# A Critical Study on Public Opinion Regarding Robotic Surgery in Tamil Nadu

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**ABSTRACT:**
Usage of AI in almost all sectors of the economy has significantly boosted the growth rate of the country. But even after implementation, the knowledge and awareness of people about such technology is scarce in countries like India. One such important example is Robotic surgery, also known as robot assisted surgeries in the Healthcare sector. To understand the popularity of Robot assisted surgeries and to find the differences between the Robot assisted surgeries, and traditional surgeries are the major objectives. This paper strictly focuses on the awareness of the public regarding the concept of Robotic Surgery in Tamil Nadu, and the scope in the future, along with the advantages and disadvantages of it. For this purpose of this study secondary data collection is done from journals and literature review and primary data collection is being collected from 105 sample respondents through the convenient sampling method for which a well-structured questionnaire was curated. Upon the findings of the study, awareness amongst the older generation regarding such procedure is comparatively lower than the younger generations and people are more dependent upon the online sources to search upon on their health concerns. People think that the main disadvantage of RAS is that it is very costly and that there are chances of technical malfunction.

**KEYWORDS:** Robotic surgery, Minimally invasive surgery, Surgical advancements, High cost, Lower Acceptability

**INTRODUCTION:**

A development of minimally invasive surgery, Robotic Surgery (RS) blends engineering, robotics, and medical science. This advanced technology, sometimes referred to as **robot-assisted surgery**, uses customised robotic platforms to enhance the accuracy of surgeon motions in intricate procedures and small anatomical areas. Hand tremors can be filtered by RS, increasing flexibility and reducing unintentional errors. Smaller, less obvious scars, less discomfort, less blood loss, a shorter hospital stay, and a quicker recovery are the outcomes that follow surgery.

The **surgeon's master console and control devices** are the two primary parts of this system, which are connected to a computer via data cables. The primary surgeon is situated in the surgeon's master console, which **offers a three-dimensional image of the surgical field** via an endoscopic camera inside the patient's body. The surgeon can control the camera from the console to feel as though they are actually in the surgical field. The surgeon makes surgical

movements with control devices like **handles or joysticks**, and the robotic arms above the patient transform those commands into real-time movements. Through laparoscopic ports attached to the patient's body, these robotic arms' micro-joints enable the movement of surgical equipment and the endoscopic camera.

In the **1970s,** robotics research supported by **NASA and the US Defence Research Advanced Projects Agency** gave rise to the idea of RS. The main goal was to develop a system that would allow for remote control of surgical operations, replacing surgeons in dangerous or difficult-to-reach locations like spacecraft and battlefields. Westinghouse Electric in Pittsburgh, Pennsylvania, employed the first surgical robot, known as the **Programmable Universal Machine for Assembly 560 (PUMA 560)**, for a neurosurgical biopsy in 1985. Later, in 1988, Imperial College in London created the **ProBot**, a robotic device with four axes of movement, a high-speed rotating blade for resection, and a small size appropriate for prostatectomy operations, to aid in transurethral prostatectomies.

Established in 1989, Computer Motion became the top provider of surgical robots. The first tele-presence surgical robot was their robotic arm, the **Automated Endoscope System for Optimal Positioning (AESOP)**, which was approved by the FDA in 1994. Later, this AESOP system was improved and changed into the three-arm remotely operated **ZEUS Robotic Surgical System**. At the same time, in the early 1990s, IBM Corp. and Integrated Surgical Solutions, Inc. worked together to create **ROBODOC**, which in 1992 successfully prepared the femur for hip replacement in human subjects. The first da Vinci "Standard" surgical robot was unveiled by **Intuitive Surgical in 1999**, and it was first utilised at the Cleveland Clinic in Cleveland, Ohio, in 1998.

The da Vinci technology became widely used in clinical practice to prevent potential arm collisions. The **ZEUS Robotic Surgical System was discontinued** as a result of the 2003 merger of Computer Motion and Intuitive Surgical, which became da Vinci Surgical Systems, the industry leader in robotic-assisted laparoscopic abdominal procedures. Three more da Vinci Surgical System versions with progressively more sophisticated features have been created since the FDA approved Intuitive Surgical's da Vinci Standard System in 2000: **the S System (2003), the Si System (2009), and the Xi System (2014).**

**TYPES OF ROBOTIC SURGERY SYSTEM:**

1. **Da Vinci Robotic System:**

The three primary components of the da Vinci Surgical System are as follows: (a) **Surgeon cart:** This device provides the surgeon with access to the surgical site and a high-definition 3D view; (b) **Patient cart:** This is situated next to the patient's bed and houses the camera and operative instruments that the surgeon controls during the procedure; (c) **Vision cart**: This device bridges the gap between components to obtain the high-quality image from the vision system. The da Vinci system can be divided into four models to perform minimally invasive surgery: the da Vinci Si, X, Xi, and SP. It is crucial to note that of these, the da Vinci SP model is used for single-port urological procedures, lateral oropharynx ectomy procedures and tongue based resection.

2. **Versius Minimally Invasive Robotic System:**

It is an advanced operating room system created to help surgeons perform delicate and minimally invasive procedures. It was made by **CMR Surgical** And has enhanced dexterity, control, and visualisation over the conventional approach. Its modularity in design enables varied set-up and utilisation for various surgeries. With 3D high-definition imaging and the capability to perform through tiny incisions, Versius has the potential to increase the ability of the surgeon, decrease the recovery time for patients, and lower postoperative complications.

3. **The Hugo RAS Robotic System:**

A revolutionary surgical platform intended to improve the accuracy, flexibility, and dexterity of surgeons in minimally invasive surgeries. **Intuitive Surgical** developed the system that combines sophisticated robotic technology with high-definition visualisation and precision instruments, enabling more accurate and minimally invasive surgery. Surgeons use the system by sitting at a console with enhanced 3D imaging of the patient, real-time feedback, and ergonomic advantages. The design of the system is to enhance patient outcomes through decreased recovery times, less surgical trauma, and more precise surgery. It has widespread application in multiple medical specialties, such as urology, gynecology, and general surgery, providing advanced benefits over conventional surgical methods. The versatility of the

system, coupled with its potential for achieving complex procedures with high accuracy, establishes it as a revolutionary tool in contemporary surgery.

4. **The Corindus CorPath GRX:**

A robotic-assisted platform intended to help physicians perform percutaneous coronary and peripheral vascular interventions with increased precision and control. Developed by **Corindus Vascular Robotics**, the system allows interventional cardiologists to manipulate guide-wires, balloons, and stents from a radiation-shielded workstation, thus reducing radiation exposure and physical stress. It provides robotic precision that can improve the accuracy of the procedure, thus potentially improving outcomes and consistency in complex procedures. Through the combination of advanced robotic technology with interventional strategies, the CorPath GRX is an advance in the history of minimally invasive cardiovascular care.

**USES OF ROBOTICS IN SURGERY:**

Applications of robotics in **urology** include prostatectomy for removal of prostate cancer. Nephrectomy is the removal of the kidney, either partial or radical, for reasons such as cancer. Cystectomy is removal of the bladder, usually due to cancer. Pyeloplasty corrects obstruction at the junction of kidney and ureter. Ureteral reimplantation corrects urine reflux. Adrenalectomy is removal of the adrenal gland. Simple prostatectomy removes benign prostatic hyperplasia. Reconstructive procedures fix problems in the urinary tract and male reproductive system. Retroperitoneal lymph node dissection is done for testicular cancer. Nephroureterectomy is the removal of the kidney and ureter, usually for cancer.

Robotics is used in numerous surgical disciplines other than urology. In **general surgery**, it is used for complicated hernia repair, colorectal and bariatric surgery, gallbladder and splenectomy, and foregut surgery. **Gynecologic surgery** employs robotics for hysterectomy, myomectomy, ovarian surgery, endometriosis resection, prolapse repair, and gynecologic oncology. **Cardiothoracic surgery** uses robotics for CABG, mitral valve repair, ASD closure, and lung resection. **Head and neck surgery** employs Transoral Robotic Surgery (TORS) and is helping with thyroidectomy and laryngectomy. In **orthopedic surgery,** robotics supports joint replacement and spine surgery. Neurosurgery employs it in brain and spinal tumor resection and stereotactic procedures. **Pediatric surgery** witnesses growing uses in different conditions. Otolaryngology discovers uses beyond TORS. **Vascular surgery** is researching robotic help for aneurysm repair. Even interventional radiology is looking at robotics for image-guided intervention. Throughout these disciplines, robotics provides minimally invasive access, greater dexterity and motion, better visualization, higher precision, ergonomic advantages for surgeons, and the potential for improved outcomes. Its use only expands with continuing research and developing technologies.

**ADVANTAGES AND DISADVANTAGES OF ROBOTIC SURGERY:**

**Increased precision** and dexterity enable more precise surgical movements. **Better visualization** by the use of high-definition 3D magnified images benefits the surgeon. It is a **minimally invasive technique**, resulting in smaller cuts, less discomfort, **reduced blood loss, and minimal scarring.** Patients have shorter stays in the hospital and **quicker recovery**. Postoperative pain is reduced, resulting in fewer painkillers. Robotic surgery has the potential to provide better outcomes in some complex procedures. Surgeons enjoy better ergonomics at the console. The technology allows for the execution of complex procedures in hard-to-reach locations. The robotic system can eliminate any hand tremors, enhancing instrument control.

The upfront and maintenance costs of the robotic system and equipment are high. Surgeons can lack tactile feedback in relation to open surgery. There is a risk of technical failure during the procedure. Surgeons need specialty training, and there is a learning curve in terms of mastering the technology. The robotic system takes up more space in the operating room. In certain cases, the initial operating time could be more. Robotic surgery is not appropriate in all urological procedures. There are chances of converting to standard open surgery in the middle of the procedure. Though extremely rare, certain complications specific to the robotic platform can happen.

**OBJECTIVE OF THE STUDY:**

The research is aimed to have the following objectives:

1. To study the opinion of pubic on Robotic surgery.
2. To find out the Acceptance or Non-acceptance of people in Robot- assisted surgeries.

**3.** To analyse the implementation of Robotic Surgery in different Departments of Healthcare Sector.
**4.** To recommend solutions or strategies for the effective and efficient implementation and usage of Robotic Surgery.

**LITERATURE REVIEW:**

1. **"Robotic Surgery: A Comprehensive Review" by J. C. Lee et al. (2014)** This paper reviews the history, applications, and technological advancements in robotic surgery, focusing on the Da Vinci system and its impact on minimally invasive procedures.

2. "**Robotic Surgery: A Review of Its Clinical Applications and Current Technology" by S. K. Agarwal and A. K. Gupta (2015)** The review discusses different types of robotic systems used in surgery and evaluates their clinical applications in urology, gynaecology, and general surgery.

3. **"Advancements in Robotic Surgery: Review of Current Applications and Future Directions" by S. A. K. Karim (2017)** This paper reviews the use of robotics in various fields of surgery and presents potential advancements in robot-assisted surgeries.

4. **"Robotics in Surgery: An Overview" by M. L. Low and J. M. Carpentier (2018)** This article discusses the clinical and technical aspects of robotic surgery and provides a look into how robotics is changing the landscape of surgery.

5. **"The Future of Robotic Surgery: A Review of Progress and Challenges" by R. W. Chung et al. (2019)** This review paper provides an in-depth analysis of the challenges and the progress in the development of robotic surgery, including the integration of artificial intelligence.

6. **"Robot-Assisted Surgery: A Systematic Review" by R. T. Carrau and R. M. Endres (2014)** A systematic review of clinical outcomes associated with robot-assisted surgery in different specialties like urology, orthopedics, and gynecology.

7. **"The Impact of Robotic Surgery on Patient Outcomes: A Literature Review" by D. S. Green (2016)** This review focuses on the patient outcomes resulting from robotic surgery, with an emphasis on the benefits and drawbacks in comparison to traditional surgery.

8. **"Robotic Surgery in General Surgery: A Review" by L. H. McKinley et al. (2015)** This literature review focuses specifically on robotic surgery in general surgery, evaluating its impact on laparoscopic procedures and patient recovery times.

9. **"Challenges and Future Perspectives in Robotic Surgery" by T. O. S. Keller (2018)** A review discussing the current challenges in robotic surgery and the potential future advancements, including robot autonomy and machine learning.

10. **"Robotic Surgery in Urology: A Systematic Review of the Literature" by J. R. Kim and S. Y. Lee (2017)**This paper systematically reviews the application of robotic surgery in urology, particularly in prostatectomy and other urological surgeries.

11. **"The Role of Robotic Surgery in Minimally Invasive Surgery" by P. S. Johnson et al. (2017)** This article reviews the benefits of robotic surgery as a subset of minimally invasive surgery, particularly its ability to reduce patient trauma and enhance recovery.

12. **"A Review of Robotic Surgery in Gynecology" by R. T. Patil and L. M. Smith (2016)** Focuses on the application of robotic surgery in gynecological procedures, including hysterectomies and pelvic floor surgeries.

13. **"Evaluation of Robot-Assisted Surgery: A Comprehensive Review" by T. E. M. Milligan (2015)** This paper evaluates both the advantages and challenges faced by surgeons and patients in robot-assisted surgery.

14. **"Robotics in Surgery: A Review of Techniques, Technologies, and Applications" by M. R. Sugimoto and T. N. Moore (2018)** Provides an overview of different robotic systems, their technologies, and applications in surgical disciplines.

15. **"Robotic Surgery for Colorectal Cancer: A Review of Current Practice" by D. A. Davis et al. (2017)** A focused review on the use of robotic surgery in colorectal cancer treatment and its outcomes.

16. **"Outcomes of Robotic Surgery in Obesity: A Review of the Literature" by S. K. Thomas (2016)** Examines how robotic surgery has been utilized in bariatric surgery and its effects on patient outcomes.

17. **"Robotic Surgery in Pediatric Patients: A Literature Review" by P. W. Cresswell and H. H. Martinez (2018)** Reviews the applications and challenges of robotic surgery in pediatric surgery, especially in minimally invasive procedures.

18. **"Cost Analysis and Economic Impact of Robotic Surgery: A Literature Review" by J. K. Stevens and D. S. Green (2019)** This article focuses on the financial aspects of implementing robotic surgery in healthcare settings, including cost-effectiveness.

19. **"Human Factors in Robotic Surgery: A Literature Review" by T. P. Andrews and E. F. Walker (2017)** Discusses the human factors that impact the success of robotic surgery, including surgeon training and ergonomics.

20. **"The Role of Robotics in Spinal Surgery: A Comprehensive Review" by A. S. Shapiro (2016)** A review of robotic surgery's impact in spinal surgery, particularly in procedures such as spinal fusion.

21. **"Evaluation of the Impact of Robotic Surgery on Surgical Education" by S. L. Adams (2018)** Focuses on how robotic surgery has affected surgical education and the skills required for new generations of surgeons.

22. **"Comparative Effectiveness of Robotic and Traditional Surgery: A Systematic Review" by B. R. Wagner et al. (2019)** A systematic review comparing the effectiveness and efficiency of robotic versus traditional surgery in multiple specialties.

23. **"Robotic Surgery in Cardiac Surgery: Current Status and Future Directions" by M. J. J. Bennett (2017)** This review covers the utilization of robotic technology in cardiac surgery, including coronary artery bypass and valve surgeries.

24. **"Robotic Surgery: Trends, Developments, and Future Prospects" by A. F. Patel and B. T. Thompson (2018)** Reviews current trends and the future potential of robotic surgery in various medical fields.

25. **"Robotic Surgery: A Step Forward in Minimally Invasive Surgical Techniques" by J. D. Johnson (2016)** Discusses the importance of robotic surgery in advancing minimally invasive surgery techniques and the technological hurdles that remain.

26. **"The Safety and Efficacy of Robotic Surgery: A Review of the Literature" by S. D. Lander et al. (2015)** Analyzes the safety and efficacy of robotic surgery across various types of surgeries, including the challenges faced during implementation.

27. **"Integration of Artificial Intelligence with Robotic Surgery: A Literature Review" by J. J. Keegan (2020)** Explores the integration of AI in robotic surgery and its potential to revolutionize surgical precision and autonomy.

28. "**Robotics in Neurosurgery: A Comprehensive Review of Current Applications" by R. D. Weng and M. F. Zong (2018)** A review of how robotics is being applied in neurosurgery and its effectiveness in minimally invasive procedures.

29. "**Robotic Surgery and the Role of Telemedicine: A Review" by D. M. Holstein (2020)** Focuses on the intersection of robotic surgery and telemedicine, discussing the benefits of remote surgical assistance.

30. "**Ethical Considerations in Robotic Surgery: A Review" by E. H. Feldman and R. L. Greenbaum (2017)** Discusses the ethical implications of robotic surgery, including issues related to consent, liability, and patient safety.

**METHODOLOGY:**

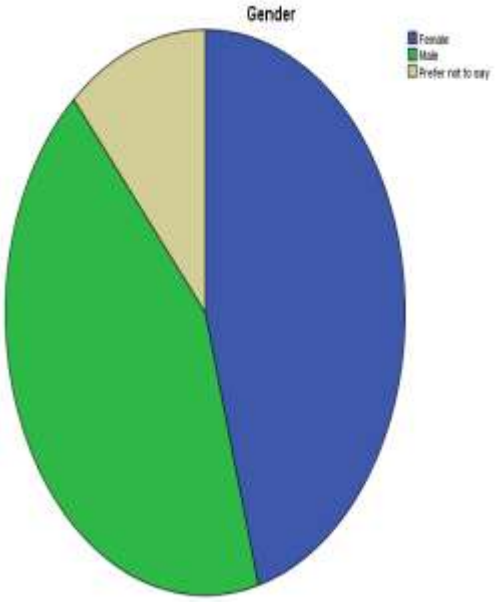
The study is based on primary and secondary data collection. The secondary is using the data information already collected by someone and using it for the problem. Examples of Data Collection are newspaper, magazine, website, blogs, case law, published books, a report published by private, government or Agencies, journal, articles working /discussion papers. For this study secondary data collection is done from journals and literature review and primary data collection is being collected from 100 sample respondents through the convenient sampling method. The research instrument used to collect primary data is a well-structured questionnaire. The independent variables used here are age, gender, and the dependent variables are the public opinions on Robot Assisted surgery, the advantages and the disadvantages. The researcher has made use of IBM SPSS Statistics version 23.0 and has analysed the data using One-way Analysis of Variance (ANOVA) also made use of tables and graphs for the best and systematic analysis of the opinion of RAS.

**ANALYSIS AND INTERPRETATION OF DATA:**

**Analysis of Demographic Information:**

Gender

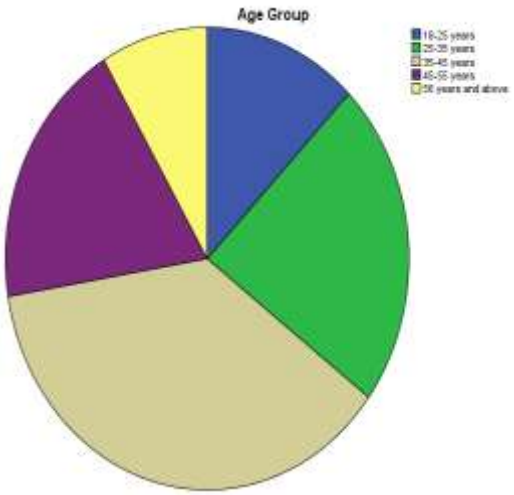
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Female | 48 | 45.7 | 45.7 | 45.7 |
| | Male | 45 | 42.9 | 42.9 | 88.6 |
| | Prefer not to say | 12 | 11.4 | 11.4 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |




From the above table and graph, it is evident that the majority of the respondents are **female (45.7%)** followed by males and others with a percentage of 42.9% and 11.4%.

**Age Group**

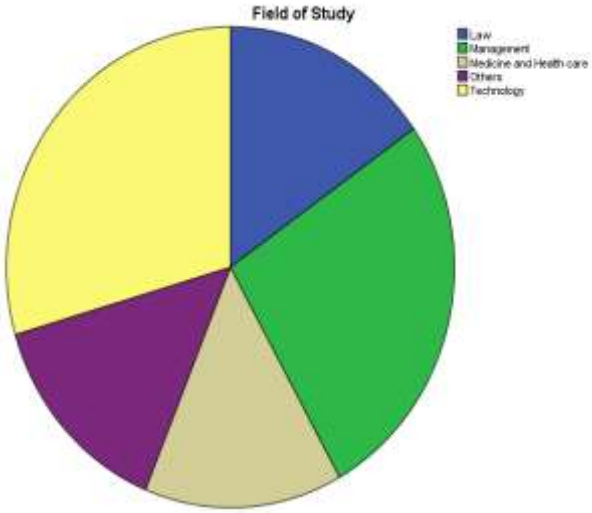
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 18-25 years | 13 | 12.4 | 12.4 | 12.4 |
| | 25-35 years | 24 | 22.9 | 22.9 | 35.2 |
| | 35-45 years | 39 | 37.1 | 37.1 | 72.4 |
| | 45-55 years | 20 | 19.0 | 19.0 | 91.4 |
| | 56 years and above | 9 | 8.6 | 8.6 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |




From the above table and graph, it is evident that the majority of respondents **(37.1%) belong to the age group of 35-45 yea** 22.9% of respondents belong to the age group of 25-35 years, 19.0% of respondents belong to the age group of 45-55 years a 12.4% and 8.6% of the respondents belong to the age group of 18-25 years and 56 years and above respectively. This prov that the survey has covered almost all age group of people upon their diversified interest and awareness on robotic surgery.

**Field of Study**

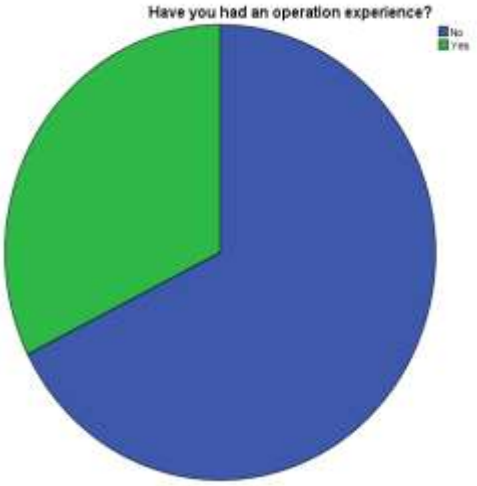
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Law | 16 | 15.2 | 15.2 | 15.2 |
| | Management | 28 | 26.7 | 26.7 | 41.9 |
| | Medicine and Health care | 15 | 14.3 | 14.3 | 56.2 |
| | Others | 15 | 14.3 | 14.3 | 70.5 |
| | Technology | 31 | 29.5 | 29.5 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |




From the above table and graph, it is evident that majority of the respondents **(29.5%) work in the sector of Technology**, 26.7% work in the sector of Management, 15.2% work in the sector of Law, 14.3% and 14.3% belong to the sector of Medicine and Health Care and Others respectively. This proves that all the respondents are working in the sectors which have the prime aspect of Robotics, and that Most of the respondents belong to the sector of Technology, where Robotics knowledge and implementations flourish into the Indian Economy.

Have you had an operation experience?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | No | 71 | 67.6 | 67.6 | 67.6 |
| | Yes | 34 | 32.4 | 32.4 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |




From the above table and Graph, it is evident that most of the respondents **(67.6%)** do not have prior operation experience, while 32.4% of the respondents had undergone surgery in their life.

**Analysis of data that relates to the Public opinion on Robotic surgery or minimally- invasive surgery in Tamil Nadu**

Are you aware of Robotic Assisted Surgery or Minimally Invasive Surgery?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Maybe | 30 | 28.6 | 28.6 | 28.6 |
| | No | 18 | 17.1 | 17.1 | 45.7 |
| | Yes | 57 | 54.3 | 54.3 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |

**TABLE 1**

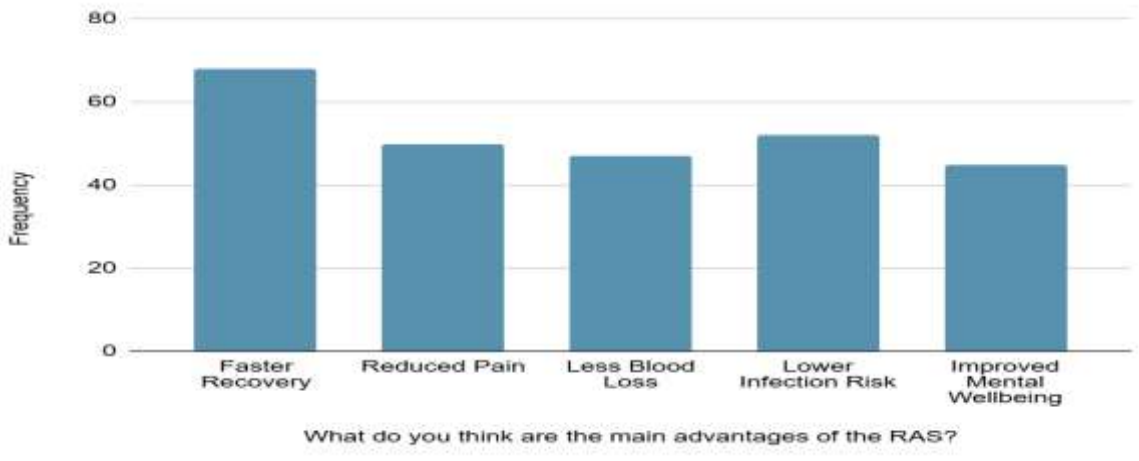
Do you know some one who had Robotic Assisted Surgery?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | No | 57 | 54.3 | 54.3 | 54.3 |
| | Yes | 48 | 45.7 | 45.7 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |

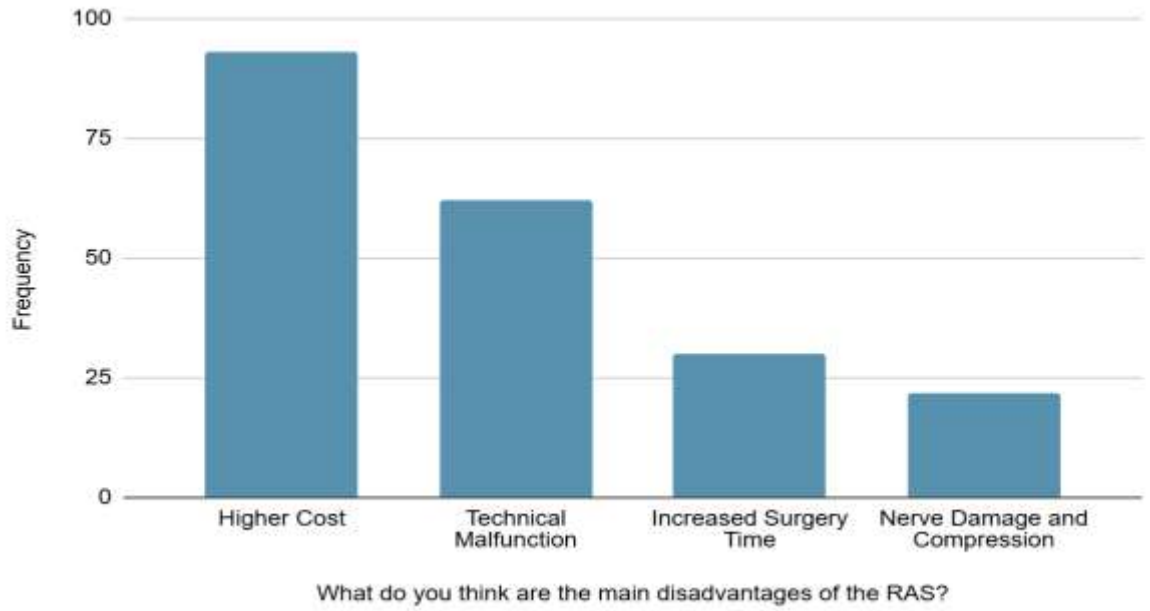
**TABLE 2**

**Table 1** analyses the awareness amongst public about Robotic Assisted Surgery or Minimally Invasive Surgery in which it is evident that majority of the respondents **( 54.3%)** are aware about RAS, while 28.6% of the respondents have an idea that such thing exist and 17.1% of the respondents are unaware of Robotic surgery being an option that exist for surgeries.

**Table 2** analyses the no. of people who have undergone a RAS in their life with a indirect question, as of whether the respondents knew any people who had undergone Robotic surgery, for which, **54.3%** of the respondents have answered NO, while, 45.7% of the respondents have answered YES. Though not much difference in the statistics, still, the no. of persons who had undergone the procedure is low.



The above Chart analyses about the public opinion on the advantages of Robotic Surgery, wherein most think that Faster Recovery is possible if RAS is performed. This is due to the fact that RAS involves Minimal Invasion, i.e., as robotic arms are used, the surgery is performed just through a small incision in the body, because of which the patient is able to recover much faster than the traditional surgery methods.




This chart analyses the major disadvantage of Robotic Surgery acceptance amongst public, in which it is evident that Higher Cost of the Surgery is an important point that discourages people for accepting Robotic surgery. Robotic Surgery cost higher than that of the traditional method of surgery due to the cost of Robot itself, Maintenance charges, the training for the medical professionals on how to operate the machine, and much more contributes to the higher cost.

**What do you think about the statement: Robotic-assisted surgery is safer than other forms of surgery**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Agree | 36 | 34.3 | 34.3 | 34.3 |
| | Disagree | 19 | 18.1 | 18.1 | 52.4 |
| | Neutral | 50 | 47.6 | 47.6 | 100.0 |
| | Total | 105 | 100.0 | 100.0 | |

Public opinion on the safety of RAS than Traditional surgery is predominantly neural because people think that they don't know or have enough information upon this type of surgery to decide on its safety, and it was also noted that people think that though RAS is a new technology, its implementation and awareness amongst people in Tamil Nadu is comparatively lower.

**1. One way ANOVA test for significant difference between Age groups with respect to their willing to use Robotic-assisted surgery for treatment in the future?**

**HYPOTHESIS:**

H1: There is a significant difference between the age group with respect to their willing to use Robotic-assisted surgery for treatment in the future.

H0: There is no significant difference between the age group with respect to their willing to use Robotic-assisted surgery for treatment in the future.

**Descriptives**

Are you willing to use Robotic-assisted surgery for treatment in the future?

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| 18-25 years | 13 | 2.077 | .7596 | .2107 | 1.618 | 2.536 | 1.0 | 3.0 |
| 25-35 years | 24 | 2.500 | .8341 | .1703 | 2.148 | 2.852 | 1.0 | 4.0 |
| 35-45 years | 39 | 2.795 | .6561 | .1051 | 2.582 | 3.008 | 1.0 | 4.0 |
| 45-55 years | 20 | 2.950 | .6863 | .1535 | 2.629 | 3.271 | 2.0 | 5.0 |
| 56 years and above | 9 | 3.111 | .9280 | .3093 | 2.398 | 3.824 | 2.0 | 5.0 |
| Total | 105 | 2.695 | .7860 | .0767 | 2.543 | 2.847 | 1.0 | 5.0 |

**ANOVA**

Are you willing to use Robotic-assisted surgery for treatment in the future?

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 9.127 | 4 | 2.282 | 4.139 | .004 |
| Within Groups | 55.121 | 100 | .551 | | |
| Total | 64.248 | 104 | | | |

**Multiple Comparisons**

Dependent Variable: Are you willing to use Robotic-assisted surgery for treatment in the future?

Tukey HSD

| (I) Age Group | (J) Age Group | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| 18-25 years | 25-35 years | -.4231 | .2557 | .467 | -1.133 | .287 |
| | 35-45 years | -.7179* | .2378 | .026 | -1.379 | -.057 |
| | 45-55 years | -.8731* | .2645 | .011 | -1.608 | -.138 |
| | 56 years and above | -1.0342* | .3219 | .015 | -1.929 | -.140 |
| 25-35 years | 18-25 years | .4231 | .2557 | .467 | -.287 | 1.133 |
| | 35-45 years | -.2949 | .1926 | .545 | -.830 | .240 |
| | 45-55 years | -.4500 | .2248 | .273 | -1.074 | .174 |
| | 56 years and above | -.6111 | .2902 | .226 | -1.417 | .195 |
| 35-45 years | 18-25 years | .7179* | .2378 | .026 | .057 | 1.379 |
| | 25-35 years | .2949 | .1926 | .545 | -.240 | .830 |
| | 45-55 years | -.1551 | .2042 | .941 | -.722 | .412 |
| | 56 years and above | -.3162 | .2746 | .778 | -1.079 | .447 |
| 45-55 years | 18-25 years | .8731* | .2645 | .011 | .138 | 1.608 |
| | 25-35 years | .4500 | .2248 | .273 | -.174 | 1.074 |
| | 35-45 years | .1551 | .2042 | .941 | -.412 | .722 |
| | 56 years and above | -.1611 | .2980 | .983 | -.989 | .667 |
| 56 years and above | 18-25 years | 1.0342* | .3219 | .015 | .140 | 1.929 |
| | 25-35 years | .6111 | .2902 | .226 | -.195 | 1.417 |
| | 35-45 years | .3162 | .2746 | .778 | -.447 | 1.079 |
| | 45-55 years | .1611 | .2980 | .983 | -.667 | .989 |

*. The mean difference is significant at the 0.05 level.

A one-way ANOVA was performed to compare the effect of age on the willingness that the respondents has to the use of Robotic Surgery in future for treatment.

A one-way ANOVA revealed that there was a statistically significant difference in the willingness that the respondents has upon the usage of RAS for treatment in the future between at least two groups (F(2.282,0.551) = [4.139], p = [0.004]).

Tukey's HSD Test for multiple comparisons found that the mean value of willingness of the respondents to the usage of RAS for treatment in the future was significantly different between 18-25 years and 45-55 years (p = 0.011 , 95% C.I. = [1.38,1.608]).

There was no statistically significant difference between 45-55 years and 56 years and above (p=0.983).

Henceforth, this proves that the **null hypothesis is rejected** for this variable and proves that there is a significant difference between the age group with respect to their willingness to use robotic surgery in the future.

2. **One way ANOVA test for significant difference between people who already had surgery with respect to their recommendation of RAS to others.**

**HYPOTHESIS:**

H1: There is a significant difference between the persons who had surgery with respect to their recommendation of Robotic Surgery to others.

H0: There is no significant difference between the persons who had surgery with respect to their recommendation of Robotic Surgery to others.

**Descriptives**

Would you recommend Robotic Assisted Surgeries?

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Yes | 34 | 2.176 | .9365 | .1606 | 1.850 | 2.503 | 1.0 | 3.0 |
| No | 71 | 2.507 | .8259 | .0980 | 2.312 | 2.703 | 1.0 | 3.0 |
| Total | 105 | 2.400 | .8727 | .0852 | 2.231 | 2.569 | 1.0 | 3.0 |

**ANOVA**

Would you recommend Robotic Assisted Surgeries?

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 2.512 | 1 | 2.512 | 3.374 | .069 |
| Within Groups | 76.688 | 103 | .745 | | |
| Total | 79.200 | 104 | | | |

The p value of variable, belief that AI could potentially alienate/ engage customers effectively is more than 0.05, at the 5% level of significance. Hence **null hypothesis is accepted** for this test. It concludes that there is no significant difference between the respondents who already had operation experience with respect to their recommendation of RAS to others. It is evident from the above analysis that there is no impact or influence of the thoughts of the person who had already undergone an operation and their recommendations upon RAS.

Ideally, these variables were chosen for the test as sometimes, there might be an influence of the people who had already undergone a operation because those respondents might have already known all the procedures, advantages and disadvantages of RAS.

3. **One way ANOVA test for significant difference between the age group of the respondents with respect to their expectancy of the knowledge of doctor about Robotic Surgery.**

**HYPOTHESIS:**

H1: There is a significant difference between the age group of the respondents with respect to their expectancy of the knowledge of doctor about Robotic Surgery.

H0: There is no significant difference between the age group of the respondents with respect to their expectancy of the knowledge of doctor about Robotic Surgery.

**Descriptives**

How important is it for your doctor to know about Robotic-assisted surgical treatments and techniques.

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| 18-25 years | 13 | 1.923 | .7596 | .2107 | 1.464 | 2.382 | 1.0 | 3.0 |
| 25-35 years | 24 | 2.125 | .7974 | .1628 | 1.788 | 2.462 | 1.0 | 4.0 |
| 35-45 years | 39 | 2.308 | .8931 | .1430 | 2.018 | 2.597 | 1.0 | 4.0 |
| 45-55 years | 20 | 2.300 | .9234 | .2065 | 1.868 | 2.732 | 1.0 | 4.0 |
| 56 years and above | 9 | 3.222 | 1.0929 | .3643 | 2.382 | 4.062 | 1.0 | 4.0 |
| Total | 105 | 2.295 | .9191 | .0897 | 2.117 | 2.473 | 1.0 | 4.0 |

**ANOVA**

How important is it for your doctor to know about Robotic-assisted surgical treatments and t

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 10.236 | 4 | 2.559 | 3.297 | .014 |
| Within Groups | 77.611 | 100 | .776 | | |
| Total | 87.848 | 104 | | | |

The p value of variable, the importance of the knowledge of doctor on Robotic Surgery, is less than 0.05, at the 5% level of significance. Hence **null hypothesis is rejected** for this variable, which proves that there is a significant difference between the age group of the respondents with respect to their expectancy of the knowledge of doctor about Robotic Surgery.

These two variables were compared as respondents belonging to the age group of 56 years and above may not have a clear idea as of what the modern era is all about and particularly about Robotic Surgery, the process of how it works, while it is not so in the case of respondents who belong to the age group of 18-25 years.

4. **One way ANOVA test for significant difference between people who work who work in different sector with respect to their knowledge about non applicability of insurance for Robotic Surgery.**

**HYPOTHESIS:**

H1: There is a significant difference between the people who work who work in different sector with respect to their knowledge about non applicability of insurance for Robotic Surgery.

H0: There is no significant difference between the people who work who work in different sector with respect to their knowledge about non applicability of insurance for Robotic Surgery.

**Descriptives**

Are you aware that Robotic-assisted surgery is not covered by all Indian Health Insurance and you will have to pay out of pocket?

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Medicine and Health care | 15 | 1.267 | .4577 | .1182 | 1.013 | 1.520 | 1.0 | 2.0 |
| Technology | 31 | 1.677 | .4752 | .0853 | 1.503 | 1.852 | 1.0 | 2.0 |
| Management | 28 | 1.714 | .4600 | .0869 | 1.536 | 1.893 | 1.0 | 2.0 |
| Law | 16 | 1.563 | .5123 | .1281 | 1.289 | 1.836 | 1.0 | 2.0 |
| Others | 15 | 1.733 | .4577 | .1182 | 1.480 | 1.987 | 1.0 | 2.0 |
| Total | 105 | 1.619 | .4880 | .0476 | 1.525 | 1.713 | 1.0 | 2.0 |

**ANOVA**

Are you aware that Robotic-assisted surgery is not covered by all Indian Health Insurance a

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 2.469 | 4 | .617 | 2.769 | .031 |
| Within Groups | 22.293 | 100 | .223 | | |
| Total | 24.762 | 104 | | | |

A one-way ANOVA was performed to compare the people who work who work in different sector with respect to their knowledge about non applicability of insurance for Robotic Surgery.

A one-way ANOVA revealed that there was a statistically significant difference in the knowledge that the respondents has in terms of the non- applicability of insurance for Robotic Surgery between at least two groups (F(0.617,0.223) = [2.769], p = [0.031]).

**Multiple Comparisons**

Dependent Variable: Are you aware that Robotic-assisted surgery is not covered by all Indian Health Insurance and you will have to p:
Tukey HSD

| (I) Field of Study | (J) Field of Study | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Medicine and Health care | Technology | -.4108 | .1485 | .052 | -.823 | .002 |
| | Management | -.4476* | .1511 | .031 | -.867 | -.028 |
| | Law | -.2958 | .1697 | .412 | -.767 | .176 |
| | Others | -.4667 | .1724 | .060 | -.946 | .012 |
| Technology | Medicine and Health care | .4108 | .1485 | .052 | -.002 | .823 |
| | Management | -.0369 | .1231 | .998 | -.379 | .305 |
| | Law | .1149 | .1453 | .933 | -.289 | .519 |
| | Others | -.0559 | .1485 | .996 | -.468 | .357 |
| Management | Medicine and Health care | .4476* | .1511 | .031 | .028 | .867 |
| | Technology | .0369 | .1231 | .998 | -.305 | .379 |
| | Law | .1518 | .1480 | .843 | -.259 | .563 |
| | Others | -.0190 | .1511 | 1.000 | -.439 | .401 |
| Law | Medicine and Health care | .2958 | .1697 | .412 | -.176 | .767 |
| | Technology | -.1149 | .1453 | .933 | -.519 | .289 |
| | Management | -.1518 | .1480 | .843 | -.563 | .259 |
| | Others | -.1708 | .1697 | .852 | -.642 | .301 |
| Others | Medicine and Health care | .4667 | .1724 | .060 | -.012 | .946 |
| | Technology | .0559 | .1485 | .996 | -.357 | .468 |
| | Management | .0190 | .1511 | 1.000 | -.401 | .439 |
| | Law | .1708 | .1697 | .852 | -.301 | .642 |

*. The mean difference is significant at the 0.05 level.

Tukey's HSD Test for multiple comparisons found that the mean value of awareness amongst the respondent that Robotic Surgeries are not covered by insurance was significantly different between Financial Services and Healthcare and Life Sciences (p =0.31, 95% C.I. = [-.867,0.28]).

There was no statistically significant difference between the group of Management and others, where the significance level is (p=1.000).

Henceforth, this proves that the **null hypothesis is rejected** for this variable and proves that there is a significant difference between the field of study of the respondent and the awareness about the non-applicability of insurance for Robotic Surgeries.

**FINDINGS:**

From the research conducted on the topic "**A CRITICAL STUDY ON PUBLIC OPINION REGARDING ROBOTIC SURGERY IN TAMILNADU",** the following points were found out significantly:

- **71.4%** of the respondents send time online researching about their health concerns.
- **54.3%** of the respondents are aware of Robotic Assisted Surgery or Minimally Invasive Surgery.
- **34.3%** of the respondents agree with the statement that Robotic Surgeries are safer than other type of surgery.
- **19%** of the respondents agree that Robotic Surgery is effective while **58.1%** of the respondents have a neutral stance.
- **25.7%** of the respondents are willing to use robotic surgery for their future treatment.
- **25.7%** of the respondents agree that they would recommend Robotic surgery to others.
- There is a significant **impact of the age group of the respondents** upon factors like, expectancy of knowledge of doctors on Robotic surgery, willingness to use Robotic surgery for future treatment etc.
- One of the biggest advantages of Robotic Surgery is that it aids in **Faster Recovery** of the Patient.
- The main disadvantage of Robotic Surgery is that it is **costlier** than other forms of surgery**.**
- **61.9%** of the respondents are not aware of the fact that Robotic-assisted surgery is not covered by all Indian Health Insurance and that they will have to pay out of pocket.

**RECOMMENDATIONS:**

- **Establishment of Robotic Surgery Units** in Government Key Hospitals for pilot implementation would aid in a full-fledged implementation in the future.
- To reduce the cost of Robotic Surgery, the government can take initiative **to include robotic procedures under Tamil Nadu Chief Minister's Comprehensive Health Insurance Scheme (CMCHIS).**
- **Usage of Local Media, community health workers, and influencers** to inform the public about the safety, benefits and the availability of Robotic Surgery in Tamil Nadu.
- A **Public Private Partnership (PPP)** between the state government and private medical technology company would lead to sharing of technology, cost, expertise and best practices.
- **Specialized training programs** for surgeons and super specialty residents in robotic surgery techniques through certified or fellowship programs, as the current and upcoming era focuses on digitalization, AI & ML.
- **Establishing State Guidelines** for clinical protocols, data standards and patient consent model would lead to safer and secure type of surgery.
- **Tele Monitoring and Remote support** of senior surgeons to assist surgeries in rural areas would expand he implementation of Robotic surgery.
- **Expanding the scope of usage** of Robotic Surgery other than orthopaedics, urology, gynecology, colorectal, gastrointestinal, to Tamil Nadu's specific heath challenges through clinical trials.
- **Tailoring specialized awareness programs** targeting the elderly population (Highlighting faster recovery) and the youth population (highlighting the career opportunities that are available in medical robotics).

**CONCLUSION:**

Robot assisted surgery is a grand step ahead of contemporary health care with greater precision, reduced recovery, and improved outcomes But the smooth implementation of robotic surgery in Tamil Nadu cannot be dependent on technology. It needs a holistic, well-coordinated approach—founded on sound policy planning, multi-level infrastructure, and continuous investments in education and building capacities. Regulatory systems and public educational campaigns must run parallel for augmenting credibility and affecting appropriate utilization.

By fostering collaborations between government, private institutions, and local innovators, Tamil Nadu can create a sustainable and scalable model for robotic surgery. Consolidation of tertiary care hospitals with robotic facilities, and training a new generation of surgeons in newer techniques are ground-level steps. Financial inclusion by covering robotic procedures under government insurance schemes such as CMCHIS and Ayushman Bharat is equally critical to make this innovation reach all sections of society and not merely the privileged ones.

Public perception is another vital pillar of support. Misconceptions regarding robotic surgery—especially in rural and semi-urban regions—need to be dispelled by targeted outreach. Further, promoting research, innovation, and collaboration with Med Tech start-ups will not only make it more cost-effective in the long run but also place Tamil Nadu at the forefront of indigenously created healthcare technology.

The potential payoff is broad: shorter hospital stays, fewer complications from and after surgery, less strain on overtaxed health systems, and overall better quality of care. Tamil Nadu has a long and rich tradition of healthcare delivery; the moment is right to continue that tradition into the era of robotic medicine.

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