses showed that 52.9% felt atleast a moderate discomfort, with 24.3% slightly uncomfortable and 3.1% extremely uncomfortable. This suggests visibility concerns may be a

moderate barrier affecting willingness to adopt scalp cooling. In contrast, previous studies (such as Blair, 2024) indicate that while social stigma related to chemotherapy-induced alopecia is common, discomfort with visible devices was not extensively studied (Blair, 2024).

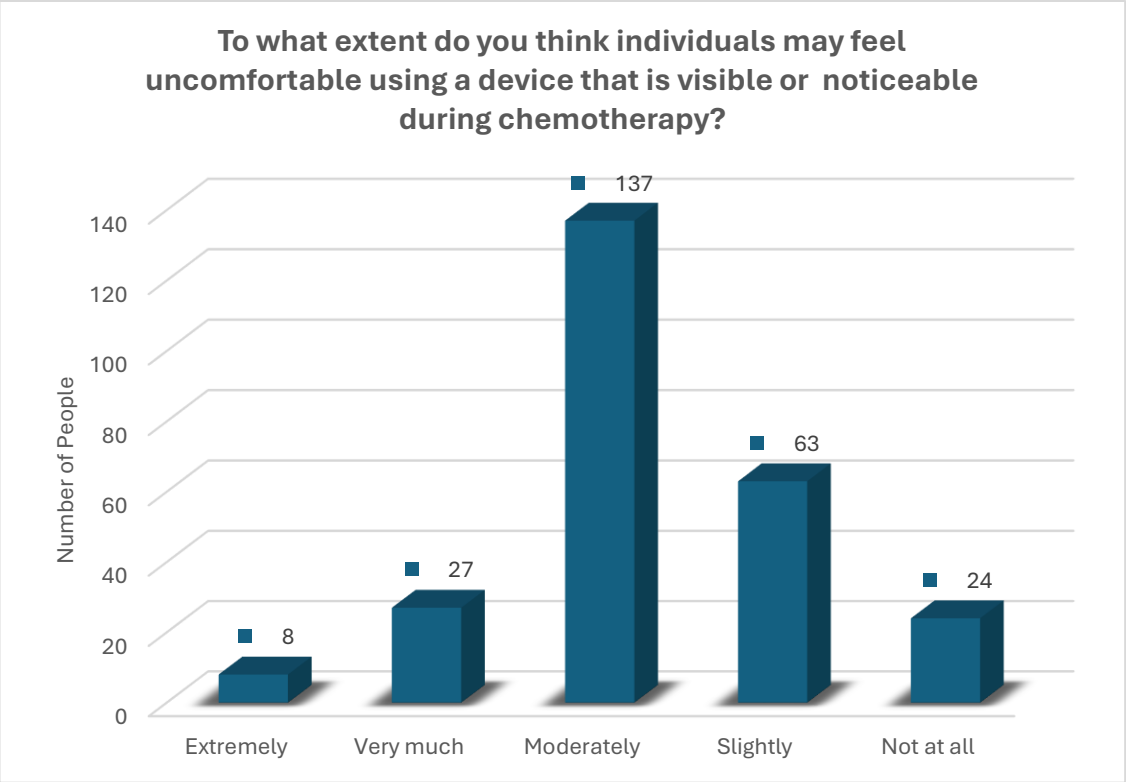

Figure 33:Perceived Discomfort with Visible Scalp Cooling Devices

Factors Influencing the Decision of Usage

When asked what factors would influence their decision to use a scalp-cooling device during chemotherapy, Multiple responses were allowed. The most common factors included preventing hair loss (32.7%), recommendation from healthcare professionals (26.6%), and positive experiences shared by others (24.7%). These responses indicate that practical and emotional factors, such as the desire to maintain appearance and the influence of trusted individuals, play a significant role in shaping decision-making**.**

Factors Influencing the Decision of Usage	**Count(Percentage)**
Preventing hair loss	166(32.7%)
Healthcare professionals' recommendation	135(26.6%)
Positive experiences shared by others	125(24.7%)
Maintaining appearance during treatment	81(16.0%)
Total	**507(100%)**

Table 31:Factors Influencing the Decision of Usage

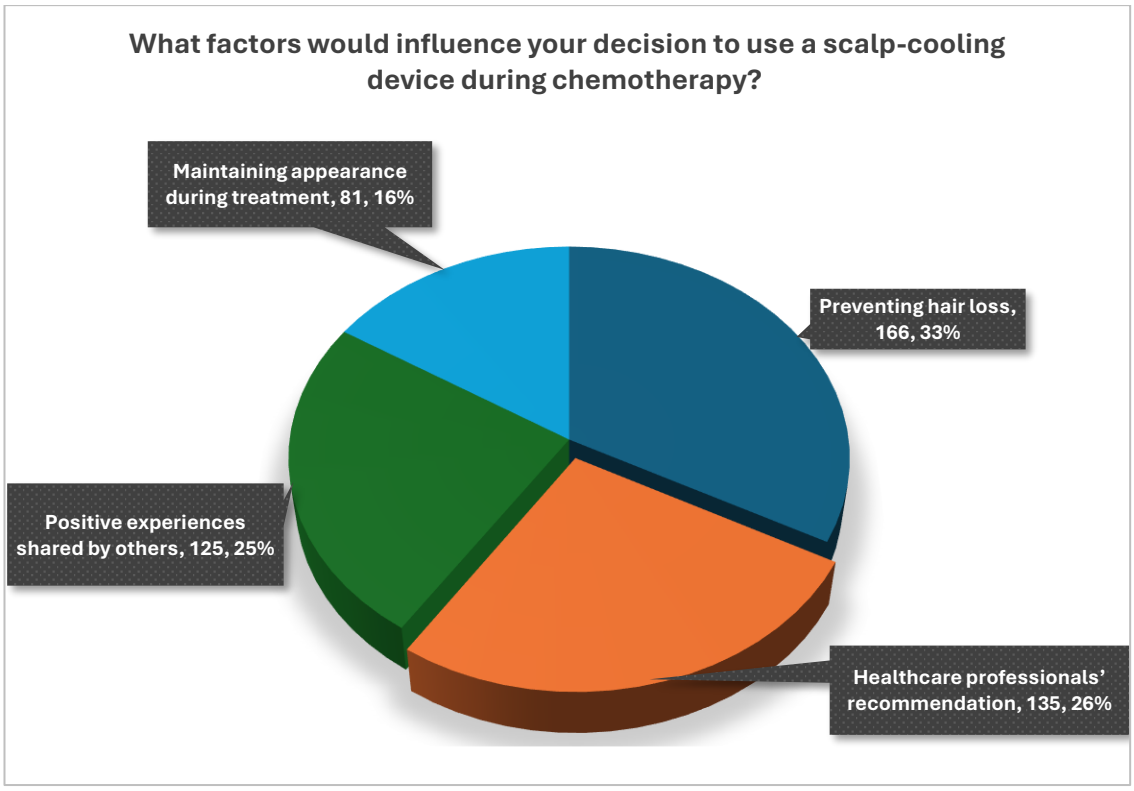

Figure 34:Factors Influencing the Decision of Usage

These factors align with the literature, where (Mekha *et al.*, 2024) identified appearance maintenance and hair loss prevention as key motivators for adopting scalp cooling, and (Peerbooms *et al.*, 2015b) highlighted the significant influence of healthcare professionals' recommendations.

4.5. Improvement Suggestions for Scalp Cooling Devices Based on Public Feedback

4.5.1. Preference for Local Access

To explore potential improvements in accessibility, participants were asked about their preference for the availability of scalp cooling devices at local healthcare centers or hospitals. A significant majority (75%) supported this idea, while a smaller portion indicated uncertainty or opposition.

Preference for Local Availability	Count(Percentage)
Yes	198(75.0%)
Maybe	47(17.8%)
Unsure	12(4.5%)
No	7(2.7%)
Total	**264(100%)**

Table 32:Preference for Local Availability

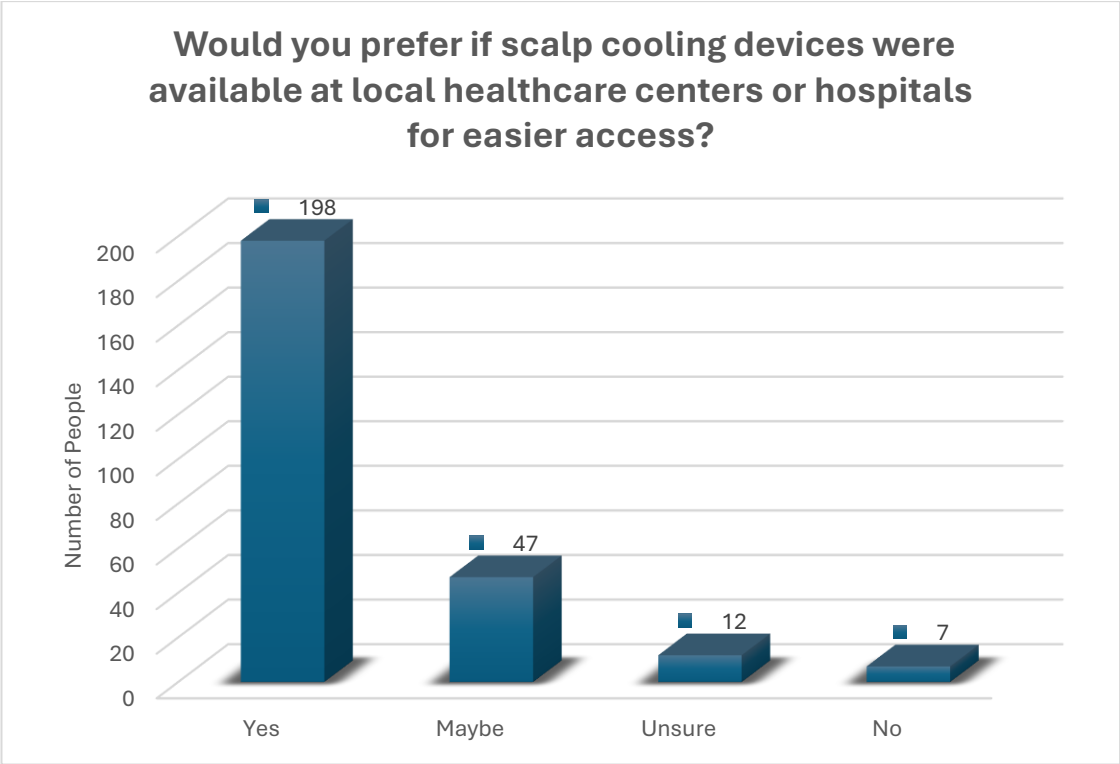

Figure 35:Preference for Local Availability

These results suggest that local availability could increase usage by making the devices more accessible. Mane et al. (2019) also support this idea by saying that new medical devices should be designed to fit the needs of different regions (S. Mane *et al.*, 2019).

4.5.2. Information Requirements for Adoption

Participants were also asked what types of information would increase their confidence in using a scalp cooling device.

Information Needed for Confidence in Use	Count(Percentage)
Success rates in preventing hair loss	76(30.5%)
Patient testimonials and experiences	68(27.3%)
Information about costs and insurance coverage	54(21.7%)
Details on the safety and effectiveness of the device	51(20.5%)
Total	**249(100%)**

Table 33:Information Needed for Confidence in Use

The most frequently selected information need was success rates, highlighting a demand for quantitative outcomes. This aligns with findings from Goldfarb et al. (2023), who explored scalp cooling efficacy under varied chemotherapy regimens (Goldfarb *et al.*, 2023). Respondents also sought patient testimonials, indicating that lived experience holds value in decision-making, a

theme supported by Unver et al. (2022), who emphasised patient comfort and emotional support as factors in adoption (Unver *et al.*, 2022b).

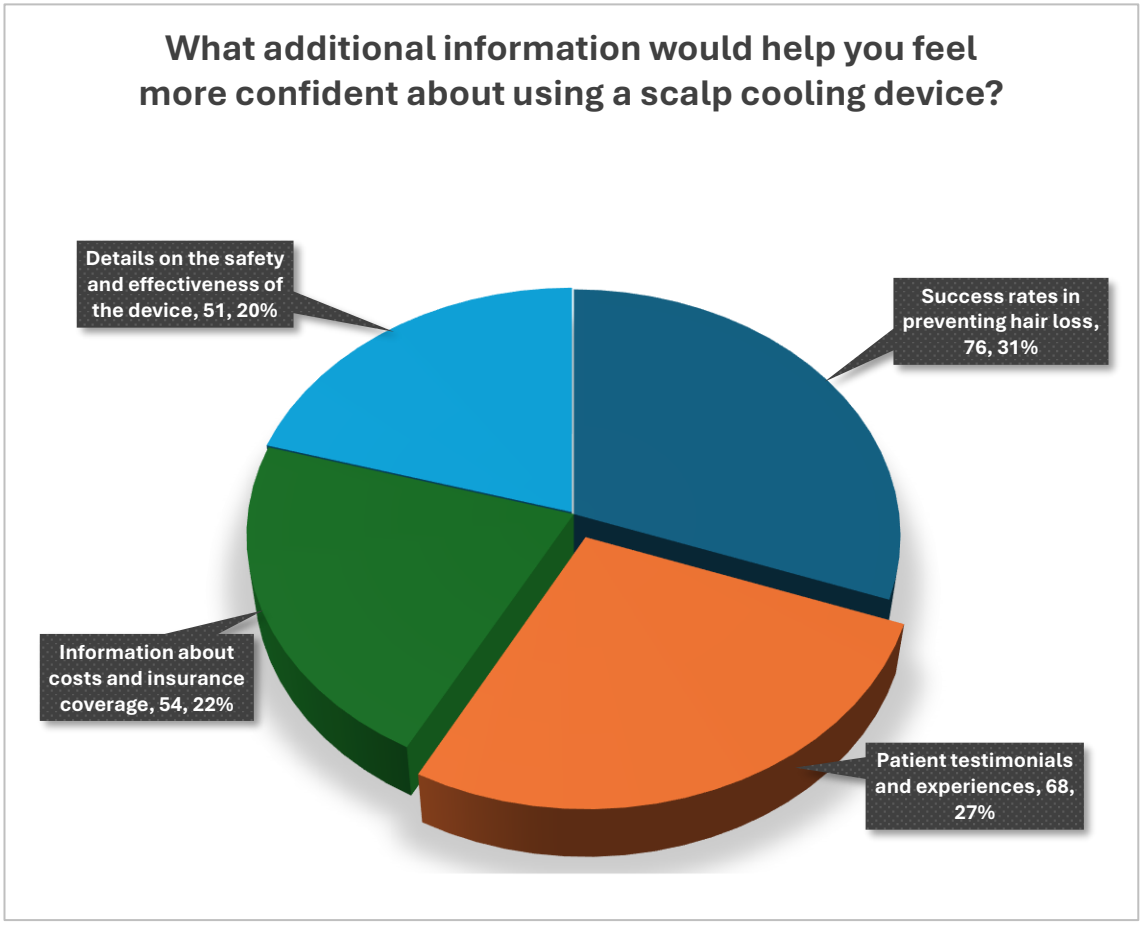

Figure 36:Information Needed for Confidence in Use

Cost transparency (21.7%) also emerged as a notable concern. While not directly comparable, this aligns with van den Hurk et al.'s (2014) findings that increased machine utilisation can lower per-session costs (van den Hurk *et al.*, 2014). Additionally, the need for more safety-related information (20.5%) highlights the importance of trust-building through patient education.

4.5.3. Thematic Analysis

Thematic analysis was conducted on responses to the open-ended survey questions. First, the raw data were compiled, and responses were reviewed to remove filler words and irrelevant content, resulting in a cleaned dataset. Before analysis, a word cloud was generated to highlight the most frequent words, using WordCloud.com. Thematic codes were then generated to represent key recommendations, which were grouped into broader, recurring themes.

Recommendations for Scalp Cooling Device Use

Firstly, the word cloud was generated to highlight the most frequent words (Figure 37).

Figure 37:Word cloud for Recommendations for usage

Following, thematic analysis was conducted based on responses to the open-ended survey question: “If you have used or prescribed the use of a scalp cooling device, are there any

recommendations or improvements you would suggest for the use of scalp cooling devices to benefit future users?". Thematic codes were generated to represent key recommendations, which were grouped into broader themes, as shown in Tables 34 and 35. Table 34 illustrates how codes were transcribed into themes, while Table 35 presents the themes, their frequency, and definitions.

Raw Data	Cleaned Data	Thematic Code	Theme
Make it cost-effective	Make cost effective	Cost concerns	Affordability

Table 34:Example of how codes were transcribed into themes (see Appendix C – Table for Recommendations for Scalp Cooling Device Use for the full table)

Theme	Frequency	Definition of Theme
Affordability	11	Suggests reducing costs or providing subsidies for wider access.
Technical Improvements	8	Suggestions to enhance device performance and functionality.
Need for Awareness	6	Emphasis on educating patients and the public about scalp cooling.
Device Comfort	4	Feedback on improving physical comfort during use.
Safety	3	Concerns about minimising risks and ensuring safe usage.
Accessibility	2	Requests to increase device availability in remote areas.
Psychological Well-being	1	Highlighting the emotional benefits of improved device experience.
Public Outreach	1	Calls for broader community engagement and visibility.
Embracing Innovation	1	Encouragement to adopt new tech and methods in design.
Social Support	1	Suggests offering peer or emotional support with treatment.
Perceived Usefulness / Patient Benefit	1	Focus on ensuring visible patient benefit and effectiveness.
Total	**62**	

Table 35:Recommendations for Scalp Cooling Device Use

Affordability (28%) was the most recurring theme, consistent with studies highlighting high cost as a major challenge and advocating for subsidies or localised manufacturing to address it (Unver *et al.*, 2022b). Technical improvements (20%) and Comfort (10%) followed, calling for better usability, efficiency, and patient experience, reflecting literature on user-centred design and innovations (S. Mane *et al.*, 2019). The Need for Awareness (15%) was also reiterated, echoing findings that limited knowledge among patients and professionals remains a key barrier (Peerbooms *et al.*, 2015b).

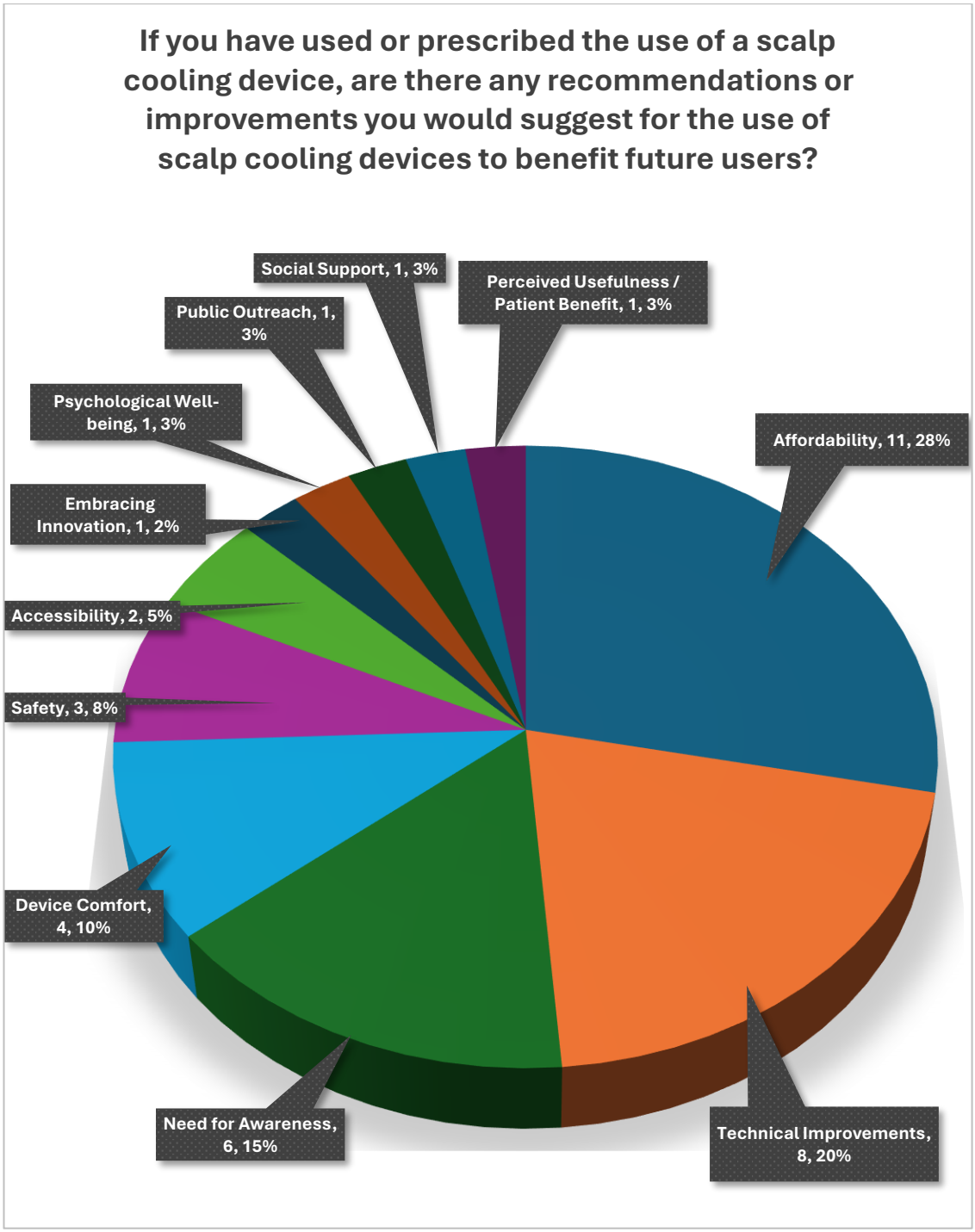

Figure 38:Recommendations for Scalp Cooling Device Use

The survey also raised important points like safety, psychological well-being, and social support, highlighting the need to consider emotional and practical aspects alongside technical and economic ones. Overall, a multifaceted approach, combining cost reduction, technical refinement, education, and patient support, is essential to boost adoption in Southern India.

Recommendations for Improving Availability and Accessibility

Firstly, the word cloud was generated to highlight the most frequent words (Figure 39).

Figure 39:Word Cloud for Recommendations for Improving Availability and Accessibility

Following, thematic analysis was conducted based on responses to the open-ended survey question: "In your opinion, what changes or improvements could be made to enhance the availability and accessibility of scalp cooling devices in Southern India?". Thematic codes were generated to represent key recommendations, which were grouped into broader themes, as shown in Tables 36 and 37. Table 36 illustrates how codes were transcribed into themes, while Table 35 presents the themes, their frequency, and definitions.

Raw Data	Cleaned Data	Thematic Code	Theme
Should be easily accessible	Easily accessible	Focus on accessibility	Accessibility

Table 36:Example of how codes were transcribed into themes (see Appendix – D – Table for Recommendations for Improving Availability and Accessibility the full table)

Theme	Frequency	Definition of Theme
Awareness & Education	33	Emphasis on public campaigns and professional training to increase knowledge and acceptance.
Accessibility	11	Calls to improve availability in rural or underserved areas through better distribution.
Healthcare System Involvement	11	Integration of scalp cooling into treatment protocols and hospital infrastructure.
Affordability	10	Suggestions to reduce costs through subsidies, insurance, or budget devices.
Integrated Strategy	4	Need for a holistic approach combining cost, access, education, and system support.
Total	**69**	

Table 37:Recommendations for Improving Availability and Accessibility

The thematic analysis revealed Awareness and Education (48%) as the most recurring theme, with participants calling for public health campaigns and training for healthcare professionals. This aligns with the literature, which also emphasises the importance of raising awareness to overcome adoption barriers (Unver *et al.*, 2022b) (S. Mane *et al.*, 2019). Accessibility (16%) was another key theme, reflecting concerns about the devices' limited availability. The literature similarly advocates for localised manufacturing and portable systems to improve accessibility (S. Mane *et al.*, 2019). Healthcare System Involvement (16%) underscored the need to integrate scalp cooling into clinical protocols.

Affordability (14%) emerged as a significant opportunity for improvement, with respondents suggesting subsidies or payment plans to reduce costs. The literature supports this, emphasising cost reduction through advanced production techniques (Unver *et al.*, 2022b). Finally, the theme of an Integrated Strategy (6%) reflects the need for a comprehensive approach that combines accessibility, affordability, and education, which is consistent with the literature's call for patient and healthcare professional input in device designs (Unver *et al.*, 2022b) (S. Mane *et al.*, 2019). Overall, both survey responses and literature emphasise a multifaceted strategy to enhance the adoption of scalp cooling devices in Southern India.

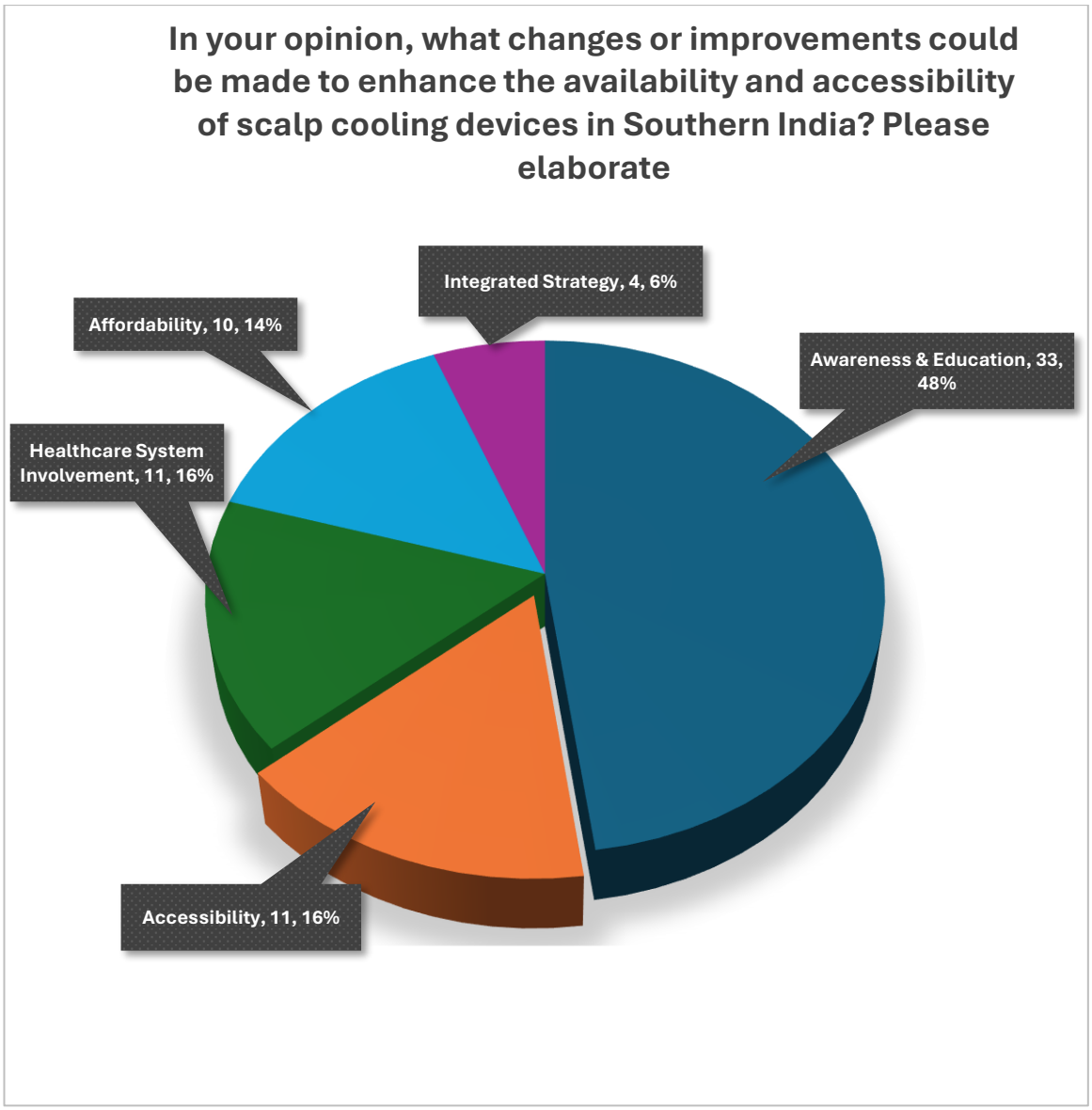

Figure 40: Recommendations for Improving Availability and Accessibility

CHAPTER- 5

5. Conclusions and Recommendations

This chapter wraps up the study by highlighting the key findings and their relevance to the research objectives. It also compares these findings with existing literature, offers practical and academic recommendations, addresses the study's limitations and contributions, and outlines suggestions for future research.

5.1. Summary of Key Findings and Their Implications

The study aimed to assess public awareness and perceptions regarding scalp cooling devices in Southern India, identify barriers to their adoption, and gather suggestions for improvement. The following are the key findings aligned with the research questions:

5.1.1. Public Awareness of Scalp Cooling Devices

A key finding from this study is that public awareness of scalp cooling devices in Southern India is relatively low. Many respondents indicated that they had never heard of the device before taking part in the survey, which points to a significant gap in knowledge. This highlights a clear need for more effective public awareness campaigns to educate people on the benefits of scalp cooling during chemotherapy.

Implications: The lack of awareness suggests that many individuals undergoing chemotherapy may be unaware of scalp cooling as a supportive care option. Without basic knowledge, patients are unlikely to consider or inquire about such interventions, regardless of their potential benefits. This indicates that awareness plays a foundational role in driving adoption.

5.1.2. Public Perceptions and Attitudes Towards Scalp Cooling Devices

Despite the low awareness, the general attitude towards scalp cooling was largely positive. Many respondents indicated interest in using the device, provided that it becomes more accessible and affordable. The perceived emotional benefit of reducing chemotherapy-induced hair loss was recognised as a factor in the positive outlook towards the device.

Implications: Positive perceptions of the device suggest that there is potential for adoption, particularly if barriers such as cost and access are addressed. This suggests that once individuals are informed about the device, they are likely to value its use, underscoring the emotional significance of hair preservation during cancer treatment.

5.1.3. Barriers to Adoption

Respondents highlighted three main barriers to scalp cooling adoption: high cost, limited information, and design discomfort. Many found the device unaffordable and suggested subsidies to improve access. Others noted a lack of clear information on effectiveness, safety, and costs, calling for success rates and patient testimonials. Some also recommended design improvements to enhance comfort and usability.

Implications: This feedback suggests a genuine willingness among the public to engage with scalp cooling technologies, provided their concerns are acknowledged and addressed. By acting on this feedback, stakeholders can take meaningful steps toward creating a more user-friendly and inclusive solution.

5.1.4. Public Feedback for Improving Scalp Cooling Devices

Participants offered several suggestions to improve scalp cooling devices. They recommended expanding access by making the devices available in local healthcare settings, reducing financial barriers through subsidies or insurance coverage, and increasing transparency by sharing information on effectiveness, patient experiences, and safety. These improvements were viewed as important steps toward encouraging wider adoption.

Implications: Improving access, affordability, and awareness around scalp cooling devices could help more people feel confident in considering them as part of cancer care. Practical changes, like offering clear information and expanding local availability, may go a long way in making the technology more approachable and widely used.

5.2. Comparison with Existing Literature

The findings of this study align closely with existing literature on scalp cooling:

Lack of awareness was a recurring issue in both this research and earlier studies. Peerbooms et al. (2015) and Unver et al. (2022) highlighted that limited knowledge among patients and healthcare professionals remains a significant barrier to adoption (Peerbooms *et al.*, 2015b; Unver *et al.*, 2022b). In this study, participants were more likely to rely on informal sources of information rather than healthcare providers, which supports the findings of previous research emphasising the need for improved education and awareness campaigns.

Affordability was another major barrier, echoing the concerns raised by van den Hurk et al. (2014), Mane et al. (2019), and Unver et al. (2022). These studies emphasised the need for reducing costs, either through subsidies or localised manufacturing (van den Hurk *et al.*, 2014; S.

Mane *et al.*, 2019; Unver *et al.*, 2022b). The current study mirrored this concern, with respondents calling for more cost-effective solutions and expressing dissatisfaction with the high financial burden of the devices.

The theme of accessibility is also consistent with previous studies. Mane et al. (2019) advocated for region-specific implementation and improved infrastructure, suggesting that local availability of scalp cooling devices could increase adoption (S. Mane *et al.*, 2019). This aligns with the findings of the current study, where a significant portion of participants supported the idea of having devices available at local healthcare centers.

Finally, the importance of trust-building through patient testimonials and transparent information about success rates was emphasised in the study by (Unver *et al.*, 2022b) and supported by the current research. Participants in this study expressed a strong preference for testimonials and success rates as crucial factors in increasing their confidence in the use of scalp cooling devices.

5.3.Practical Recommendations

- **Increase Public Awareness and Education:** Public health campaigns should be implemented to raise awareness of scalp cooling devices. These campaigns should focus on communicating the emotional and psychological benefits of preserving hair during chemotherapy. Information should be disseminated through local languages and media to ensure accessibility to a broad audience.

- **Train Healthcare Providers:** Healthcare providers should be trained on the benefits and use of scalp cooling devices. This training will enable them to effectively recommend and guide patients who may benefit from the device.

- **Address the Cost Barrier:** Financial support options, such as subsidies or insurance coverage, should be explored to make scalp cooling devices more affordable. Partnerships with healthcare providers and manufacturers could help reduce costs and improve access.

- **Improve Access to Devices:** Scalp cooling devices should be made available at local healthcare centers, hospitals, and chemotherapy treatment facilities. Efforts should be made to ensure that the devices are easily accessible to patients in both urban and rural areas.
- **Enhance Device Design:** Manufacturers should focus on improving the comfort and user-friendliness of scalp cooling devices to improve the overall experience for users.

5.4.Limitations of Study

- **Voluntary Participation:** As participation in the survey was voluntary, some respondents chose to skip questions, which led to occasional gaps and uncertainty in the responses.
- **Self-Reported Data:** The findings rely on self-reported data, which may carry the risk of bias or inaccuracy. Future studies could incorporate objective measures to validate these insights.
- **Sample Composition:** The survey focused primarily on the general public. While some healthcare professionals and patients participated, direct input from cancer patients was limited due to the sensitivity of access, restricting user-specific insights.
- **Geographic Scope:** This study focused solely on Southern India. Broader research across other regions of the country would help assess variation in awareness and adoption of scalp cooling devices nationwide.

5.5.Contributions of Study

Contribution to Regional Knowledge: This research contributes to a better understanding of public awareness and perceptions of scalp cooling devices in Southern India, an area that has not been extensively studied.

Practical Recommendations for Stakeholders: The study provides actionable insights for healthcare providers, policymakers, and manufactures to contribute to the improvement of the adoption of scalp cooling devices.

Foundation for Future Research: The findings of this study serve as a foundation for future research on the adoption of scalp cooling devices in India and similar contexts.

5.6.Suggestions for Future and Academic Research

- **In-Depth Interviews of Healthcare Professionals and Cancer Patients**: Future research could include interviewing cancer patients who have utilised scalp cooling devices, as well as healthcare providers who help implement them. This study would provide greater insight into the challenges and benefits of the device's use.
- **Pilot Program Implementation:** Pilot programs testing the availability of scalp cooling devices in healthcare centers could be conducted to assess the feasibility of wider implementation and its impact on adoption rates.

- **Cross-Cultural Impact Analysis:** Future studies will evaluate the cross-cultural influences on the adoption of scalp cooling technology in different parts of India and countries with similar healthcare challenges.
- **Long-Term Efficacy Studies**: Examining the longer-term success of scalp cooling devices, and in particular how they affect patients' quality of life, has the potential to strengthen its widespread implementation.
- **Conduct Further Research on Patient Experiences:** Future studies should explore the experiences of cancer patients in Southern India who have used scalp cooling devices. Given the limited data from this region, interviews or case studies could provide deeper insights into the challenges and benefits of using the device during chemotherapy.
- **Evaluate the Effectiveness of Awareness Campaigns:** Research should assess the effectiveness of public awareness campaigns in increasing knowledge and adoption of scalp cooling devices. Identifying the most effective awareness strategies will strengthen future initiatives.
- **Investigate Regional Differences in Adoption:** Further research should explore how regional, cultural, and economic factors influence the adoption of medical technologies. This would help in designing more targeted and effective interventions.
- **Explore Cost-Reduction Strategies:** Future studies could investigate approaches to reduce the cost of scalp cooling devices, such as affordable payment plans or lower-cost models, which would help address financial barriers to adoption.

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7. Appendices

7.1. Appendix A – Survey Questions

Link to form: Public Awareness and Feedback on Scalp Cooling Devices for Chemotherapy-Induced Alopecia in Southern India: Implications for Medical Device Innovation

Public Awareness and Feedback on Scalp Cooling Devices in Southern India

My name is Meghana Jiji Johnson, I am studying MSc. in Medical Device Technology and Business at Griffith College, Dublin, Ireland. I am conducting this research as part of my MSc dissertation to explore public awareness, perceptions, and feedback on scalp cooling devices used to reduce chemotherapy-induced hair loss. This study aims to assess the level of awareness and understanding of these devices among the general public in Southern India (Kerala, Tamil Nadu, and Karnataka) and evaluate their perceptions, attitudes, and willingness to adopt scalp cooling technology.

- ***The survey will take approximately 10-15 minutes to complete.***
- ***Your participation is entirely voluntary, and you may choose to skip any question or withdraw at any time (by closing the form).***
- ***All responses will remain confidential and will be used solely for research purposes.***

Thank you for your valuable time and input. For more information, please contact:
meghana.jijijohnson@student.griffith.ie

Consent to Participate in the Survey

Kindly confirm that you have understood the purpose of this study. *

- ◯ Yes
- ◯ No

Please select "Agree" if you voluntarily agree to participate in this research. If you do not wish to participate, select "Disagree" to decline participation. *

- ◯ Agree
- ◯ Disagree

Preliminary Questions

Are you 18 years or older? *

- ◯ Yes
- ◯ No

Which state are you from? *

- ◯ Kerala
- ◯ Tamil Nadu
- ◯ Karnataka
- ◯ Other

Have you or someone close to you been impacted by cancer? (Select all that apply) *

- ☐ I have/had cancer
- ☐ A family member has/had cancer
- ☐ A close friend has/had cancer
- ☐ No personal experience

Are you a healthcare professional? *

- ◯ Yes
- ◯ No

Awareness and Understanding of Scalp Cooling Devices

Have you ever heard of scalp cooling devices being used during chemotherapy?

- ◯ Yes
- ◯ No

Before taking this survey, were you aware that scalp cooling devices are used to reduce chemotherapy-induced hair loss?

- ◯ Yes
- ◯ No

How would you rate your level of awareness about scalp cooling devices?

- ◯ Not aware at all
- ◯ Slightly aware
- ◯ Moderately aware
- ◯ Very aware
- ◯ Extremely aware

Where did you first learn about scalp cooling devices?

- ◯ Healthcare professionals
- ◯ Social media
- ◯ Family/friends
- ◯ TV or news articles
- ◯ Other

How confident do you feel about understanding how scalp cooling devices work?

- ◯ Not confident at all
- ◯ Slightly confident
- ◯ Moderately confident
- ◯ Very confident
- ◯ Extremely confident

How effective do you think scalp cooling devices are in preventing hair loss during chemotherapy?

- ◯ Not effective at all
- ◯ Slightly effective
- ◯ Moderately effective
- ◯ Very effective
- ◯ Unsure

Perceptions, Attitudes, and Willingness to Adopt Scalp Cooling Devices

If you were to undergo chemotherapy, would you consider using a scalp cooling device to help manage hair loss?

- ◯ Yes
- ◯ No
- ◯ Maybe
- ◯ Unsure

What factors would influence your decision to use a scalp-cooling device during chemotherapy? (Select all that apply)

- ☐ Preventing hair loss
- ☐ Maintaining appearance during treatment
- ☐ Healthcare professionals' recommendation
- ☐ Positive experiences shared by others
- ☐ Other

How important is hair preservation during chemotherapy for emotional well-being?

- ◯ Not important at all
- ◯ Slightly important
- ◯ Moderately important
- ◯ Very important
- ◯ Extremely important

In your opinion, do you think healthcare professionals should play an important role in recommending and explaining the use of scalp cooling devices to patients undergoing chemotherapy?

- ◯ Yes
- ◯ No
- ◯ Maybe

If you have answered 'No' to the above question, who do you think should be responsible for recommending and explaining scalp cooling devices to patients undergoing chemotherapy? (Select all that apply)

- ☐ Word of mouth (recommendations from other patients, survivors, or caregivers)
- ☐ Medical device companies or manufacturers through direct outreach and education
- ☐ Patient advocacy groups or cancer support organizations
- ☐ Online communities, forums, or social media influencers
- ☐ Healthcare professionals through patient testimonials rather than direct recommendations
- ☐ Other

Barriers to Access and Acceptance of Scalp Cooling Devices

Do you think Lack of awareness about the device could be a barrier to using scalp cooling devices during chemotherapy?

- ◯ Yes
- ◯ No

Do you think cultural beliefs or perceptions could be a barrier to using scalp cooling devices during chemotherapy?

- ◯ Yes
- ◯ No

To what extent do you think cultural views in Southern India influence people's acceptance of scalp-cooling devices?

- ◯ Not at all
- ◯ Slightly
- ◯ Moderately
- ◯ Very much
- ◯ Extremely

What specific cultural beliefs or perceptions do you think discourage the use of scalp cooling devices during chemotherapy? (Select all that apply)

- [ ] Viewing hair loss as a natural part of the cancer journey or a symbol of strength
- [ ] Belief that medical devices should only be used for life-saving treatments
- [ ] Religious or spiritual beliefs influencing decisions about medical treatments
- [ ] Limited discussion or awareness of hair preservation in certain communities
- [ ] Family or societal pressure to focus only on life-saving treatments
- [ ] Other

Do you think the cost of scalp cooling devices influences a patient's decision to use them during chemotherapy?

- ◯ Yes
- ◯ No

To what extent do you think the cost of scalp cooling devices influences a patient's decision?

- ◯ Not at all
- ◯ Slightly
- ◯ Moderately
- ◯ Very much
- ◯ Extremely

what specific cost-related factors might discourage the use of scalp cooling devices during chemotherapy? (Select all that apply)

- [ ] High upfront cost of the device/treatment
- [ ] Lack of insurance coverage or reimbursement options
- [ ] Ongoing maintenance or session-based costs
- [ ] Competing financial priorities during cancer treatment
- [ ] Uncertainty about cost-effectiveness compared to benefits
- [ ] Other

To what extent do you think individuals may feel uncomfortable using a device that is visible or noticeable during chemotherapy?

- ◯ Not at all
- ◯ Slightly
- ◯ Moderately
- ◯ Very much
- ◯ Extremely

What do you think is the most effective way to raise awareness about scalp-cooling devices in your community?

- ◯ Information campaigns through healthcare professionals
- ◯ Social media and online platforms
- ◯ Word of mouth from patients or their families
- ◯ Other

Potential Improvements to Enhance Acceptability and Usage of Scalp Cooling Devices

Would you prefer if scalp cooling devices were available at local healthcare centers or hospitals for easier access?

- ◯ Yes
- ◯ No
- ◯ Maybe
- ◯ Unsure

What additional information would help you feel more confident about using a scalp cooling device? (Select all that apply)

- ☐ Success rates in preventing hair loss
- ☐ Patient testimonials and experiences
- ☐ Information about costs and insurance coverage
- ☐ Details on the safety and effectiveness of the device
- ☐ Other

If you have used or prescribed the use of a scalp cooling device, are there any recommendations or improvements you would suggest for the use of scalp cooling devices to benefit future users? Please share your thoughts.

In your opinion, what changes or improvements could be made to enhance the availability and accessibility of scalp cooling devices in Southern India? Please elaborate

7.2.Appendix B – Ethics Form

Innopharma education

GRIFFITH COLLEGE

Ethics Application & Declaration Form

DISSERTATION TITLE: Public Awareness and Feedback on Scalp Cooling Devices for Chemotherapy-Induced Alopecia in Southern India: Implications for Medical Device Innovation

RESEARCHER'S NAME: Meghana Jiji Johnson

PROGRAMME OF STUDY: MSc. In Medical Device Technology and Business

SUPERVISOR'S NAME: Patricia Mooney

DECLARATION:
The information in this application form is accurate to the best of my knowledge. I undertake to abide by the principles outlined by Innopharma/Griffith College ethics policy in my research dissertation. I confirm that I have completed a full ethics assessment for my research dissertation as per the college guidelines. I will not begin my primary research until such approval from my supervisor and/or the ethics Committee has been obtained.
I pledge to carry out my research according to the Innopharma/Griffith College academic integrity standards. Any results presented in my dissertation will be from my own, original research, I will reference and/or acknowledge any material or sources used in its preparation and I will not plagiarise the work of anyone else.

For Student:

STUDENT SIGNATURE:

DATE: 20-03-2025

The research contained within this research dissertation proposal has been approved.

For Supervisor:
Ethics Committee Approval Required: Yes [x] No [ ]

SUPERVISOR SIGNATURE:

DATE:27-March-2025

For Ethics Committee (if required):
Ethics Committee Approval Given: Yes [x] No [ ]

ETHICS COMMITTEE MEMBER SIGNATURE:

DATE:27.0325

NOTE: Supervisors are responsible for ensuring their students fill in this form correctly and that all ethical areas have been considered.

SECTION 1: DESCRIPTION OF RESEARCH STUDY

1.1 Purpose and objectives of research *[300 words maximum/ use literature review findings to guide]*

The purpose of this research is to assess the awareness, perceptions, and barriers related to the adoption of scalp cooling devices for chemotherapy-induced alopecia (CIA) in Southern India. Given the increasing incidence of cancer and its emotional impacts, especially regarding hair loss during chemotherapy, this research aims to bridge the knowledge gap by evaluating the understanding of these devices among the general public, including people affected by cancer as well as healthcare providers. While the effectiveness of scalp cooling devices has been demonstrated in studies conducted in other parts of India, limited data exists on their awareness and usage in the Southern region. This research focuses on understanding the public's perception and willingness to adopt such technology, highlighting the need for culturally appropriate solutions to enhance patient outcomes and experiences.

The main objectives of this study are:

- To assess the level of awareness and understanding of scalp cooling devices among the general public in southern India
- To evaluate the perceptions, attitudes, and willingness of the general public toward the adoption of scalp-cooling devices
- To identify barriers (such as cultural, economic, and informational) that make it difficult for people in Southern India to access or accept scalp cooling devices.
- To explore potential modifications or improvements to scalp cooling devices based on public feedback, aiming to increase their acceptability and usage among the general population

The findings could guide strategies to enhance awareness and accessibility of this technology, ultimately improving supportive care for cancer patients in the region and potentially shaping the future of medical device innovation in oncology.

1.2 Research methodology: *[300 words maximum/ detail how you will acquire your primary data (focus groups/interviews/online surveys etc). Proposed questions for questionnaires and/or interviews **must be included** in the appendix.*

A survey-based methodology will be used to collect primary data from the adult population (18 and above) in Southern India, specifically from Kerala, Tamil Nadu, and Karnataka. Participants will be included based on age (18 and above) and geographical location (Southern India). Screening questions will be used to differentiate participants based on their background and experiences, capturing diverse perspectives. While the primary focus is on the general public, the study will also gather insights from individuals affected by cancer and healthcare professionals based on their self-identified responses. Their responses will contribute additional insights to the overall findings.

The survey will include a mix of multiple-choice questions, Likert scale and open-ended responses. This design allows for measurable data from multiple-choice and Likert scale as well as deeper insights through open-ended questions. Participants will be differentiated by their self-identified experience with cancer or their profession in healthcare, ensuring diverse perspectives are captured.

The survey will be distributed via Google Forms, ensuring ease of access and broad reach. It will be shared through platforms like LinkedIn, Facebook, and WhatsApp, and through professional networks to target healthcare professionals. The researcher's previous professional connections will be used to gather insights from this group.

The study's geographical focus is Southern India, particularly Kerala, Tamil Nadu, and Karnataka. While responses from these regions are prioritised, those from outside this scope will be reviewed separately. Screening questions will ensure participants are 18 or older, and data will be excluded if participants do not meet this criterion or do not belong to the relevant subgroups.

Ethical considerations include informed consent, where participants will be briefed on the study's purpose before participating. Confidentiality will be maintained by anonymizing data, and care will be taken in question design to avoid distress. Participants will have the option to skip questions or exit at any time.

SECTION 2: POSSIBLE ETHICAL ISSUES

Answer 'yes' or 'no' to the following questions.

SUBJECT MATTER

Does the research proposal involve:	
Research into specific company activities that would be deemed sensitive or confidential	No
Research into politically and/or racially/ethnically and/or commercially sensitive areas	No
Sensitive, personal, professional or corporate issues	No

RESEARCH PROCEDURES

Does the research proposal involve:	
Research that might damage the reputation of companies or participants	No
Research that may negatively affect the reputation of Griffith College/Innopharma	No
Use of personal records without consent	No
Use of company data without consent	No
The offer of any inducements to participate	No
Audio or visual recording without consent	No
Using a language other than English	No

PARTICIPANTS

Does the research proposal involve:	
People who are not competent and/or fluent in English	No
Does your research group include any of the following vulnerable groups *(Adults with psychological impairments; Adults with learning difficulties; Adults under the protection/control /influence of others (e.g. in care/prison); Relatives of ill people (e.g. parents of sick children); Hospital or GP participants recruited in a medical facility; persons under the age of 18)*	Yes

If you have answered NO to ALL questions, please go straight to Section 4.

If you have answered YES to ANY question in SECTION 2, you must fill in SECTION 3.

SECTION 3: STEPS TAKEN TO AVOID ETHICAL ISSUES

[Only fill in this section if you answered YES to ANY of the questions in Section 3. For example, if you answered yes to including participants who are not fluent in English, you might put forward a plan that offers your survey in two languages to take this into account. Another example could be a study where the researcher wants to include information about the care received by children with a long-term condition but it would not be ethical to approach the children directly, but it might be acceptable to instead ask parents questions about their child's care. If these plans are acceptable to your supervisor, you may not need to apply for ethical approval from the Ethics Committee].

3.1. If your ethics relates to ***Subject Matter***, outline your action plan to work around any sensitive issues.
3.2. If your ethics relates to ***Research Procedures***, outline your action plan to deal with possible ethical issues in your research procedures.
3.3. If your ethics relate to ***Participants***, outline how you will protect vulnerable persons or those that do not have English as their first language.

Since my research focuses on public awareness of scalp cooling devices for chemotherapy-induced alopecia, it applies to the general public. However, some participants may belong to a vulnerable group, particularly those who have experienced cancer themselves or have close connections to someone affected by it.

To protect vulnerable participants, I will ensure that everyone gives informed consent before taking part in the survey. The purpose of the study will be explained clearly, and participants will be told that their participation is completely voluntary. They can skip any question or exit the survey at any time if they choose.

The survey does not include any distressing questions, and all questions are designed to be simple and easy to understand.

SECTION 4: ABOUT YOUR PARTICIPANTS

4.1. Outline your participant profile and why you have chosen them for this study *[Do not provide names except where it is deemed impossible to conceal identity].*
The participant profile for this study includes the general adult population (18 and above) from Southern India, specifically in Kerala, Tamil Nadu, and Karnataka. Participants will be differentiated based on their background and experiences through screening questions to capture a diverse range of perspectives. While the primary focus is on the general public, the study will also capture insights from individuals affected by cancer and healthcare professionals based on their self-identified responses. This group is chosen to provide a broad understanding of public perceptions and experiences, while insights from the other subgroups (cancer-affected individuals and healthcare professionals) will add valuable context to the study.

4.2 How do you plan to gain access to/contact/approach your participant(s).
I plan to contact participants through online platforms such as LinkedIn, Facebook, and WhatsApp. The survey will be distributed via Microsoft Forms, which makes it easy to access and share. I will also leverage my personal and professional networks to reach a wide audience. Screening questions will be used to ensure participants meet the study criteria.

SECTION 5: INFORMATION, CONSENT AND CONFIDENTIALITY

5.1 **Participant Information Letter (PIL) for participants**

[You must submit an information letter for participants with this application, as part of your appendices document. For online surveys, it is sufficient to include a paragraph summarising and explaining the purpose of the research at the beginning of the survey. In all other research e.g. interviews, phone calls, a PIL should be provided to each participant before they are asked for their consent to take part. A template PIL is available in Moodle].

Please confirm below that your information letter covers:

Description of the research topic and method	Yes/No
Details of what participation will involve	Yes/No
Rights to anonymity	Yes/No
Confidentiality	Yes/No
Rights to withdraw from the research	Yes/No
The contact details of the researcher and supervisor (if necessary)	Yes/No

5.2 **Informed Consent Form (ICF) for participants**

[Informed consent is required for most research. For online surveys, it is sufficient to get the participant to tick two boxes at the beginning of the survey – one to state they understand the research and one to give consent. In all other research e.g. interviews, phonecalls, a signed consent form is required. If the data is gathered online e.g. zoom, a signed consent form can be scanned and sent to the researcher. A template ICF is available in Moodle. The signed ICFs, along with the surveys, audio files or interview notes etc. must be stored in the primary data folder on moodle and can be accessed by Innopharma staff for the purposes of verifying the authenticity of the research carried out and the data collected].

Please indicate below if your research requires a signed consent form by selecting the relevant option only:

No: my research study involves an online survey only and/or does not require signed consent

SECTION 6: STORAGE OF DATA

[Please ensure that you are abiding by GDPR and the national Data protection laws https://www.hrb.ie/funding/gdpr-guidance-for-researchers/gdpr-and-health-research/).

The student is responsible for storage of data and this will be handed over to the college in an electronic format as part of the thesis submission i.e. primary data and completed ICFs where applicable will be added to the primary data folder

*on moodle. The rationale is to keep data **as long as it is still useful** and there is an intention to use it further **for research** so if this is not the case then this can be stipulated here and a shorter retention period given.]*

6.1 How will you store the research data and for how long? How will you manage data protection issues?

The data will be securely stored on a password-protected computer that only the research team can access. Since there is no intention to use the data for future research, it will be retained for two years. To further reduce data security risks, the data will be saved in a separate, password-protected folder with additional layers of password protection to safeguard the participants' information.

SECTION 7: NON-DISCLOSURE AGREEMENT & STUDENT CONSENT

7.1 **Non-Disclosure Agreement (NDA)**
Will the final dissertation contain any information pertaining to any source what would warrant the use of a Non-Disclosure Agreement (NDA) e.g. industry-based research?

No

7.2 **Student consent**
If a Non-Disclosure Agreement (NDA) is not required, does the student consent to allow their completed dissertation to be held/published by Innopharma/Griffith College?

Yes

SECTION 8: RECORDING AND RETENTION OF DISSERTATION VIVA

8.1 **Viva Recording**
The Dissertation viva will be recorded. This recording may be used to facilitate assessment by Innopharma staff, a third reader if necessary and/or if requested by the external examiner for the Programme. The recording will be held in line with current GDPR guidelines and will not be made publicly available.

SECTION 9: DOCUMENT CHECKLIST

NOTE: Applicants must attach the following documents in electronic format to the appendix.

Which documents are added to the appendix? Please tick N/A if not applicable:

9.1 Participant Information Letter (PIL) for participant	N/A
9.2 Informed Consent Form (ICF) for participant	N/A
9.3 Questions/survey for interviewees/focus groups etc *(can be in draft form)*	Yes
9.4 Any other documents e.g. Non-Disclosure Agreement	N/A

I confirm that this application is complete and all required documents are included in the appendix.

For Student:

STUDENT SIGNATURE: 

DATE: 20-03-2025

SECTION 10: APPENDIX

Public Awareness and Feedback on Scalp Cooling Devices for Chemotherapy-Induced Alopecia in Southern India: Implications for Medical Device Innovation

My name is Meghana Jiji Johnson, I am studying MSc. In Medical Device Technology and Business at Griffith College, Dublin, Ireland. I am conducting this research as part of my MSc dissertation to explore public awareness, perceptions, and feedback on scalp-cooling devices used to reduce chemotherapy-induced hair loss. This study aims to assess the level of awareness and understanding of these devices among the general public in Southern India (Kerala, Tamil Nadu, and Karnataka) and evaluate their perceptions, attitudes, and willingness to adopt scalp-cooling technology.

- ***The survey will take approximately 10-15 minutes to complete.***
- ***Your participation is entirely voluntary, and you may choose to skip any question or withdraw at any time.***
- ***All responses will remain confidential and will be used solely for research purposes.***

Thank you for your valuable time and input.

For more information, please contact: meghana.jijijohnson@student.griffith.ie

a. Kindly confirm that you have understood the purpose of this study.

- ***Yes***
- ***No***

b. Please select "Agree" if you voluntarily agree to participate in this research. If you do not wish to participate, select "Disagree" to decline participation.

- ***Agree***
- ***Disagree***

Preliminary Questions:

1. Are you 18 years or older?
   - Yes
   - No

2. Which state do you currently reside in?
   - Kerala
   - Tamil Nadu
   - Karnataka
   - Other _____

3. Have you or someone close to you been impacted by cancer? (Select all that apply)
   - I have/had cancer
   - A family member has/had cancer
   - A close friend has/had cancer
   - No personal experience

4. Are you a healthcare professional?
    - Yes
    - No

Main Survey Questions:

Awareness and Understanding of Scalp Cooling Devices

1. Have you ever heard of scalp cooling devices being used during chemotherapy?
    - Yes
    - No
2. Before taking this survey, were you aware that scalp cooling devices are used to reduce chemotherapy-induced hair loss?
    - Yes
    - No
3. How would you rate your level of awareness about scalp cooling devices?
    - Not aware at all
    - Slightly aware
    - Moderately aware
    - Very aware
    - Extremely aware
4. Where did you first learn about scalp cooling devices?
    - Healthcare professionals
    - Social media
    - Family/friends
    - TV or news articles
    - Other (please specify) _____
5. How confident do you feel about understanding how scalp cooling devices work?
    - Not confident at all
    - Slightly confident
    - Moderately confident
    - Very confident
    - Extremely confident
6. How effective do you think scalp cooling devices are in preventing hair loss during chemotherapy?
    - Not effective at all
    - Slightly effective

- Moderately effective
- Very effective
- Unsure

Perceptions, Attitudes, and Willingness to Adopt Scalp Cooling Devices

7. If you were to undergo chemotherapy, would you consider using a scalp cooling device to help manage hair loss?

    - Yes
    - No
    - Maybe
    - Unsure

8. What factors would influence your decision to use a scalp-cooling device during chemotherapy? (Select all that apply)

    - Preventing hair loss
    - Maintaining appearance during treatment
    - Healthcare professionals' recommendation
    - Positive experiences shared by others
    - Other _____

9. How important is hair preservation during chemotherapy for emotional well-being?

    - Not important at all
    - Slightly important
    - Moderately important
    - Very important
    - Extremely important

10. In your opinion, do you think healthcare professionals should play an important role in recommending and explaining the use of scalp cooling devices to patients undergoing chemotherapy?

    - Yes
    - No
    - Maybe

11. If you have answered 'No' to the above question, who do you think should be responsible for recommending and explaining scalp cooling devices to patients undergoing chemotherapy? (Select all that apply)

    - Word of mouth (recommendations from other patients, survivors, or caregivers)
    - Medical device companies or manufacturers through direct outreach and education
    - Patient advocacy groups or cancer support organizations
    - Online communities, forums, or social media influencers

- Healthcare professionals through patient testimonials rather than direct recommendations
- Other _____

Barriers to Access and Acceptance of Scalp Cooling Devices

12. Do you think Lack of awareness about the device could be a barrier to using scalp-cooling devices during chemotherapy?
    - Yes
    - No

13. Do you think cultural beliefs or perceptions could be a barrier to using scalp cooling devices during chemotherapy?

    - Yes
    - No

14. To what extent do you think cultural views in Southern India influence people's acceptance of scalp-cooling devices?

    - Not at all
    - Slightly
    - Moderately
    - Very much
    - Extremely

15. what specific cultural beliefs or perceptions might discourage the use of scalp cooling devices during chemotherapy? (Select all that apply)

    - Viewing hair loss as a natural part of the cancer journey or a symbol of strength
    - Belief that medical devices should only be used for life-saving treatments
    - Religious or spiritual beliefs influencing decisions about medical treatments
    - Limited discussion or awareness of hair preservation in certain communities
    - Family or societal pressure to focus only on life-saving treatments
    - Other (please specify) _____

16. Do you think the cost of scalp cooling devices influences a patient's decision to use them during chemotherapy?

    - Yes
    - No

17. To what extent do you think the cost of scalp cooling devices influences a patient's decision?

    - Not at all
    - Slightly

- Moderately
- Very much
- Extremely

18. what specific cost-related factors might discourage the use of scalp cooling devices during chemotherapy? (Select all that apply)

    - High upfront cost of the device/treatment
    - Lack of insurance coverage or reimbursement options
    - Ongoing maintenance or session-based costs
    - Competing financial priorities during cancer treatment
    - Uncertainty about cost-effectiveness compared to benefits
    - Other _____

19. To what extent do you think individuals may feel uncomfortable using a device that is visible or noticeable during chemotherapy?

    - Not at all
    - Slightly
    - Moderately
    - Very much
    - Extremely

20. What do you think is the most effective way to raise awareness about scalp-cooling devices in your community?

    - Information campaigns through healthcare professionals
    - Social media and online platforms
    - Word of mouth from patients or their families
    - Other _____

Potential Improvements to Enhance Acceptability and Usage of Scalp Cooling Devices

21. Would you prefer if scalp cooling devices were available at local healthcare centers or hospitals for easier access?

    - Yes
    - No
    - Maybe
    - Unsure

22. What additional information would help you feel more confident about using a scalp cooling device? (Please select all that apply)

    - Success rates in preventing hair loss
    - Patient testimonials and experiences
    - Information about costs and insurance coverage

- Details on the safety and effectiveness of the device
- Other (please specify) _____

Optional Questions:

23. If you have used or prescribed the use of a scalp cooling device, are there any recommendations or improvements you would suggest for the use of scalp cooling devices to benefit future users? Please share your thoughts.

24. In your opinion, what changes or improvements could be made to enhance the availability and accessibility of scalp cooling devices in Southern India? Please elaborate

7.3. Appendix C – Table for Recommendations for Scalp Cooling Device Use

Question 23: *If you have used or prescribed the use of a scalp cooling device, are there any recommendations or improvements you would suggest for the use of scalp cooling devices to benefit future users? Please share your thoughts.*

Raw Data	Cleaned Data	Thematic Code	Theme
No awareness	No~awareness	Lack of awareness	Need for Awareness
Pricing should be kept under control	pricing kept under control	Cost concerns	Affordability
Cost reduction	Cost~reduction	Cost concerns	Affordability
Make sure it has no harmful side effects	make sure harmful effects	Side effects concerns	Safety
I haven't used or prescribed scalp cooling device. More awareness is required to all the patients about the availability and effectiveness of scalp cooling devices	haven t used prescribed scalp~cooling device awareness required patients availability effectiveness scalp~cooling devices	Lack of awareness	Need for Awareness
Cost effective	Cost~effective	Cost concerns	Affordability
Once you got a chance to know more about the device and the technology try to get to know more and help others who had never heard about it. To change a stereo type thinkings about the disease we have to start exploring new ideas and technologies that help to get back to normal life even after caught by a disease like cancer.	got chance know device technology try know help heard change stereo type thinkings disease start exploring new ideas technologies help normal life caught disease like cancer	Need for Awareness and Education, Support for Others, Encouragement of Innovation, Normalising Life Post-Diagnosis	Need for Awareness, Social Support, and Embracing Innovation
Improved temperature control: Develop more precise temperature control systems to maintain optimal cooling temperatures (around 18°C to 20°C) throughout the treatment.	improved temperature control develop precise temperature control systems maintain optimal cooling temperatures 18 c 20 c treatment	Temperature control	Technical Improvements
Make it cost effective	make cost~effective	Cost concerns	Affordability
Economic factors, success rate, visibility of the device can be masked	economic factors success rate visibility device masked	Cost concerns	Affordability
Reduces the negativity of taking chemotherapy	reduces negativity taking chemotherapy	Emotional Benefit	Psychological Well-being
It will very useful to the patients	useful patients	Perceived Benefit for Patients	Perceived Usefulness / Patient Benefit

Personally haven't used it as I'm not quite aware of this. However, increased patient education on such devices could increase its usage	personally haven t Never used m quite aware increased patient education devices increase usage	Lack of awareness	Need for Awareness
Since I don't have the experience of using this device I can't surely say. But by proving it's safety and efficacy I might be helpful	don't experience using device can't surely say. proving safety efficacy helpful	Side effects concerns	Safety
However, I also understand that cancer treatment itself is already a huge financial burden for many families. That's why I believe it's important to present scalp cooling as an option rather than a necessity, making sure patients and their families fully understand both its benefits and costs.	understand cancer treatment huge financial burden families s believe s important present scalp~cooling option necessity making sure patients families fully understand benefits costs	Cost concerns	Affordability
Before moving forward, I would always have an open discussion with them to confirm if it's financially feasible. If cost is a concern, I'd also explore whether insurance, subsidies, or NGO support could help make it more accessible in the future."	moving forward open discussion confirm s financially feasible cost concern d explore insurance subsidies ngo support help make accessible future	Cost concerns	Affordability
"Personalized Cooling Protocols:	personalized cooling protocols	Temperature control	Technical Improvements
* Research into individual variations in scalp temperature and blood flow could lead to more personalized cooling protocols. This could optimize effectiveness and minimize discomfort.	research individual variations scalp temperature blood flow lead personalized cooling protocols optimize effectiveness minimize discomfort	Temperature control	Technical Improvements
* Development of sensors that provide real-time scalp temperature monitoring could allow for dynamic adjustments to the cooling process.	development sensors provide real time scalp temperature monitoring allow dynamic adjustments cooling process	Temperature control	Technical Improvements
* Improved Cap Design:	improved cap design	Cap design	Device Comfort
* Enhancements in cap design to ensure consistent and uniform cooling across the entire scalp.	enhancements cap design ensure consistent uniform cooling entire scalp	Cap design	Device Comfort

* Increased comfort for the patient, with lighter, more flexible materials.	increased comfort patient lighter flexible materials	Comfort	Device Comfort
* Variations in cap sizes and shapes to accommodate diverse head anatomies.	variations cap sizes shapes accommodate diverse head anatomies	Cap design	Device Comfort
* Enhanced User Experience:	enhanced user experience	User experience	Technical Improvements
* Simplified setup and operation of cooling systems for both patients and healthcare providers.	simplified setup operation cooling systems patients healthcare providers	User experience	Technical Improvements
* Clearer and more accessible educational materials and support resources for patients.	clearer accessible educational materials support resources patients	Lack of awareness	Need for Awareness
* Integration of technology, such as mobile apps, to track treatment progress and provide guidance.	integration technology mobile apps track treatment progress provide guidance	Application Improvement	Technical Improvements
* Increased Accessibility and Affordability:	increased accessibility affordability	Access and affordibility	Access & affordibility
Scalp cooling devices could be improved with better cap fit for comfort, more consistent temperature regulation, and reduced application time. Enhancing affordability and accessibility would also benefit more users.	scalp~cooling devices improved better cap fit comfort consistent temperature regulation reduced application time enhancing affordability accessibility benefit users	Design, temperature control, cost concern, accesibility	Technical Improvements,Affordibility,Accessibility
It should be cost effective and should have positive impact on hair growth	cost~effective positive impact hair growth	Cost concerns	Affordability
Kindly update the details of such medical devices among the common people	kindly update details medical devices common people	Need for Public Awareness, Information Dissemination	Need for Awareness, Public Outreach
"Hi, I work in Oncology Unit in Philadelphia. Scalp cooling devices were not encouraged by our Oncologist due to its ineffectiveness. Patients can be very tired and have side effects of chemotherapy so they fail to continue with the cooling device."	hi work oncology unit philadelphia scalp~cooling devices encouraged oncologist ineffectiveness patients tired effects chemotherapy fail continue cooling device	Side effects concerns	Safety
It should be cost effective, guarantee, and it should not be harmful to health	cost~effective guarantee not~harmful health	Cost concerns	Affordability

7.4. Appendix – D – Table for Recommendations for Improving Availability and Accessibility

Question 24: *In your opinion, what changes or improvements could be made to enhance the availability and accessibility of scalp cooling devices in Southern India? Please elaborate.*

Raw Data	Cleaned Data for Word Cloud	Thematic Code	Theme
Affordable cost of the scalp cooling device & awareness by campaign through social media platforms	affordable cost, awareness, social media	Affordable cost and social media awareness	Affordability
Most people are not aware. Reduced cost of such device and promotion from healthcare professionals to the patient can boost the use of such devices. People may also like subscription if they are not willing to pay huge upfront cost.	awareness, reduced cost, promotion, subscription	Awareness and cost-reduction strategies	Awareness & Education
Most people are not aware. Reduced cost of such device and promotion from healthcare professionals to the patient can boost the use of such devices. People may also like subscription if they are not willing to pay huge upfront cost.	awareness, reduced cost, promotion, subscription	Awareness and cost-reduction strategies	Affordability
Do counselling to patients who undergo chemotherapy via physicians about effectiveness and correct usage, make aware patients about cost of device, insurance coverage, device servicing options, making sure of devices' availability in hospitals, different models of device, impact of usage during treatment.	counseling, chemotherapy, effectiveness, cost, insurance, availability	Comprehensive counseling approach	Healthcare System Involvement
Affordable cost of the scalp cooling device & awareness by campaign through social media platforms	affordable cost, awareness, social media	Affordable cost and social media awareness	Awareness & Education
Availability in local healthcare facilities and pharmacies.	availability, healthcare facilities, pharmacies	Availability in local facilities	Accessibility

Availability of the device in all health care facilities dealing with cancer or patients undergoing chemotherapy	availability, healthcare facilities, cancer patients	Universal availability in healthcare	Accessibility
Public awareness of the device has to be done in healthcare centres, hospitals and social media platforms. An initiative for an awareness class from the healthcare professional's side has to be done to the population for better awareness.	public awareness, healthcare centers, social media, awareness class	Public awareness and education	Awareness & Education
To improve scalp cooling device availability in Southern India, focus on raising awareness, integrating devices into hospitals, and supporting local manufacturing to reduce costs. Mobile units, insurance coverage, and CSR funding can address accessibility barriers. Partnerships and research can drive policy changes, while including scalp cooling in oncology guidelines and easing regulations will promote wider adoption.	awareness, integration, local manufacturing, insurance, mobile units, partnerships, policy changes	Comprehensive approach: awareness, accessibility, policy	Integrated Strategy
Set up centralized hubs in major cities like Chennai, Bangalore, and Hyderabad to store, maintain, and distribute scalp cooling devices	centralized hubs, distribution, cities	Centralized distribution hubs	Accessibility
More Availability or easy access	availability, easy access	Focus on availability and access	Accessibility
Making it cost effective and awareness	cost-effective, awareness	Affordability and awareness	Affordability
Create awareness among people about scalp cooling devices	awareness, public, scalp cooling	Public awareness creation	Awareness & Education
By making sure that the medical professionals are made aware of the existing device and recommending them to the patients.	medical professionals, awareness, recommendation	Medical professionals' role in awareness	Healthcare System Involvement

Making it cost effective and awareness	cost-effective, awareness	Affordability and awareness	Awareness & Education
Healthcare professionals' feedback is crucial, especially in explaining the device's benefits. The device should be easily accessible, and instructional videos can help reach patients. Clear guidelines on whether it's for self-use or professional use are essential. Positive feedback encourages trust.	healthcare professionals, feedback, accessibility, instructional videos, self-use	Professional feedback and patient guidance	Healthcare System Involvement
Should be easily accessible	easily accessible	Focus on accessibility	Accessibility
Low cost & more effective, No side effects	low cost, effective, no side effects	Cost-effectiveness and safety	Affordability
It should be available at government hospital and trusts	available government hospitals trusts	Public hospital availability	Accessibility
Partnership with hospitals and cancer centers	partnership hospitals cancer centers	Hospital collaborations	Healthcare System Involvement
Aware the patients and their families about this method and convince them	aware patients families convince	Educating patients & families	Awareness & Education
Awareness about these devices and benefits caused by it should be well known to patients	awareness benefits patients	Promote patient knowledge	Awareness & Education
First of all people should have knowledge about this and proving and letting the know that this device it's effective and safe and it gives the intended outcome.	knowledge, effective, safe, outcome	Demonstrate safety & effectiveness	Awareness & Education
Social awareness	social awareness	General public campaigns	Awareness & Education

* Increased Awareness and Education: * Conducting widespread awareness campaigns among oncologists, nurses, and patients about the benefits of scalp cooling. * Providing educational materials in regional languages to ensure clear understanding. * Organizing workshops and training sessions for healthcare professionals on the proper use and maintenance of scalp cooling devices. * Improved Infrastructure and Distribution: * Establishing partnerships with hospitals and cancer centers across Southern India to ensure wider availability of the devices. * Streamlining the distribution process to reduce delays in device delivery. * Ensuring that hospitals have the necessary infrastructure, including reliable electricity supply and maintenance support, to operate the devices effectively. * Cost Reduction and Financial Assistance: * Exploring options for reducing the cost of scalp cooling devices to make them more affordable. * Working with government agencies and insurance providers to increase coverage for scalp cooling therapy. * Establishing financial assistance programs to help patients who cannot afford the treatment.	awareness, education, cost, support, access	Comprehensive implementation strategy	Integrated Strategy

* Culturally Sensitive Approach: * Recognizing the cultural significance of hair in Indian society and addressing concerns about hair loss with sensitivity. * Providing culturally appropriate support and counseling to patients undergoing chemotherapy. * Ensuring that the devices and treatment protocols are adapted to the specific needs and preferences of the local population. * Technological Adaptations: * Adapting the technology to better suit the climate of southern India. This may mean, ensuring that the cooling units are able to function optimally in high heat and humidity. * exploring options for more portable and robust cooling units, that can withstand variable electrical supply. * Collaboration and Partnerships: * Fostering collaborations between medical institutions, technology providers, and patient advocacy groups. * Encouraging research and development to improve the effectiveness and affordability of scalp cooling devices			
By sharing the experiences of persons who used the devices.	sharing user experience	Use of peer stories	Awareness & Education
Many don't know that there is some thing called scalp cooling devices, awareness on these devices especially is oncology hospitals should be encouraged	lack of awareness, oncology, hospitals	Awareness gap in oncology	Awareness & Education

I feel not many people are aware about the scalp cooling devices and it's benefit in India, generally. More awareness about the same should be provided by counselors during sessions and doctors about it's cost, benefits and other relevant information so that many people become more aware on the same.	awareness, counseling, cost, benefits	Counseling & info dissemination	Awareness & Education
Price of the device has to be affordable and need to be easy to use	affordable, easy to use	Affordability and usability	Affordability
Good marketing	marketing	Marketing strategy needed	Awareness & Education
Awareness through Online Platforms	online platforms, awareness	Digital awareness efforts	Awareness & Education
Provide proper awareness	proper awareness	General awareness recommendation	Awareness & Education
Awareness to public about the device, Its pros and cons(if any), People's personal experience	awareness device pros cons experience	Information on pros, cons, and experiences	Awareness & Education
Scalp cooling technology has the potential to make a huge difference for cancer patients undergoing chemotherapy, but in Southern India, many people are still unaware of it. Patients and their families often focus entirely on survival, not realizing that preserving hair can also play a big role in emotional well-being during treatment. To change this, hospitals and cancer centers need to actively educate people through awareness campaigns, trained oncologists and pharmacists, and real-life stories from those who have	scalp cooling potential, emotional well-being, awareness, cost, accessibility	Awareness and emotional impact	Awareness & Education

benefited from scalp cooling. Cost is another major hurdle, so making it more affordable through subsidies, insurance coverage, or NGO support could help more patients access it without financial strain. Expanding its availability beyond major hospitals to regional cancer centers and even offering mobile scalp cooling services could ensure that even those in smaller towns and rural areas aren't left behind. With better awareness, financial support, and accessibility, scalp cooling can become a more widely accepted part of cancer care, helping patients feel more in control during one of the toughest times in their lives			
More awareness about the device among the masses	more awareness device	Public awareness needs	Awareness & Education
Awareness via Medical Professionals during sessions	medical professionals, awareness sessions	Role of healthcare professionals in awareness	Healthcare System Involvement
I think lack of awareness about the device need to be addressed first	lack awareness device	Awareness gap	Awareness & Education
Promoting the products with its benefits	promoting benefits	Promoting product benefits	Awareness & Education
Bring more awareness to public & healthcare professionals	awareness public healthcare professionals	Public & professional awareness	Awareness & Education
* Increased Awareness and Education: * Conducting widespread awareness campaigns among oncologists, nurses, and patients about the benefits of scalp cooling.	awareness education, campaigns, hospital partnerships, insurance, localize technology	Comprehensive solution: awareness, access, culture, tech	Integrated Strategy

* Providing educational materials in regional languages to ensure clear understanding. * Organizing workshops and training sessions for healthcare professionals on the proper use and maintenance of scalp cooling devices. * Improved Infrastructure and Distribution: * Establishing partnerships with hospitals and cancer centers across Southern India to ensure wider availability of the devices. * Streamlining the distribution process to reduce delays in device delivery. * Ensuring that hospitals have the necessary infrastructure, including reliable electricity supply and maintenance support, to operate the devices effectively. * Cost Reduction and Financial Assistance: * Exploring options for reducing the cost of scalp cooling devices to make them more affordable. * Working with government agencies and insurance providers to increase coverage for scalp cooling therapy. * Establishing financial assistance programs to help patients who cannot afford the treatment. * Culturally Sensitive Approach: * Recognizing the cultural significance of hair in Indian society and addressing concerns about hair loss with sensitivity. * Providing culturally			

appropriate support and counseling to patients undergoing chemotherapy. * Ensuring that the devices and treatment protocols are adapted to the specific needs and preferences of the local population. * Technological Adaptations: * Adapting the technology to better suit the climate of southern India. This may mean, ensuring that the cooling units are able to function optimally in high heat and humidity. * exploring options for more portable and robust cooling units, that can withstand variable electrical supply. * Collaboration and Partnerships: * Fostering collaborations between medical institutions, technology providers, and patient advocacy groups. * Encouraging research and development to improve the effectiveness and affordability of scalp cooling devices			
Generating awareness among people through social media handles help to target those people who rely on the online platforms for getting informations. But this may limit awareness among old aged people. So a combination of online awareness programme and offline would add more value as well as credibility to the topic.	social media, awareness, online offline	Digital and traditional awareness mix	Awareness & Education
To improve scalp cooling accessibility in Southern India, local manufacturing, insurance coverage, and hospital partnerships are key.	local manufacturing, insurance, hospital partnerships	Accessibility through local resources	Accessibility

More cost effective and creating awareness among the people	cost-effective, awareness	Affordable and educational efforts	Affordability
Knowledge sharing about the device and its uses by Healthcare professionals	knowledge sharing, healthcare professionals	Knowledge sharing by professionals	Healthcare System Involvement
Could be provided for free	free device	Accessibility and affordability	Affordability
It should be available in local government hospital and easily usable by the patient	available local government hospitals, easy to use	Government availability and ease of use	Accessibility
Make aware of the existence of that device	awareness existence	Raising awareness of existence	Awareness & Education
Improving the availability and accessibility of scalp cooling devices in Southern India requires several key changes. Reducing costs through subsidies, insurance coverage, and government support would make treatment more affordable. Expanding availability in hospitals and cancer centers, especially in rural areas, is crucial. Raising awareness among patients and healthcare providers through education and testimonials could increase adoption. Local manufacturing and distribution would help lower costs and ensure a steady supply. Additionally, developing mobile or home-based scalp cooling solutions could improve access for patients in remote regions. Addressing these factors could significantly enhance the reach of scalp cooling therapy.	availability, accessibility, subsidies, insurance, awareness, mobile solutions	Expanding availability and accessibility	Accessibility
Awareness among health care workers especially the consultants.	awareness healthcare workers consultants	Awareness among healthcare providers	Healthcare System Involvement

Create awareness among the general public about the device, highlighting the positive response of patients during its usage.	awareness public, positive response, patient experience	Positive patient testimonials	Awareness & Education
The price can be made into affordable	affordable price	Affordability focus	Affordability
I'm not aware	not aware	Lack of awareness	Awareness & Education
Education through health care professionals and government support schemes to make it available with low cost.	education, healthcare professionals, government support, low cost	Professional education and government support	Healthcare System Involvement
Health care professionals recommending the device and share testimony	healthcare professionals, recommendation, testimony	Professional recommendation	Healthcare System Involvement
By campaign the product through social media and advertising through healthcare professionals and make sure cost is effective for everybody so people will accept it to go for it	social media, healthcare professionals, cost-effective	Digital and professional marketing	Awareness & Education
Through social media awareness from medical professionals	social media, awareness, medical professionals	Social media and professional awareness	Awareness & Education
Educating the patient and family member about this device and It should be cost effective.	educating patient family, cost-effective	Education and affordability focus	Awareness & Education
Proper awareness of the procedure and benefits	proper awareness, procedure benefits	Educating on procedure and benefits	Awareness & Education
More information and awareness on what a scalp cooling device is as it is pretty unheard of	more information, unheard of	Need for more information	Awareness & Education
Awareness	awareness	General awareness call	Awareness & Education

Make it easily available for all	easily available	Universal accessibility	Accessibility
Establish the device with FDA approval	FDA approval	Regulatory approval for credibility	Healthcare System Involvement
Good marketing and the efficacy of product	marketing, efficacy	Effective marketing and product efficacy	Awareness & Education
I wasn't aware of such device being used until I joined this survey. Lack of awareness among people about the device and it's effectiveness, patient's experience and lack of promotion should be tackled	lack of awareness, effectiveness, promotion	Awareness and promotion needs	Awareness & Education
Cost effective	cost-effective	Affordability	Affordability
It should be available in all health care centres	available healthcare centers	Widespread healthcare availability	Accessibility
It should be made readily available in hospitals and health care workers should promote this through campaigns, social media	readily available hospitals, healthcare workers, promotion	Promoting through healthcare systems	Healthcare System Involvement
Better make the devices better accessible with best prices that an already heavily paying cancer patient to bear the cost.	better accessibility, affordable prices	Affordability and accessibility for cancer patients	Affordability
Awareness, ease of access and insurance coverage options	awareness, access, insurance coverage	Key factors for successful adoption	Integrated Strategy