

**Comparative Analysis of Radiofrequency
Vessel sealer and Ultrasonic vessel sealer in
surgery**

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Table of Content

-  Title
-  Introduction
-  Objective
-  Survey methodology
-  Finding
-  Conclusion



Introduction

Ancient Beginnings (3000 B.C. – Middle Ages):

Egyptians used heated metal tools ("cautery") to stop bleeding and treat tumors.

Hippocrates (Greece) and **Albucasis** (Islamic Golden Age) promoted surgical cautery.

The concept of “**electricity**” originated from **Thales**, who observed attraction by rubbed amber (elektron).

Scientific Advances (16th–19th Century):

Ambroise Paré introduced **ligation of vessels**, reducing pain and improving outcomes.

William Gilbert coined “electricity” and studied magnetism.

Benjamin Franklin, **Luigi Galvani**, **Alessandro Volta**, and **Michael Faraday** laid the foundation of **electrophysiology and energy generation**.

Early Medical Use (20th Century Onwards):

High-frequency energy introduced for fulguration, coagulation, and desiccation.

William T. Bovie developed the first electrosurgical generator, used by **Dr. Harvey Cushing** in neurosurgery.

This collaboration led to the **standardization of electrosurgery** in operating rooms globally.

Objective

- **To compare the effectiveness of RF and ultrasonic vessel sealing in various surgical procedures**
- **To evaluate differences in operative time, blood loss, and clinical outcomes**
- **To provide recommendations for clinical application based on procedure type**



SURVEY METHODOLOGY



Questionnaire : Semi structured Questionnaire

Sampling : Nonprobability sampling

Target doctor :
Ms Gynae and OBS , Ms Oncology, Ms GI and Bariatric surgeon , General surgeon

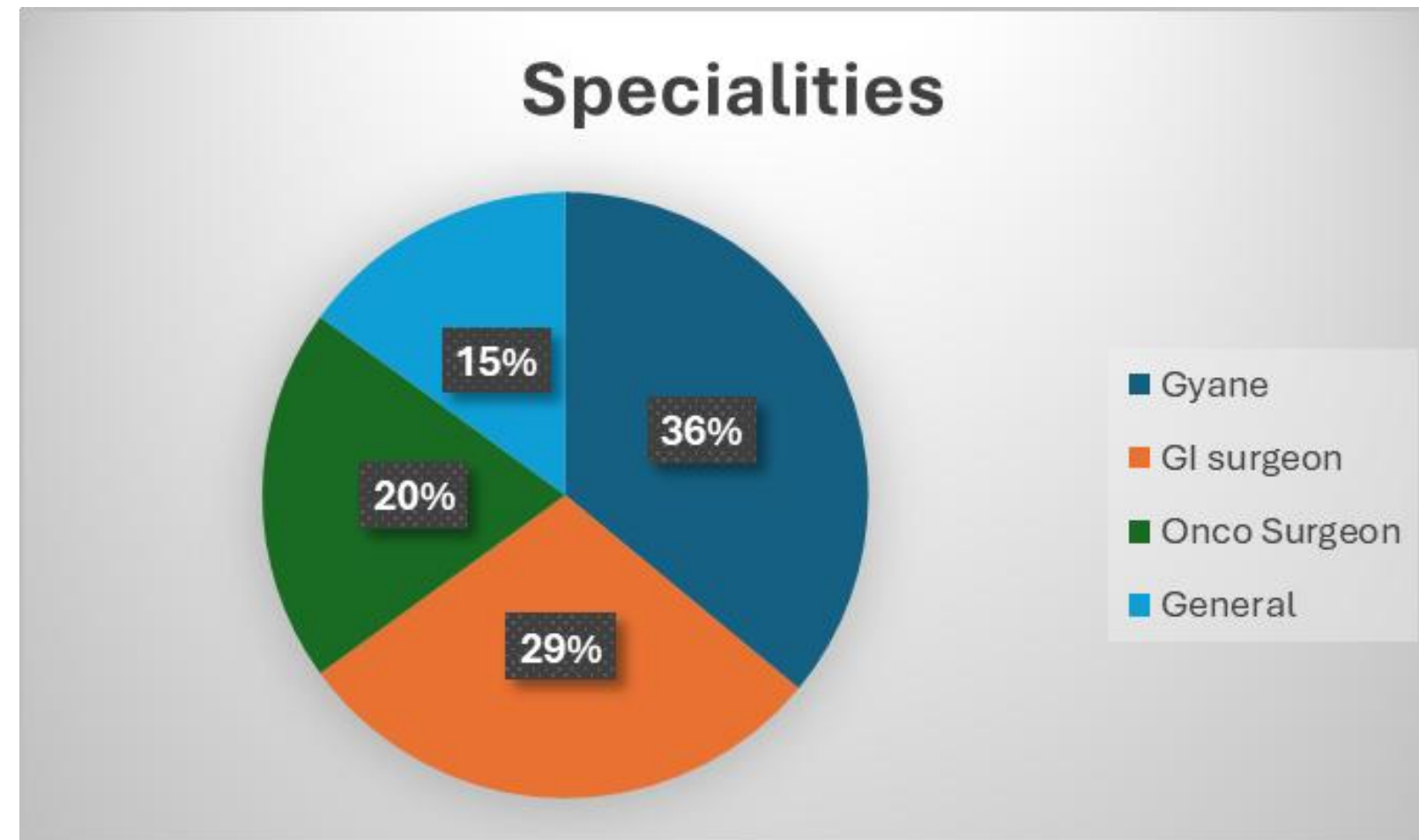
Content : Questionnaire consisted of the qualification of HCP, Types of devices used, preferred device, unmet needs and related question.

Data collection : Responses of the HCPs were collected by visiting OPD, OT,clinics etc.

FINDINGS

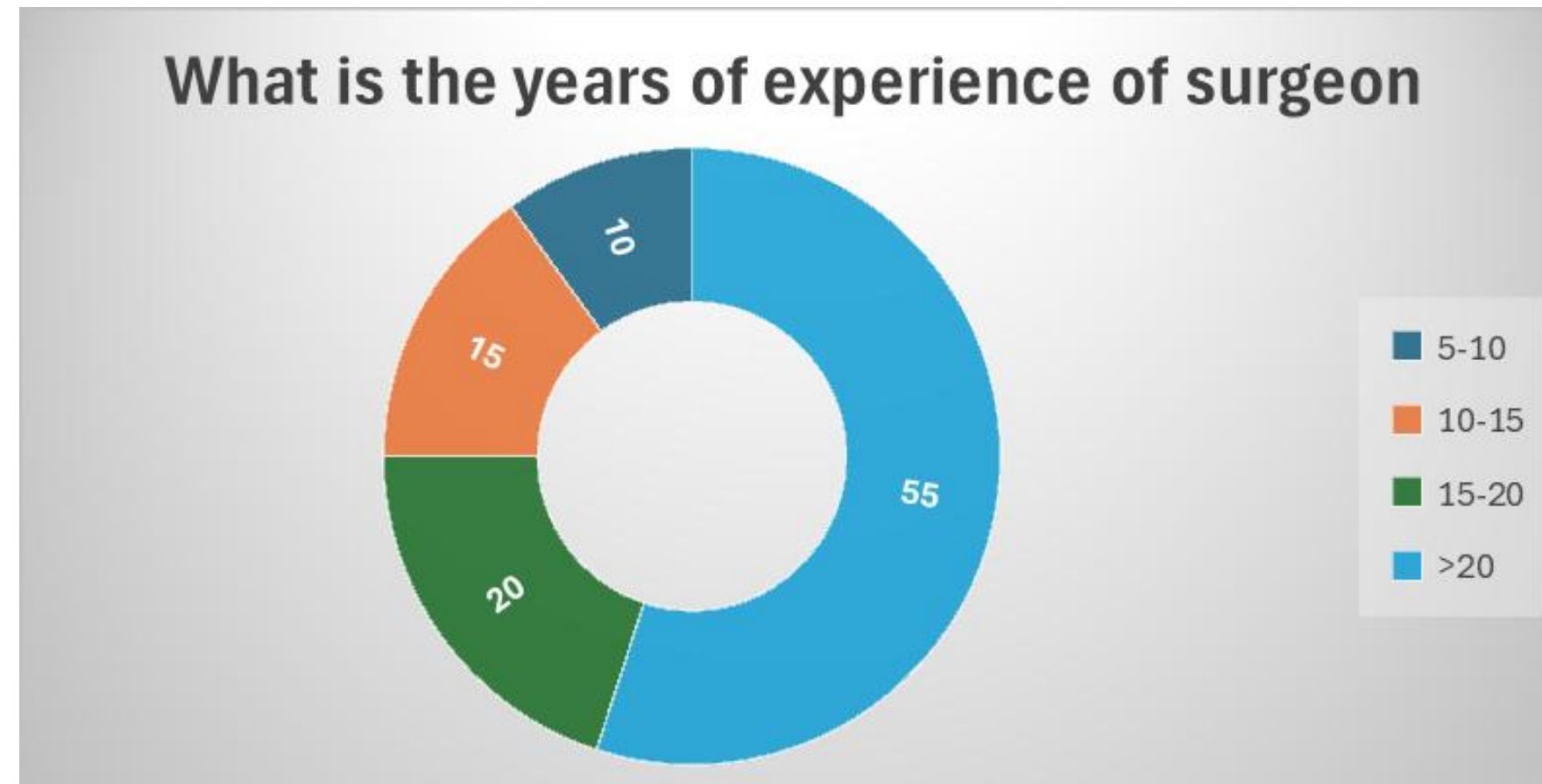


What is the surgeon Specialty?



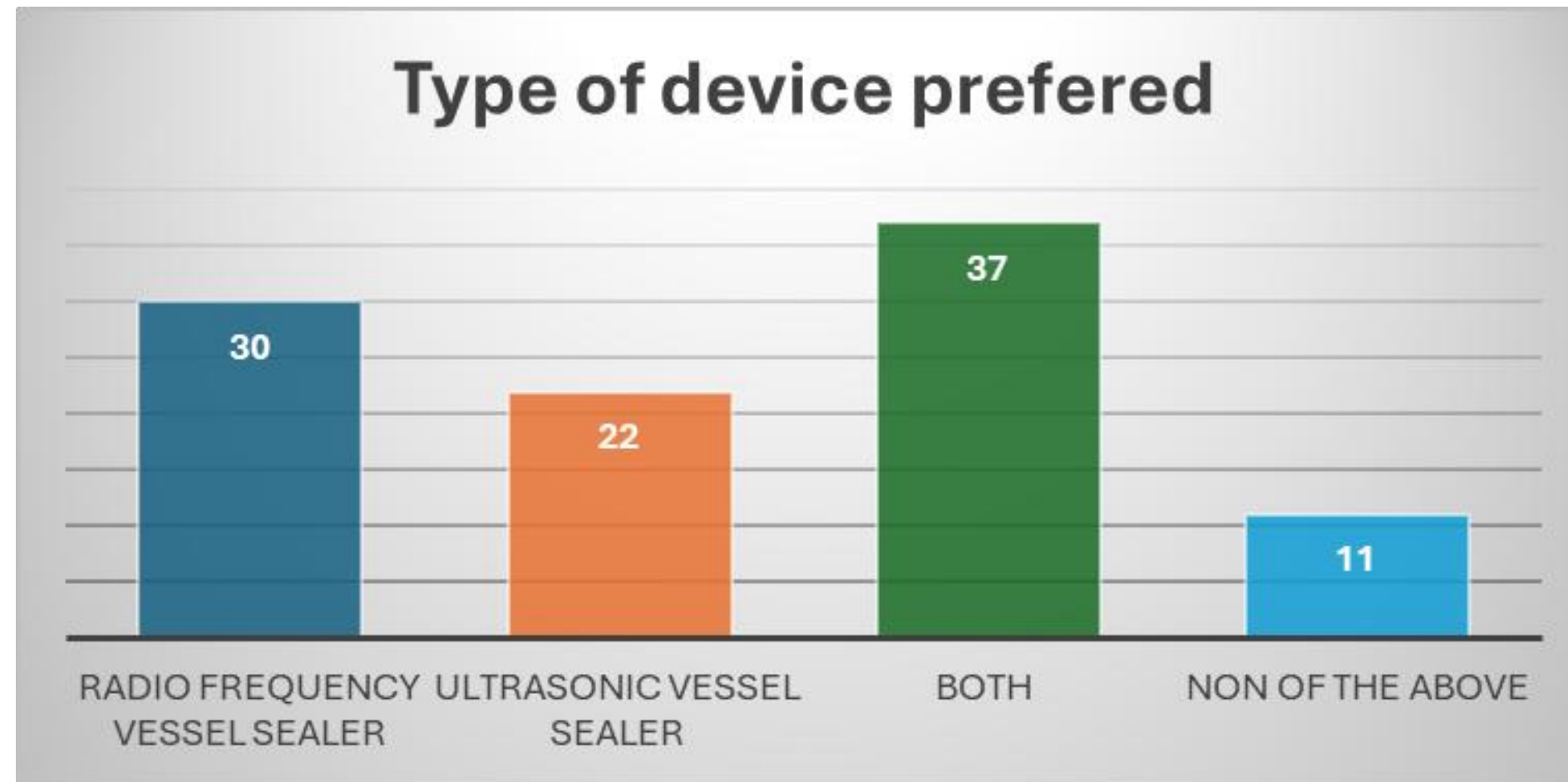
Inference: Gynaecologists form the largest specialty group among the respondents (36), followed by GI surgeons (29) and Onco surgeons (20). General surgeons make up the smallest group (15).

What is the years of experience of surgeon



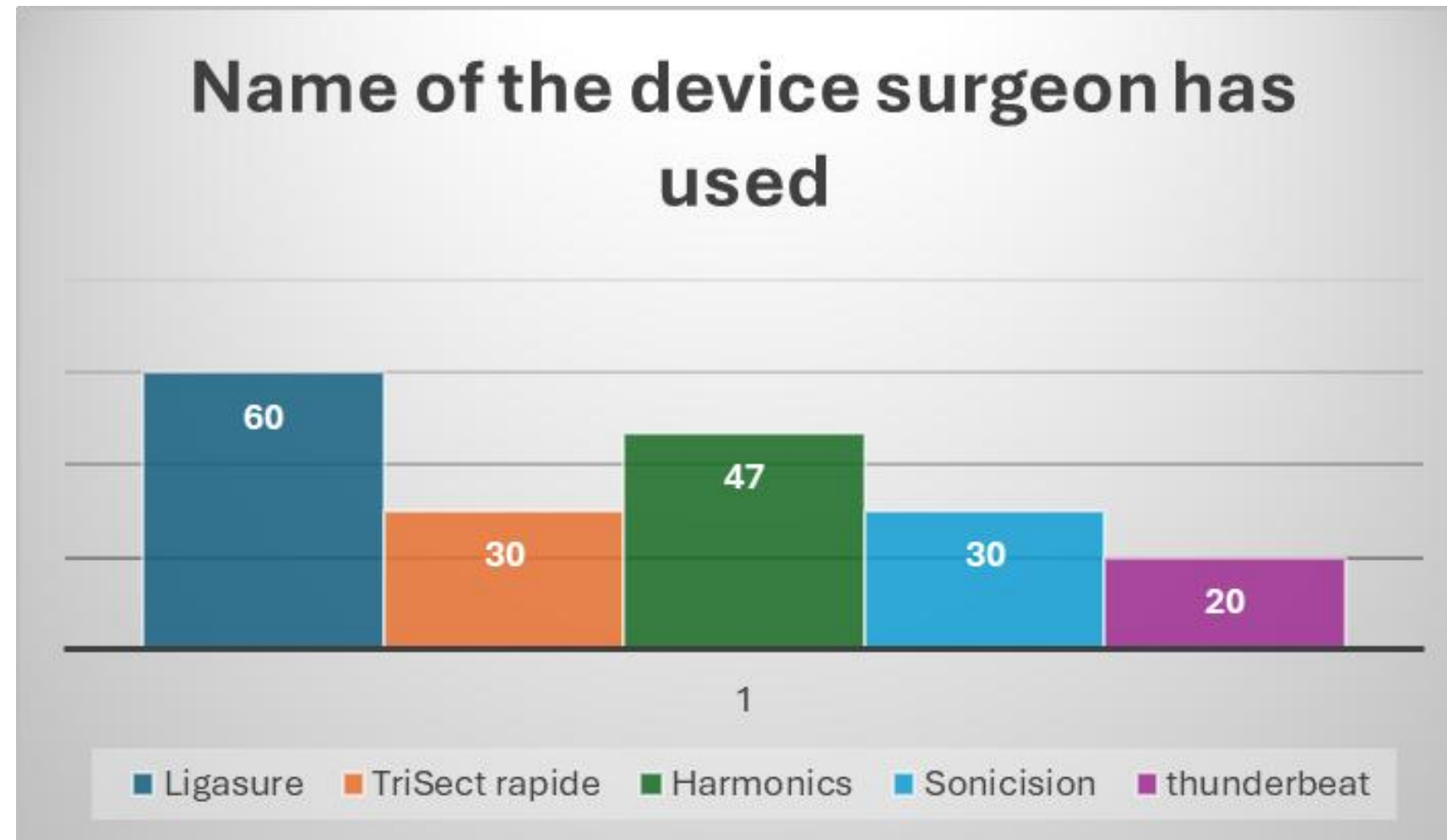
Inference: A significant majority of surgeons surveyed have extensive experience: 55% have over 20 years of experience, and another 20% have 15-20 years of experience. This indicates a highly experienced surgical cohort. While rest of the 25% have experienced ranging from 5-15 years.

Which energy devices do you currently use in your surgical practice?



Inference: A considerable number of surgeons (37) prefer to use both radiofrequency and ultrasonic vessel sealers, indicating a versatile approach to energy device utilization. Radiofrequency vessel sealers are preferred by 30 surgeons, while ultrasonic vessel sealers are preferred by 22.

Name of the device surgeon has used



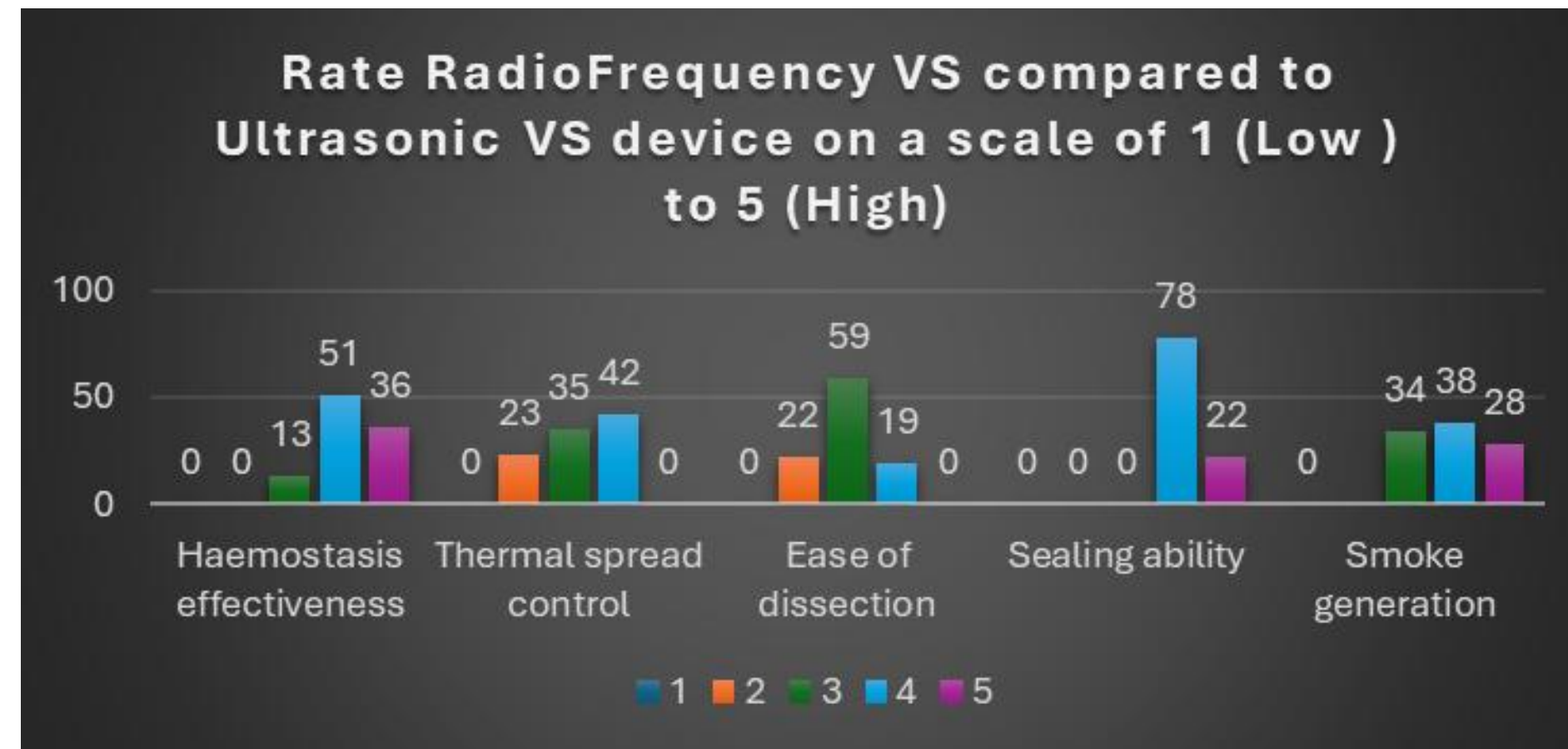
Inference: The most frequently used device among surgeons is Ligasure (60), followed by Harmonics (47). Trisect rapide (30) and Sonicision have been used by 30 surgeons each, while thunderbeat has been used by 20. This indicates that surgeon prefer to use multiple instruments during procedures

In which procedures do you most commonly use these devices?

- Total Vaginal hysterectomy (TVH)
- Laparoscopic supracervical hysterectomy (LSH)
- Total laparoscopic hysterectomy (TLH)
- Laparoscopically assisted vaginal hysterectomy (LAVH)
- Total abdominal hysterectomy (TAH)
- Radical Abdominal Hysterectomy (RAH)
- Gastrectomy
- Splenectomy
- Esophagogastrostomy
- Nissen Fundoplication
- Liver Resection Omentectomy



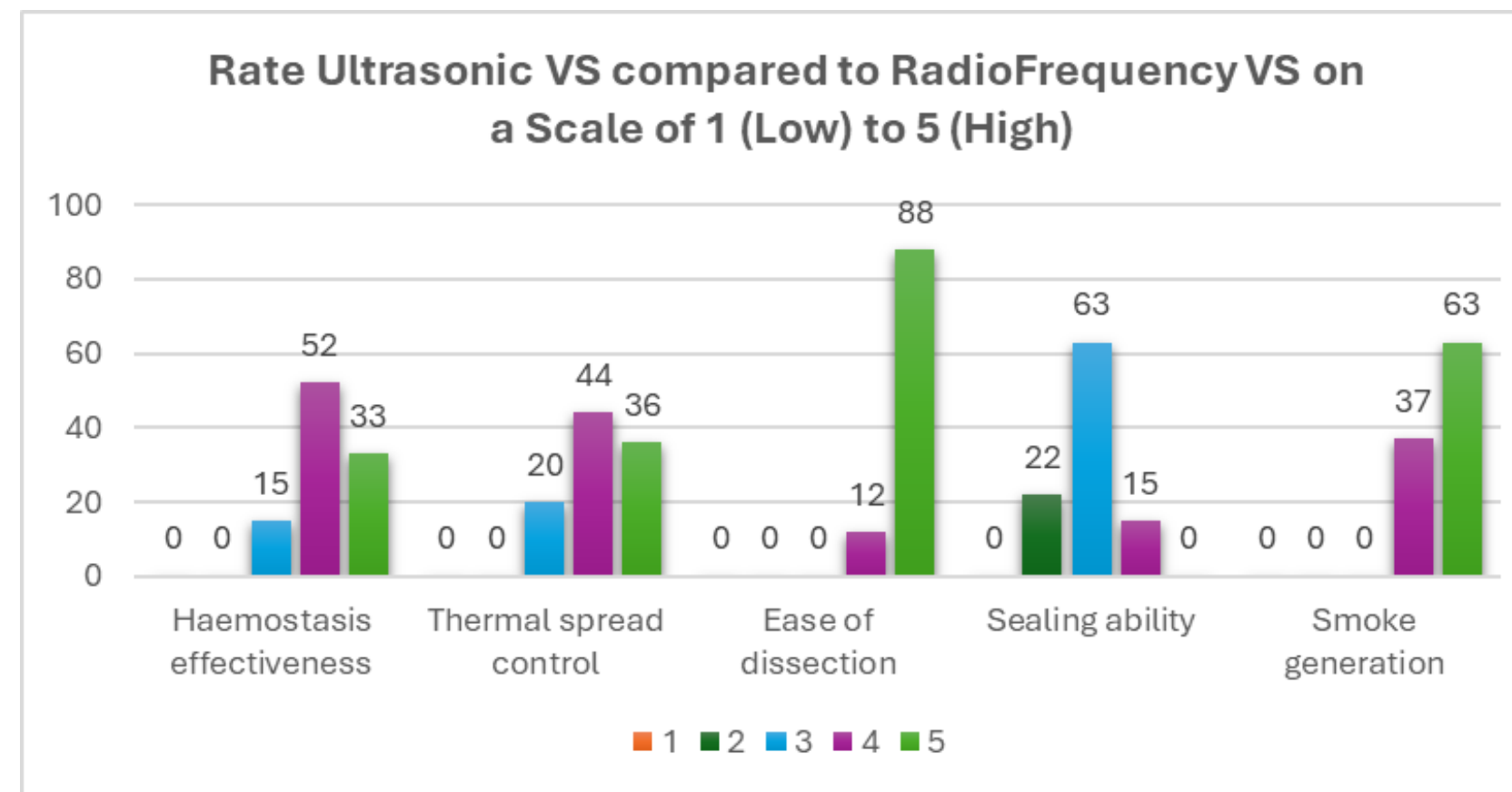
Rate Radio Frequency VS compared to Ultrasonic VS device on a scale of 1 (Low) to 5 (High) each device on a scale of 1 (Poor) to 5 (Excellent):



Inference: Radiofrequency (RF) Vessel Sealers Are highly rated for sealing ability, with 78% of respondents rating them 4 and 22% rating them 5.

- Are generally considered effective for haemostasis, with 51% rating them 4 and 36% rating them 5.
- However, thermal spread control (23% rating 2, 35% rating 3) and ease of dissection (22% rating 2, 59% rating 3) are areas where they receive lower ratings.

Rate Ultrasonic VS compared to Radio Frequency VS on a Scale of 1 (Low) to 5 (High) each device on a scale of 1 (Poor) to 5 (Excellent):



Inference: Ultrasonic Vessel Sealers:

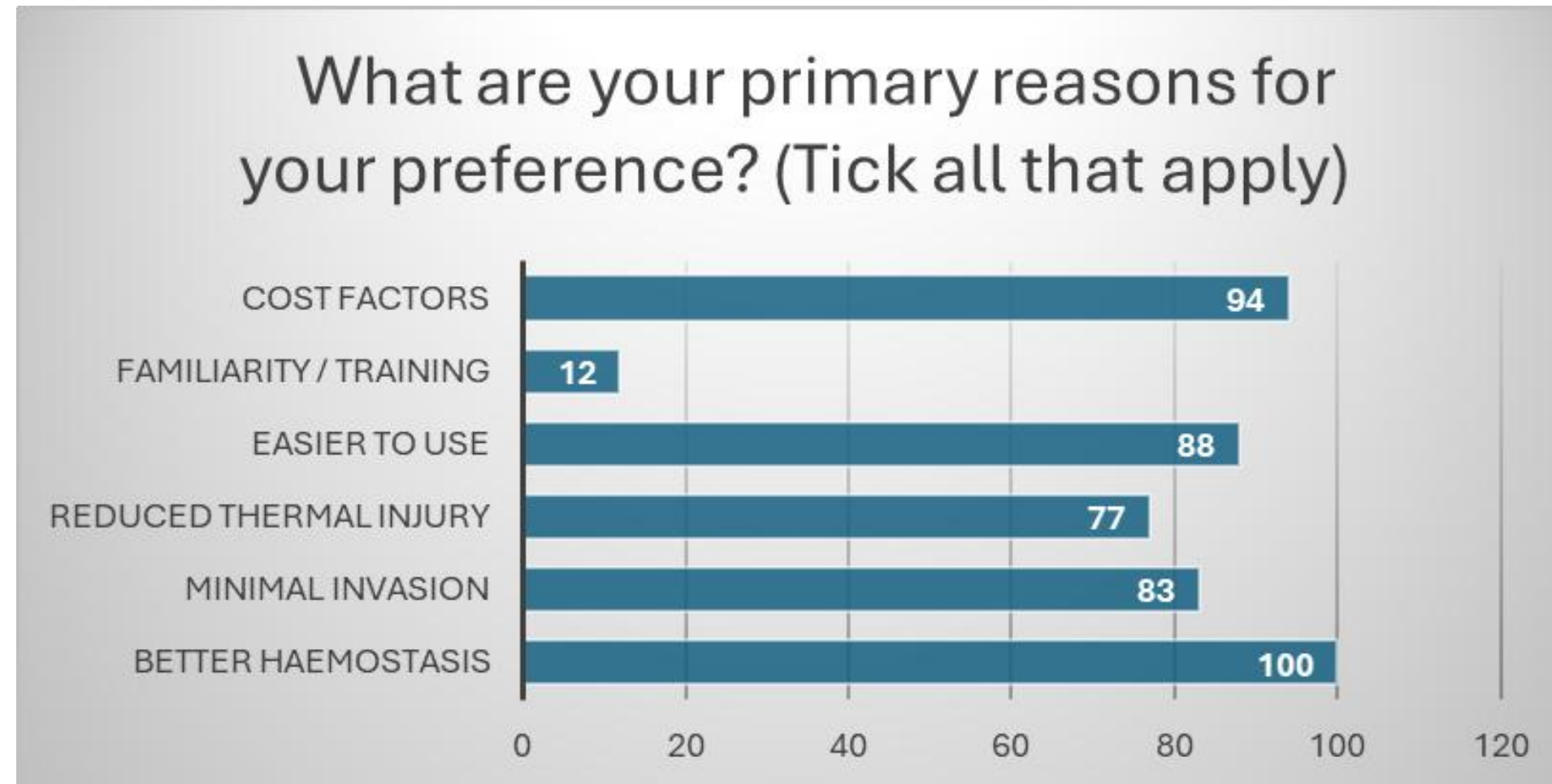
Excel in ease of dissection, with 88% of respondents rating them 5 and 12% rating them 4.

Are highly regarded for smoke generation control, with 63% rating them 5 and 37% rating them 4.

Show good haemostasis effectiveness (52% rating 4, 33% rating 5) and thermal spread control (44% rating 4, 36% rating 5).

Their sealing ability is rated lower compared to RF devices, with 63% rating them 3 and 22% rating them 2.

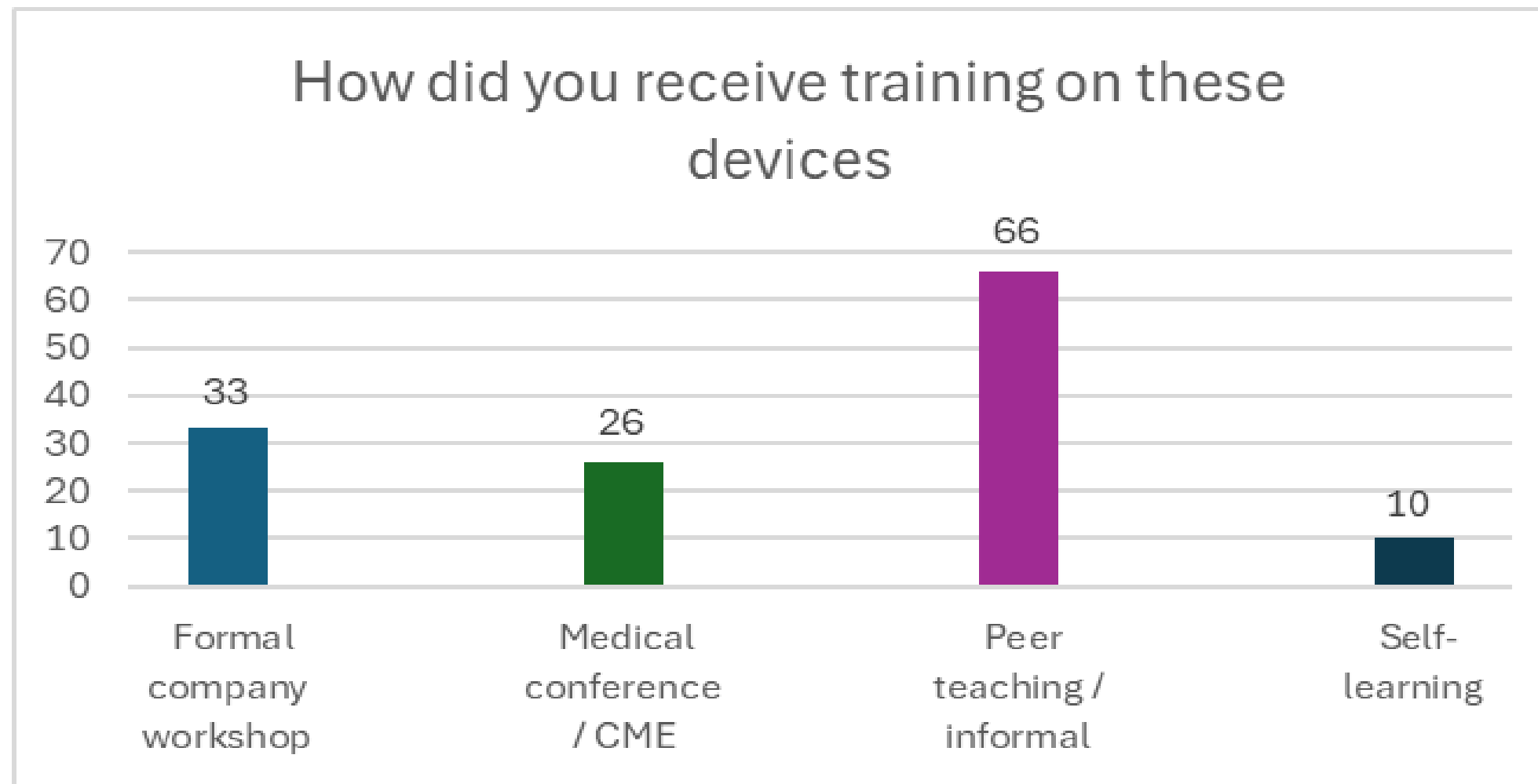
What are your primary reasons for your preference? (Tick all that apply)



Inference: The primary reasons for device preference are strongly tied to surgical outcomes: Better

- Haemostasis (100 responses), Stands out to be
- Cost factors (94 responses)
- Easier to use (88 responses)
- Minimal invasion (83 responses)
- Reduced thermal injury (77 responses) are also highly valued.
- Familiarity/training is the least cited reason for preference (12 responses)

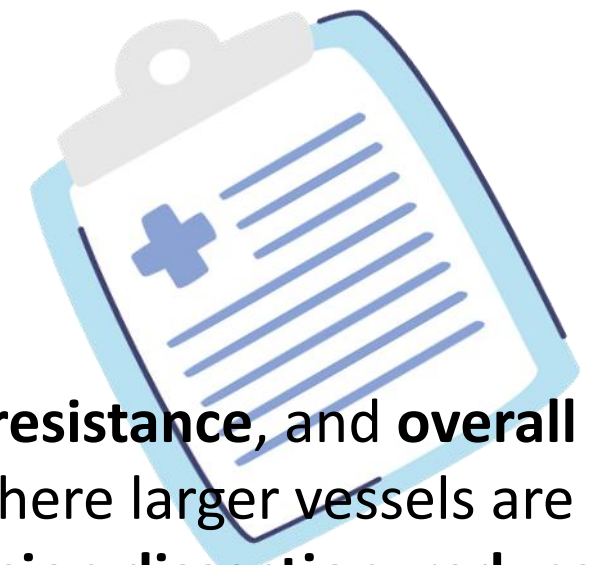
How did you receive training on these devices?



Inference: Majority for the HCP learned about the devices from their peers during procedure i.e 66%
While Formal company workshop and CME make for almost 50% of training
Only 10% had learned through self training.



Conclusion



Performance-Based Strengths:

RF devices such as *LigaSure* and *Ligapro* demonstrated superior performance in **sealing strength, burst pressure resistance, and overall haemostasis**, making them particularly suitable for **major abdominal, oncological, and gynecological surgeries** where larger vessels are involved. US devices like *Harmonic Scalpel* and *Sonicision*, while slightly less robust in sealing ability, excel in **precision dissection, reduced lateral thermal spread, and low smoke generation**, which are crucial in **laparoscopic, endoscopic, and delicate tissue surgeries**.

Adaptability and Usage Patterns:

A notable 37% of surveyed surgeons use both RF and US technologies based on **surgical context**. This adaptive approach reflects a maturing understanding in the surgical community of tailoring energy modality to **procedure type, anatomical site, and patient safety requirements**.

Surgeon Experience and Preference:

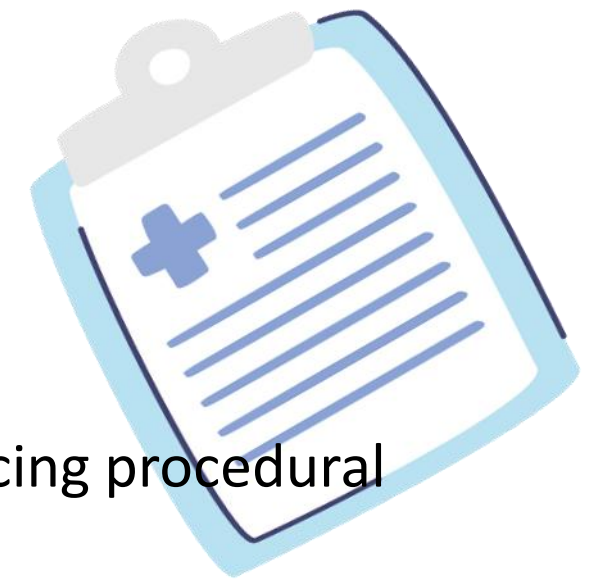
The majority of respondents had over **15–20 years of surgical experience**, lending significant credibility to their evaluations. Surgeons prioritized **clinical outcomes over brand familiarity**, indicating a shift from product loyalty to **evidence-based preference**.

Training and Learning Curve:

Most surgeons gained familiarity with these devices through **peer learning (66%)**, followed by **formal workshops and CME programs**. This highlights a need for **structured and standardized training modules** provided by manufacturers to reduce the learning curve and enhance safe adoption.



Conclusion



Device-Specific Observations:

RF devices received top ratings for **sealing reliability** and **haemostasis**.

Ultrasonic devices were preferred for **ease of use**, **ergonomic design**, and **lower fogging/smoke output**, reducing procedural interruptions.

Procedure-Specific Applications:

In surgeries such as **TLH**, **TVH**, **radical hysterectomy**, **gastrectomy**, and **splenectomy**, both devices showed utility, with **RF devices** used for **vascular control** and **ultrasonic devices** favored for **tissue separation** and **precise dissection**.

Economic Considerations:

Although ultrasonic systems often come with a higher initial cost, their **reduced operative time**, **lower blood loss**, and **faster recovery times** can offset expenses. Hospitals must weigh **device cost vs. procedure efficiency**, especially in high-volume settings.

Future Outlook and Technological Convergence:

With the rise of **hybrid systems** (e.g., Thunderbeat) and **AI-enabled tissue sensing** in RF systems, the functional distinction between RF and US technologies is narrowing. Future innovations may lead to **multi-energy platforms**, combining the best of both modalities.

The findings affirm that **no single device is universally superior**. The **optimal approach** lies in **matching the device's technical strengths with surgical needs**, guided by surgeon expertise and supported by institutional resources. This dissertation contributes to the ongoing discourse on **evidence-driven surgical decision-making** and emphasizes the value of maintaining **technological versatility** in modern operating rooms.