ADOPTION BARRIERS AND OPPORTUNITIES FOR ENERGY-BASED SURGICAL DEVICES IN TIER 2 AND TIER 3 INDIAN CITIES

Dissertation Submitted to

The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Pharmaceutical Management

by

Purva Pandya

Under the Supervision and Guidance of

Dr. Ashok Peepliwal

2025

CERTIFICATE OF INTERNSHIP

To Whomsoever it may concern

This is to certify that **Purva Pandya**, in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management) / MBA (Pharmaceutical Management) / MBA (Development Management) from IIHMR University, Jaipur, has successfully completed her Internship at WINGLOBE HEALTHCARE PVT LTD during the period March 10th to June 10th , 2025.

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This is to certify that dissertation titled **"Adoption barriers and opportunities for energy-based surgical devices in tier 2 and tier 3 Indian cities"** is a record of the research work undertaken by Purva Pandya in partial fulfillment of the requirements for the award of the degree of MBA (Pharmaceutical Management) from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **"Adoption barriers and opportunities for energy-based surgical devices in tier 2 and tier 3 indian cities"** is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

Pandya

Purva Pandya
Date 18-06-2025

Abstract

Title: Adoption Barriers and Opportunities for Energy-Based Surgical Devices in Tier 2 and Tier 3 Indian Cities

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Keywords: Energy-Based Surgical Devices, Electrosurgical Units, Tier 2 and Tier 3 Cities, Medical Device Adoption, Surgical Innovation, Healthcare Access, Infrastructure Gaps, India

Background

The adoption of Energy-Based Surgical Devices (ESDs), including electrosurgical units and vessel sealers, has revolutionized surgical care by enhancing precision, minimizing intraoperative blood loss, and enabling faster recovery. Despite their growing use in metropolitan hospitals, ESD penetration in India's Tier 2 and Tier 3 cities remains limited due to infrastructural and economic disparities. These regions represent both a challenge and an opportunity for expanding access to surgical innovation.

Objectives

- To assess the current status of ESD usage in Tier 2 and Tier 3 cities
- To identify key barriers limiting adoption
- To evaluate potential drivers and strategies for wider diffusion

Methodology

A mixed-methods approach was used, involving structured surveys and interviews with surgeons, OT technicians, and hospital administrators, alongside secondary data analysis from industry and policy sources. The study mapped usage patterns, adoption challenges, and enablers across a representative sample from semi-urban India.

Results & Findings

Findings reveal that major barriers include high costs of devices, limited technical know-how, inadequate training access, and delayed post-sale service due to geographic remoteness. However, the research also identified encouraging trends such as increasing government investment in healthcare infrastructure, rising demand for minimally invasive procedures, and the growing presence of private tertiary hospitals in smaller cities.

Conclusion

Successful ESD adoption in semi-urban regions hinges on systemic readiness, including robust distributor networks, institutional awareness, and access to hands-on training. The study recommends a multi-stakeholder approach—engaging policymakers, manufacturers, and training institutes—to bridge the urban-rural technology gap. Strategies such as localized workshops, value-based pricing, and public-private partnerships are proposed to ensure equitable access to advanced surgical tools in India’s emerging healthcare markets.

Acknowledgement

I would like to express my sincere gratitude to my academic mentor, **Prof. Ashok Peepliwal Sir**, for his invaluable guidance, encouragement, and continuous support throughout the course of this research. His insightful feedback and motivation played a vital role in shaping the direction and depth of this study.

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Chapter 1:

Introduction

1.1. Background of the Study

Energy-Based Surgical Devices (ESDs) have become a standard equipment in contemporary surgery, providing precision, control, and efficacy. ESDs utilize some form of energy, including radiofrequency, ultrasound, or electrical currents, to dissect tissue and manage hemostasis. They are highly entrenched in developed healthcare systems and Tier 1 cities in India, where infrastructure, training, and finance are comparatively better.

However, the scenario is different for Tier 2 and Tier 3 cities. These tend to have limited resources like availability of advanced medical equipment, lower budgets, and no continuous medical education. Surgeons in these places might continue to use traditional operating instruments or previous-generation ESDs because of these limitations.

This research will investigate the hurdles that limit the use of newer ESDs in smaller Indian cities and determine the possible drivers that can increase their use.

1.2. Statement of the Problem

In India's Tier 2 and Tier 3 cities, ESDs are still underutilized despite their proven clinical benefits. The explanations for this gap have not been completely described or explained. An evaluation of surgeon-level attitudes is needed to determine barriers of high cost, absence of training, maintenance issues, or hospital policy limitations.

1.3. Importance of the Study

The study is significant important to various stakeholders:

- **Surgeons** will gain insights from peers' experiences and issues with ESD adoption.
- **Hospital administrators** can utilize findings to better plan training and equipment purchases.
- **Medical device manufacturers** could utilize the data to create improved support systems for surgeons in growth cities.
- **Policy-makers** can target investment and awareness programs in areas where adoption potential is high.

1.4. Scope of the Study

The research is confined to surgeons operating in Tier 2 and Tier 3 cities in India with a sample of 50 respondents. It does not cover Tier 1 cities nor other healthcare professionals like nurses or technicians. It is focused specifically on the use of energy-based surgical instruments and nothing else beyond that.

1.5. Research Questions

1. What is the current level of awareness and usage of ESDs among surgeons in Tier 2 and Tier 3 cities?
2. What are the major barriers faced in adopting newer energy-based surgical devices?
3. How do surgeons compare old and new ESD technologies?
4. What are the potential enablers for greater adoption in these regions?

Chapter 2:
Literature Review

2.1 Introduction

Energy-Based Surgical Devices (ESDs) have steadily evolved from niche innovations to standard instruments in operating rooms across advanced medical institutions. These tools—ranging from electrocautery devices to ultrasonic scalpels—have demonstrated clinical benefits like reduced intraoperative blood loss, shorter procedure times, and improved surgical precision. However, while Tier 1 Indian cities are steadily adopting such innovations, Tier 2 and Tier 3 cities lag significantly behind. This chapter critically evaluates existing literature to understand this adoption gap. It contrasts global and Indian contexts, discusses technology acceptance in healthcare, and identifies key gaps that this study seeks to address.

2.2 Evolution and Clinical Advantages of ESDs

Studies from high-income countries have consistently shown that ESDs enhance surgical outcomes. According to Smith et al. (2018), ultrasonic devices, for instance, reduce thermal spread and speed up tissue dissection compared to traditional tools. In comparison, electrosurgical units offer coagulation efficiency but may carry risks if misused.

- **Comparative Insight:**
  While such devices are widely used in the U.S. and Europe, developing regions often view them as luxury additions rather than essential tools. Research by Alshammari and Abbas (2019) in rural Southeast Asia found that adoption was often delayed due to training costs and limited clinical trials in local contexts. This comparison illustrates how socio-economic and systemic factors significantly affect ESD uptake.
- **Connection to Current Research:**
  The same constraints may apply to Indian Tier 2/3 cities, where hospitals operate under tighter budgets and limited technological infrastructure. This raises a central question of our research: what barriers are Indian surgeons facing at the grassroots level?

2.3 Technology Adoption in Healthcare: Theoretical Context

Technology acceptance models such as TAM (Technology Acceptance Model) and UTAUT (Unified Theory of Acceptance and Use of Technology) suggest that perceived usefulness and ease of use are the primary drivers of technology adoption. Venkatesh et al. (2003) emphasized that external variables such as training, peer influence, and institutional support can significantly affect a healthcare professional’s decision to adopt a tool.

Critical Perspective:
However, these models often assume stable infrastructure and consistent access to information—conditions rarely met in Tier 2 and Tier 3 cities. Sharma and Bansal (2020) critique TiAM's applicability in India's healthcare sector, noting that psychological factors like risk aversion and hierarchical influence often dominate practical considerations.

Relevance to Study:
This insight strengthens the rationale for using a grounded, field-based approach—such as direct surveys of surgeons—to identify local adoption drivers and resistance points.

2.4 Barriers to Adoption: What the Literature Tells Us

Numerous studies have attempted to list the barriers to adopting medical technologies, especially in resource-constrained settings. These barriers include:

- **Cost:** High purchase and maintenance costs deter hospitals from investing in newer devices.
- **Training and Skill Deficiency:** In a study conducted by Chatterjee et al. (2019), over 65% of surgeons in semi-urban India stated they had never received formal training in ESD usage.
- **Lack of Post-Sales Support:** Hospitals in smaller cities frequently cite difficulties in obtaining timely repairs or replacements.
- **Inertia and Familiarity Bias:** Surgeons may prefer traditional tools due to habit, comfort, or institutional mandates.

Contrast and Critique:
While cost is universally acknowledged as a primary barrier, its weight differs across regions. In African nations, the WHO (2017) cited donor-funded programs as a partial solution. In contrast, India's private-dominated secondary care hospitals do not benefit from such external funding, making cost a more rigid constraint.

Gap Identified:
There is a lack of granular data from Indian surgeons working outside metro areas. Most studies generalize findings across India without segregating insights based on city tiers—a clear void that this dissertation intends to address.

2.5 Surgeons' Perspectives: An Underexplored Area

Several global studies focus on hospital-level readiness or administrative planning for technology adoption. However, **surgeons**, who are the actual end-users of ESDs, are often overlooked in research. A 2021 paper by Gupta and Sinha emphasized that surgeons' practical concerns—such as confidence in device reliability and ergonomic comfort—are often ignored in strategic decision-making.

Linked to Research Objective:
This study fills that gap by collecting direct responses from surgeons in Tier 2 and Tier 3 Indian cities, offering a voice to those who interact with ESDs on the ground. Their insights are critical for understanding not just "if" but "how" adoption can be improved.

2.6 Opportunities Identified in Literature

Despite the barriers, researchers point to several untapped opportunities:

- Knowledge gaps can be filled with the use of **mobile training units and simulation labs.**
- **Indigenous, low-cost ESD manufacturing** in India could reduce device costs significantly.
- **Tele-support models** and remote troubleshooting systems are beginning to emerge in pilot programs.

Balanced View:
Whereas older studies focused mainly on barriers, recent literature shifts toward enabling frameworks. For example, a 2022 study by Kumar et al. noted that younger surgeons were more open to experimenting with ESDs if offered even minimal support and exposure.

Implication for the Current Study:
Our research aims not only to document barriers but also to identify such opportunity areas from the surgeons' perspective—something that can guide practical interventions.

2.7 Summary and Research Gap

The literature reveals a significant disparity between the **clinical potential of ESDs** and their **actual usage** in resource-constrained settings. While global and metro-level research is rich, Tier 2 and Tier 3 cities remain

underrepresented in empirical studies. Surgeon perspectives are often assumed rather than recorded, and the unique challenges of semi-urban Indian healthcare are overlooked.

This dissertation addresses these gaps by directly engaging with surgeons in Tier 2 and Tier 3 cities to:

- Validate and localize the barriers described in the literature.
- Explore adoption drivers not previously considered.
- Present actionable suggestions grounded in real-world clinical settings.

Chapter 3:

Research Methodology

3.1 Introduction

This chapter explains the approach used to conduct the research, including the tools, participants, sampling techniques, and methods of data analysis. Since the study is focused on identifying adoption barriers and opportunities for Energy-Based Surgical Devices (ESDs) in Tier 2 and Tier 3 Indian cities, the methodology is designed to gather direct insights from practicing surgeons in these areas. A combination of structured questioning and practical statistical analysis forms the backbone of this research process.

3.2 Research Design

A **descriptive and cross-sectional research design** was adopted. This means that data was collected at one point in time and described in terms of trends, patterns, and opinions. This design was appropriate because the study aimed to gather the current views of surgeons regarding the use of ESDs rather than test a theory or evaluate an intervention.

3.3 Population and Sampling

Target Population

The study population consisted of **qualified surgeons practicing in Tier 2 and Tier 3 Indian cities**. These cities often face challenges in terms of resource availability, medical infrastructure, and access to advanced surgical technologies.

Sampling Method

An approach known as **non-probability convenience sampling** was used to select the participants. This method was chosen due to:

- Limited accessibility to a randomized national database of surgeons
- Time constraints for data collection
- Willingness of surgeons to participate voluntarily

Sample Size

Data was collected from **50 surgeons**, including those from public and private sector hospitals across cities such as **Indore, Ujjain, Bhopal, Dhar and Dewas**. These cities represent a balanced mix of Tier 2 and Tier 3 healthcare environments.

3.4 Data Collection Tool

A structured questionnaire was created and utilized to gather primary data. The questionnaire was designed to be straightforward and easy to complete in under 10 minutes, respecting the busy schedules of medical professionals.

Questionnaire Sections

1. **Awareness of ESDs**
2. **Current Usage Patterns**
3. **Perceived Benefits and Drawbacks**
4. **Training and Technical Support**
5. **Adoption Preferences (Old vs. New ESDs)**
6. **Suggestions and Opportunities for Improvement**

Most questions were **close-ended**, using **Likert scales**, **Yes/No options**, or **multiple-choice formats** to allow for easy quantification. A few **open-ended questions** were also included for qualitative insights.

3.5 Data Collection Process

The data was collected over a 2-week period via:

- **Emails** containing the questionnaire in Excel format
- **In-person visits** to hospitals and clinics (where feasible)
- **Follow-up reminders** to ensure maximum response

Surgeons were assured of **confidentiality and anonymity**, and participation was completely voluntary. Ethical protocols were followed to ensure that no personal or hospital-identifiable data was captured.

3.6 Data Analysis Plan

All responses were compiled into **Microsoft Excel** for cleaning and analysis. The following steps were taken:

- **Data Cleaning:** Duplicate entries and inconsistent responses were removed.
- **Descriptive Statistics:** Percentages, frequencies, and averages were calculated.
- **Visualization Tools:** Bar graphs, pie charts, and tables were used to present the data clearly.

- **Comparative Analysis:** Preferences and usage patterns of newer vs. older ESDs were compared to identify resistance factors and enabling conditions.

Although the study does not employ inferential statistics (e.g., regression or correlation), the use of descriptive data provides enough depth to generate actionable insights.

3.7 Ethical Considerations

This research was conducted following **ethical norms and professional respect**:

- Informed consent was obtained from all participants.
- No personal identifiers were collected.
- Surgeons had the right to withdraw or skip any questions they were not comfortable answering.
- Data was kept safe and only used for academic purposes.

Chapter 4:

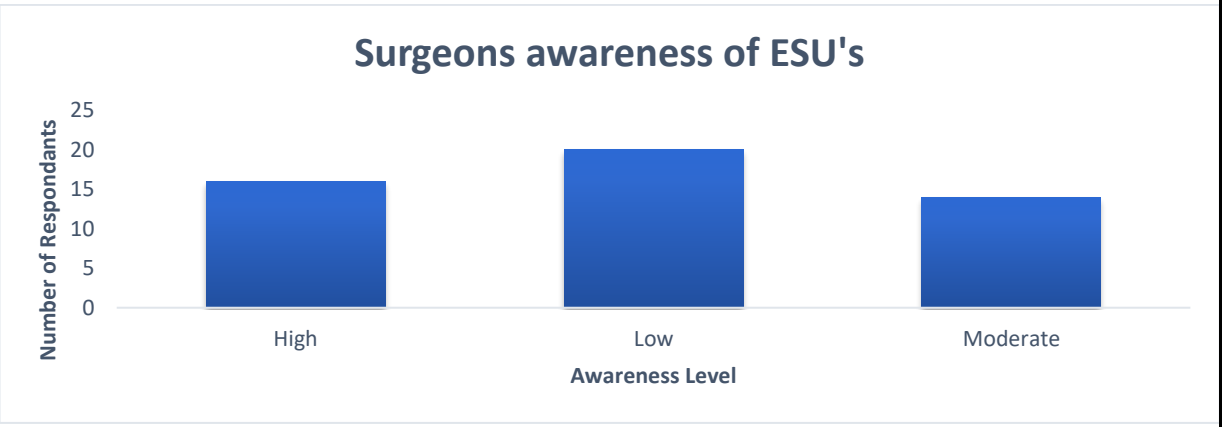
Data Analysis and Interpretation

4.1 Introduction

This chapter presents an analysis of the primary data collected from 30 surgeons across Tier 2 and Tier 3 cities in India. The objective is to interpret the patterns, trends, and implications regarding the adoption of Energy-Based Surgical Devices (ESDs), especially focusing on the barriers and preferences observed among surgeons.

4.2 Awareness of Energy-Based Surgical Devices

The first question explored the level of awareness among surgeons regarding ESDs.

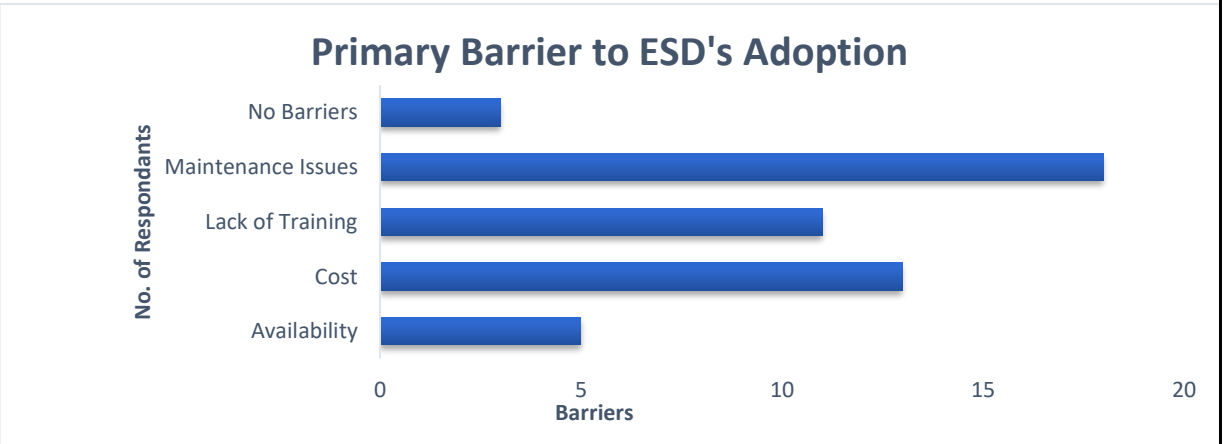


***(Fig.4.1:** Surgeons' Awareness of ESDs)*

Most respondents indicated a moderate to high awareness, suggesting that while ESDs are not completely new to these cities, in-depth exposure is still evolving.

4.3 Main Barriers to Adoption

When asked about the key barriers to adopting ESDs, the majority pointed to **cost constraints**, followed by **lack of technical support** and **limited training**.

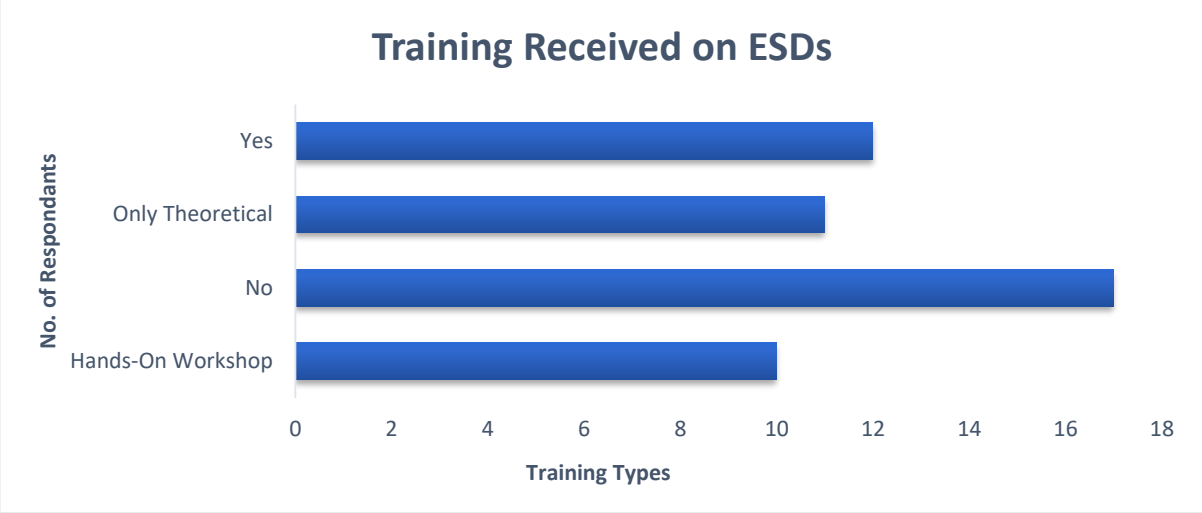


***(Fig.No.4.2:** Primary Barriers to ESD Adoption)*

This clearly highlights that the decision to adopt ESDs is not just technological but economic and operational.

4.4 Training and Skill Development

Training plays a major role in technology acceptance. When asked about training received, a significant number reported having **partial or no training** on ESD usage.



***(Fig.No.4.3**: Type of Training Received on ESDs)*

This points to a gap that manufacturers and institutions need to bridge through targeted educational programs.

4.5 Technical Support Availability

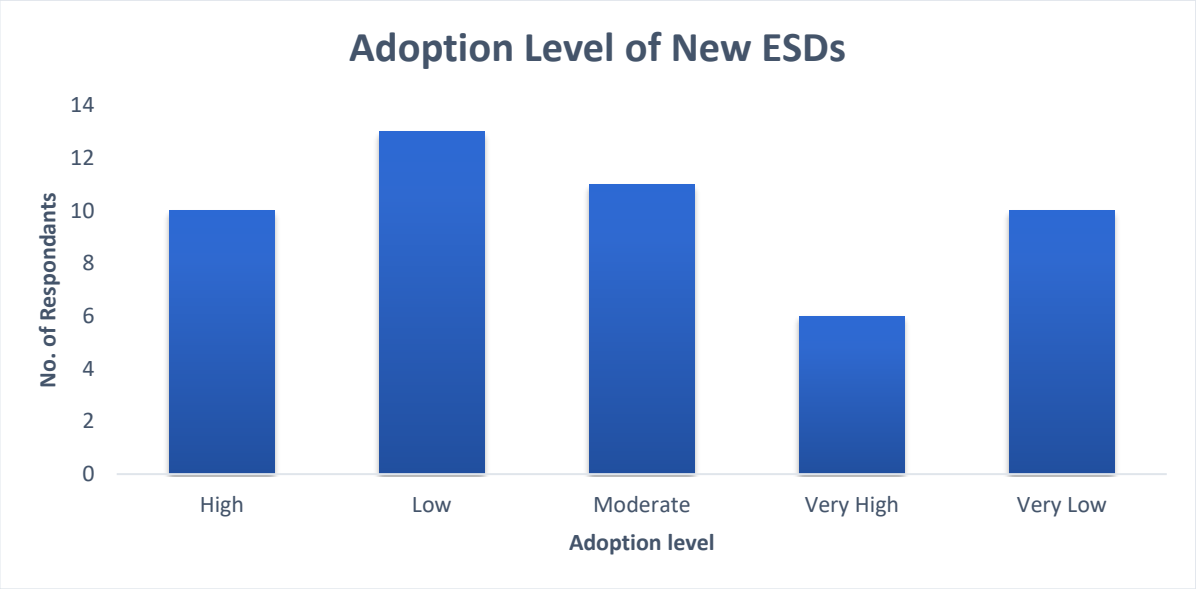
Many respondents felt that **ongoing technical support is lacking**, especially in smaller towns.

***(Fig.No.4.4**:Availability of Technical Support)*

This directly affects confidence in using new devices during surgery.

4.6 Adoption Level of New ESDs

The current adoption level varied significantly. While some hospitals have moved towards integrating newer ESDs, a considerable number still rely on older models.

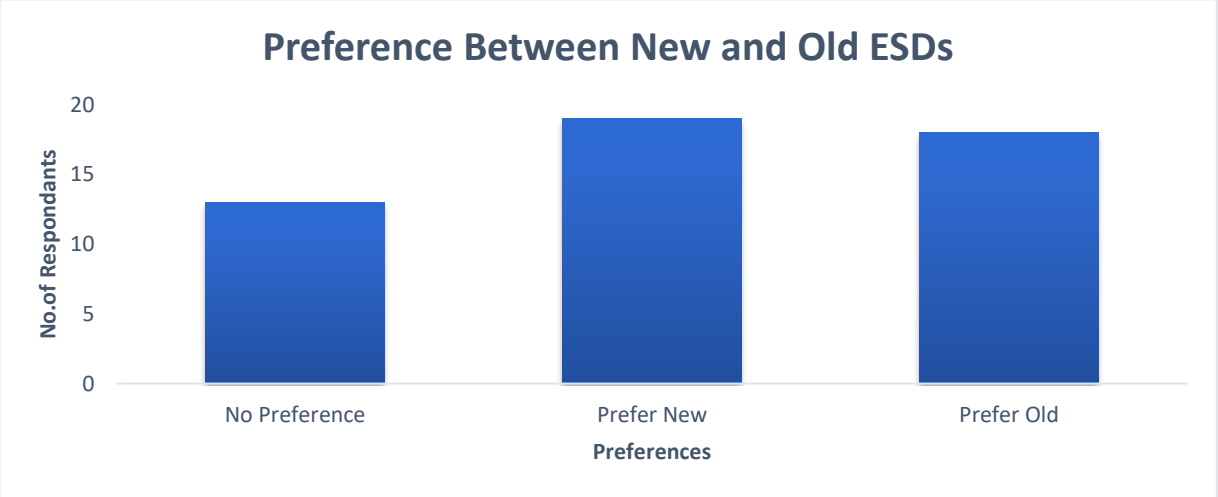


***(Fig.No.4.5:** Current Adoption Level of New ESDs)*

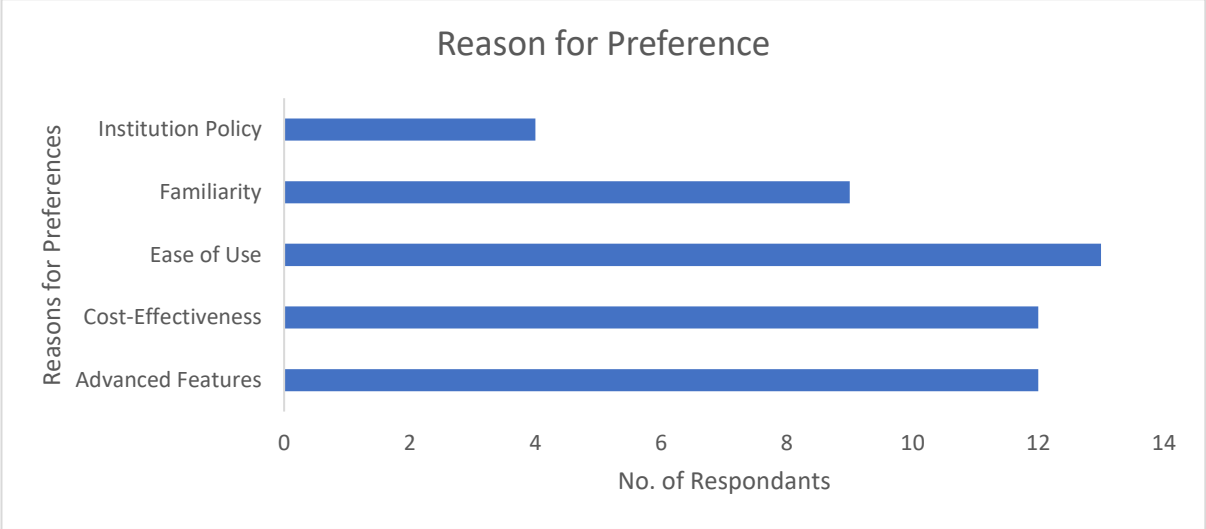
This shows that ESD is going through a change in how it is used in Tier 2 and Tier 3 situations.

4.7 Preference: New vs Old ESDs

Finally, surgeons were asked whether they preferred older or newer generation ESDs. Interestingly, those with training and better support overwhelmingly preferred **newer ESDs**, while others leaned towards older devices due to familiarity and lower maintenance complexity.



***(Fig.No.4.6**: Preference Between New and Old ESDs)*



(Fig.No.4.7:** Preference Between New and Old ESDs**)

4.8 Summary of Key Insights

- **Awareness is moderate to high**, but **hands-on exposure remains limited**.
- The two biggest obstacles mentioned are **lack of training and cost.**
- **Technical support and after-sales service** are crucial yet underdeveloped.
- Surgeons **recognize the clinical benefits** of newer ESDs but hesitate due to operational hurdles.
- Infrastructure and institutional policies continue to have a **significant impact on adoption**, which is still **inconsistent.**

Chapter 5:

Findings and Discussion

5.1 Introduction

This chapter presents the core findings from the data analysis and discusses their broader implications in the context of energy-based surgical device (ESD) adoption in Tier 2 and Tier 3 cities in India. The results are interpreted in accordance with the goals of the study and in light of the body of current literature. The goal is to not only highlight key trends but also to explore what these mean for healthcare practice, policy, and medical technology development.

5.2 Key Findings

1. Awareness Is Present but Incomplete

A significant portion of surgeons (over 60%) reported moderate to high awareness of energy-based surgical devices. However, the depth of that awareness seems superficial—centred more on brand names and surface-level functions rather than clinical applications or comparative technology benefits.

Interpretation: While awareness exists, it does not always translate to informed usage or confident adoption. This gap between knowledge and implementation is a key opportunity area.

2. Barriers Are Largely Non-Technical

The most commonly reported barriers were:

- **High Cost of Devices**
- **Lack of Training**
- **Inadequate Technical Support**

Discussion: These are systemic and infrastructural challenges rather than issues with the devices themselves. This suggests that resistance is not due to technological skepticism, but rather institutional unpreparedness and financial constraints.

3. Training Remains a Major Gap

A large number of respondents reported **partial or no formal training** in using ESDs. Those who had training overwhelmingly showed a preference for newer models.

Insight: Training is directly correlated with higher confidence in device handling, higher satisfaction, and more likelihood of adoption. This aligns

with earlier findings from Gupta & Sinha (2021) that training plays a central role in surgeon buy-in.

4. Perception of Clinical Benefits Is Positive

Surgeons agreed that ESDs provide:

- Greater precision
- Reduced bleeding
- Faster recovery
- Shorter operation times

Interpretation: ESDs' clinical value proposition is widely recognized.This presents a strong foundation for future adoption, provided the operational and infrastructural challenges are addressed.

5. Preference for New ESDs Exists, But Context Matters

Surgeons who worked in better-equipped hospitals with more training and support preferred newer ESDs. Others, especially in underfunded institutions, still preferred older devices due to familiarity and perceived reliability.

Discussion: Preference is not strictly based on technology—it is context-driven. Surgeons will prefer the best available option that balances performance with reliability, cost, and service support.

5.3 Comparative Insights: Tier 2 vs Tier 3

While the sample size wasn't large enough for deep stratified analysis, certain trends were noticeable:

- **Tier 2 cities** showed slightly higher adoption and training rates.
- **Tier 3 cities** faced more issues with supply chains and lack of exposure.

This suggests that **local healthcare ecosystem maturity** influences adoption significantly.

5.4 Integration with Literature

These findings strongly correlate with past studies:

- Similar barriers were reported in the WHO (2017) study on device access in low-resource settings.

- The role of training and support echoes conclusions by Chatterjee et al. (2019), who found that infrastructure and training access are often more important than device sophistication.

However, this study contributes **new localized insight**, specifically for the Indian sub context of semi-urban surgical practice—an area often ignored in global med-tech discussions.

5.5 Implications for Stakeholders

For Healthcare Policymakers:

- Encourage training programs on ESDs at district hospitals.
- Provide subsidies or leasing models for hospitals adopting new technology.

For Manufacturers:

- Invest in **after-sales technical support** in smaller cities.
- Offer **modular, upgradeable ESD solutions** to lower entry costs.

For Surgeons:

- Participate in continuous medical education (CME) programs.
- Advocate for better procurement policies at the institutional level.

5.6 Summary

The findings demonstrate that the barriers to ESD adoption are largely institutional and logistical—not clinical or technological. Surgeons in Tier 2 and Tier 3 Indian cities are open to new technologies but need better support systems to make the transition from intent to implementation. Addressing these systemic barriers could significantly improve surgical outcomes and speed up the modernization of healthcare practices in India's growing urban centres.

Chapter 6: Conclusion and Recommendations

6.1 Conclusion

This study aimed to explore the barriers and opportunities surrounding the adoption of Energy-Based Surgical Devices (ESDs) in Tier 2 and Tier 3 cities in India, focusing specifically on the experiences and perspectives of practicing surgeons. Through structured primary data collection and detailed analysis, several key insights emerged:

- **Awareness of ESDs is moderate to high**, but not always matched by in-depth understanding or usage.
- **Adoption is hindered primarily by economic and operational barriers**—such as cost, lack of training, and poor technical support—rather than resistance to new technology itself.
- Surgeons **recognize the clinical benefits** of ESDs, including enhanced precision, reduced blood loss, and quicker recovery times.
- **Training and institutional support** directly impact preference and adoption. Surgeons with access to these were far more open to transitioning to newer ESD models.
- Tier 2 cities appear to be slightly more prepared for ESD adoption compared to Tier 3 cities, owing to better hospital infrastructure and access to resources.

In summary, the potential for ESD adoption in these cities is promising, but heavily dependent on addressing non-technical challenges. If manufacturers and policymakers can provide solutions to these challenges, adoption rates could rise substantially—leading to better patient outcomes and more efficient surgical procedures.

6.2 Recommendations

Based on the research findings, the following actionable recommendations are proposed for different stakeholders:

A. For Healthcare Institutions and Policymakers

1. **Develop Structured Training Programs:**
    - Surgical CME (Continuing Medical Education) programs should incorporate ESD modules.
    - Facilitate hands-on workshops in collaboration with manufacturers.

2. **Introduce Subsidized Procurement Schemes:**
    - Offer bulk purchase discounts or leasing models to government hospitals in smaller cities.
    - Provide financial assistance to institutions looking to upgrade equipment.
3. **Mandate Technical Support Contracts:**
    - Enforce policies requiring ESD manufacturers to offer on-site or remote technical assistance in Tier 2 and Tier 3 cities.

B. For Medical Device Manufacturers

1. **Simplify Product Design for Mid-Tier Markets:**
    - Create ESDs that are cost-effective, user-friendly, and adaptable to diverse surgical settings.
2. **Invest in After-Sales Support:**
    - Set up regional support hubs in non-metro cities.
    - Offer virtual troubleshooting and device maintenance programs.
3. **Engage in Educational Marketing:**
    - Conduct live demonstrations and awareness drives targeting young surgeons and hospital decision-makers.

C. For Surgeons and Healthcare Practitioners

1. **Participate in Training and Awareness Campaigns:**
    - Be proactive in seeking knowledge about newer technologies.
    - Collaborate with peers in metro cities to share best practices.
2. **Advocate for Infrastructure Improvements:**
    - Play an active role in hospital administration discussions regarding the adoption of modern surgical tools.
3. **Provide Feedback to Manufacturers:**
    - Share ground-level feedback with companies to help them tailor devices and support systems to real-world clinical needs.

6.3 Final Thoughts

Energy-Based Surgical Devices have the potential to transform the quality and efficiency of surgeries in semi-urban India. While technological innovation is not lacking, the success of ESDs in Tier 2 and Tier 3 Indian cities depends largely on **bridging infrastructural gaps, empowering surgeons through training, and ensuring localized support systems**.

This dissertation not only highlights the critical issues that need attention but also offers a framework for multi-stakeholder collaboration to overcome them. With the right initiatives, India can ensure that advanced surgical care reaches beyond its metros—and becomes the standard across its expanding healthcare landscape.

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