Integration of Robotic Metabolic & Bariatric Surgery into Residency and Fellowship Programs

"Current Training Models, Challenges & Future Directions"

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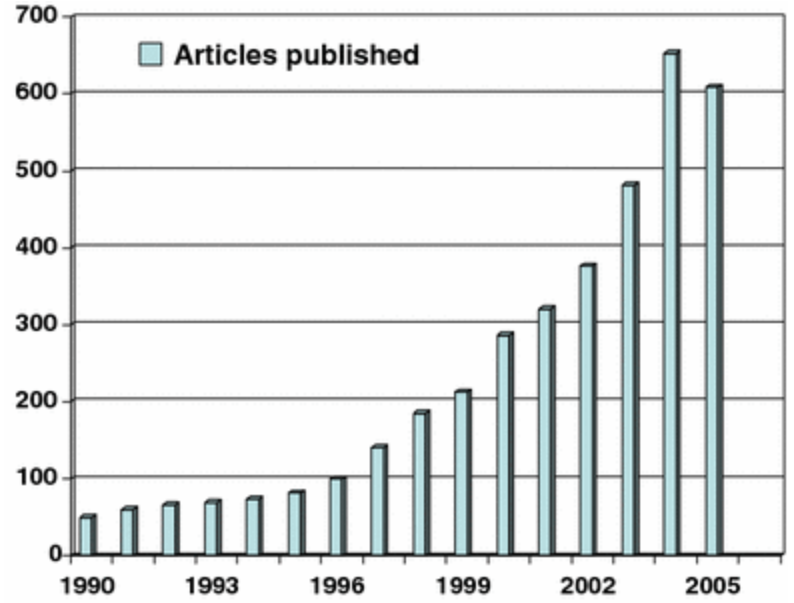
- No disclosure

Robotic surgery: The History

- **History of Robotic Surgery**
- **1985:** First use of a surgical robot (**PUMA 560**) to assist in neurosurgical biopsy.
- **1988: PROBOT** developed for transurethral resection of the prostate.
- **1992: ROBODOC** introduced for orthopedic procedures (hip replacement preparation).
- **Late 1990s:** Development of the **da Vinci Surgical System**.
- **2000:** FDA approval of the **da Vinci system** for general laparoscopic surgery.
- **2000s–Present:** Rapid expansion in many specialties:
  - General surgery
  - Urology
  - Gynecology
  - Cardiothoracic surgery
  - Bariatric surgery



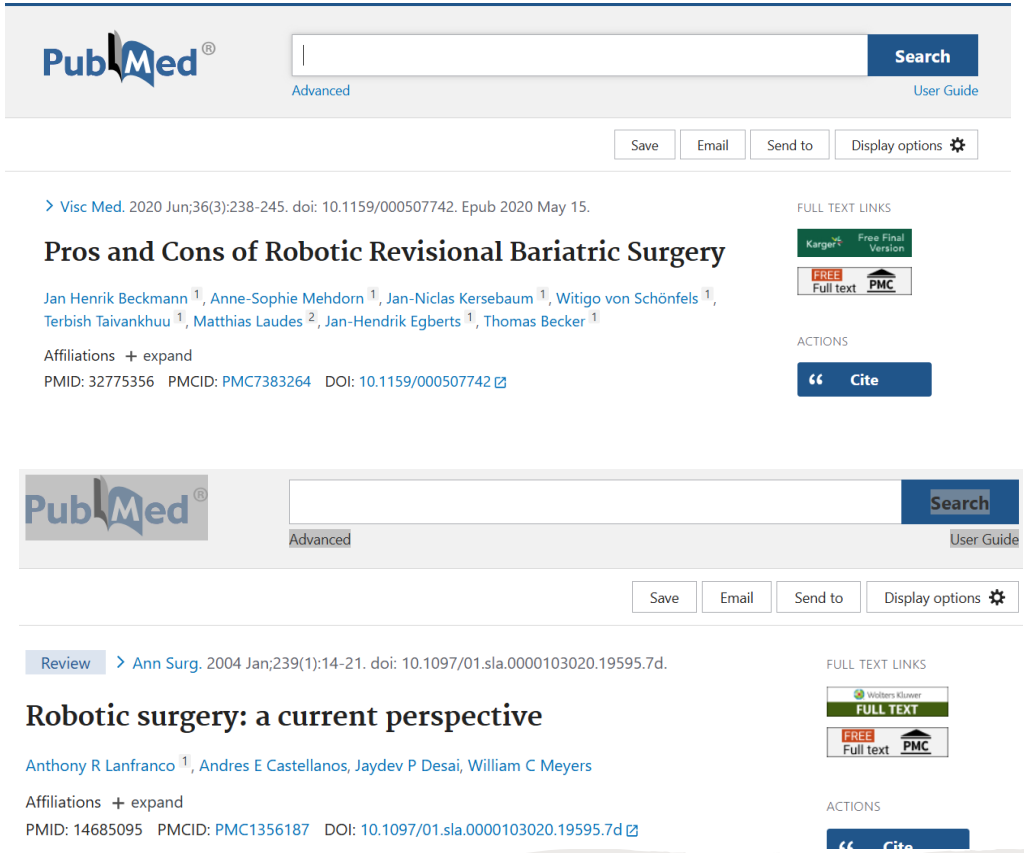
Number of articles indexed each year in a pubmed search containing the words "robot" or robotic.

Definition of Robotic Metabolic and Bariatric Surgery (RMBS)

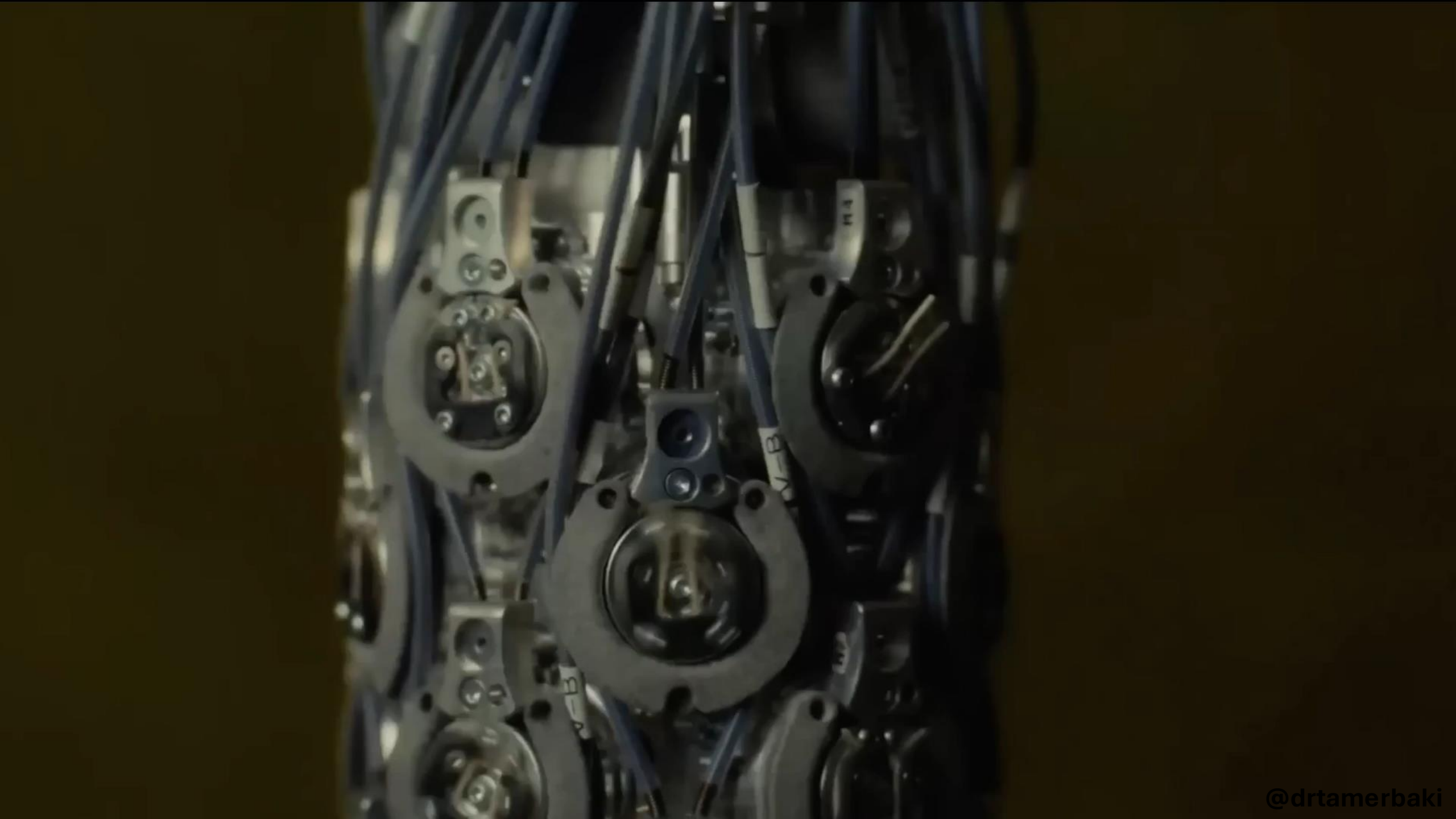
- **Robotic metabolic and bariatric surgery (RMBS)** refers to bariatric procedures performed using a **robotic surgical platform** to treat obesity and obesity-related metabolic diseases.
  • It is a **minimally invasive approach** where the surgeon controls robotic instruments from a console.
  • The robotic platform provides **enhanced precision, dexterity, and visualization** during complex bariatric procedures.
  • RMBS is increasingly used for both **primary bariatric operations and revisional surgery**.

Advantages of Robotic Bariatric Surgery

- **Enhanced visualization**
  – High-definition **3D view** improves identification of anatomical structures.
- **Greater instrument dexterity**
  – Wristed instruments allow precise dissection and suturing.
- **Improved intracorporeal suturing**
  – Particularly useful for **gastrojejunal and enteroenteric anastomoses** in gastric bypass.
- **Tremor filtration**
  – Robotic systems eliminate natural hand tremor, improving surgical precision.
- **Better ergonomics for surgeons**
  – Surgeon operates from a seated console, reducing fatigue during long procedures.
- **Potential benefits in complex cases**
  – Especially helpful in **super-obese patients** and **revisional bariatric surgery**.



Neo Hand



Limitations and Challenges of Robotic Bariatric Surgery

- **High cost**
  – Expensive equipment, **maintenance**, and disposable robotic instruments.
- **Longer operative time (especially during early learning phase)**
  – Docking and system setup may increase operative time.
- **Learning curve**
  – Surgeons require **specialized training and experience** to achieve proficiency.
- **Limited availability**
  – Robotic systems are not available in all hospitals.
- **Bulky equipment in the operating room**
  – Requires larger OR space and careful positioning.
- **Lack of tactile feedback**
  – Surgeons rely mainly on visual cues rather than direct tissue sensation.

Growing Demand for Robotic Surgery

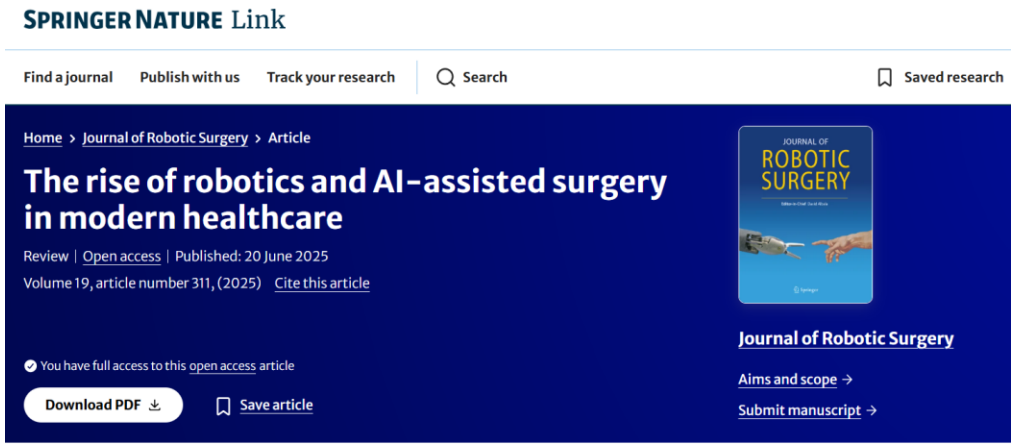
Increasing global adoption of robotic platforms such as the **da Vinci Surgical System**.

Rising number of robotic procedures in **urology, general surgery, gynecology, cardiothoracic, and bariatric surgery**.

Hospitals are investing more in **robotic surgical programs**.

Growing patient preference for **minimally invasive procedures with faster recovery and less postoperative pain**.

Demand for surgeons skilled in robotic techniques continues to increase worldwide.



Rationale for Integrating Robotics in Surgical Training

- **Rapid expansion** of **robotic-assisted surgery** across multiple surgical specialties.
- **Increasing need** for surgeons trained in **robotic technology and advanced minimally invasive techniques**.
- Robotic systems provide an opportunity to improve surgical skills such as precision, suturing, and dissection.
- **Structured** robotic training ensures **safe adoption of new technology in clinical practice**.
- Integration into residency and fellowship programs **prepares surgeons** for **modern surgical practice.**

Shift from Laparoscopy to Robotic Surgery

•In resource-rich environments, **robotic surgery is rapidly replacing laparoscopy** in many abdominal operations.

•Surgical training programs are increasingly adopting robotic techniques.

•Trainees often feel **more comfortable performing robotic procedures**, such as robotic inguinal hernia repair, compared with laparoscopic approaches.

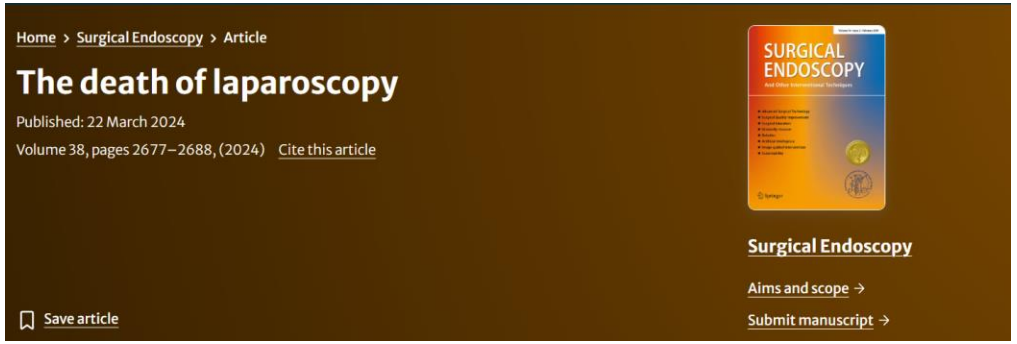
•Several operations previously done laparoscopically or via open surgery are now commonly performed robotically, including:

•Emergency **cholecystectomy**

•4-quadrant **colectomy**

•**Pancreatectomy**

•Complex hepatobiliary reconstructions



Concerns About Replacing Laparoscopy with Robotic Surgery

Rapid shift from **laparoscopy to robotic surgery** raises several concerns.

Possible **overreliance on technology**, which may lead to **deskilling of surgeons**.

High costs of robotic systems may challenge **value-based healthcare**.

Experts emphasize that technological advancement should not replace **essential surgical skills**.

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Surgery
Volume 173, Issue 6, June 2023, Pages 1340-1345

Colon/Rectum/Anus

Presented at Academic Surgical Congress 2023

National analysis of cost disparities in robotic-assisted versus laparoscopic abdominal operations

Ayesha P. Ng BS [a], Yas Sanaiha MD [a b], Syed Shahyan Bakhtiyar MD [a b c], Shayan Ebrahimian MS [a], Corynn Branche [a], Peyman Benharash MD [a b]

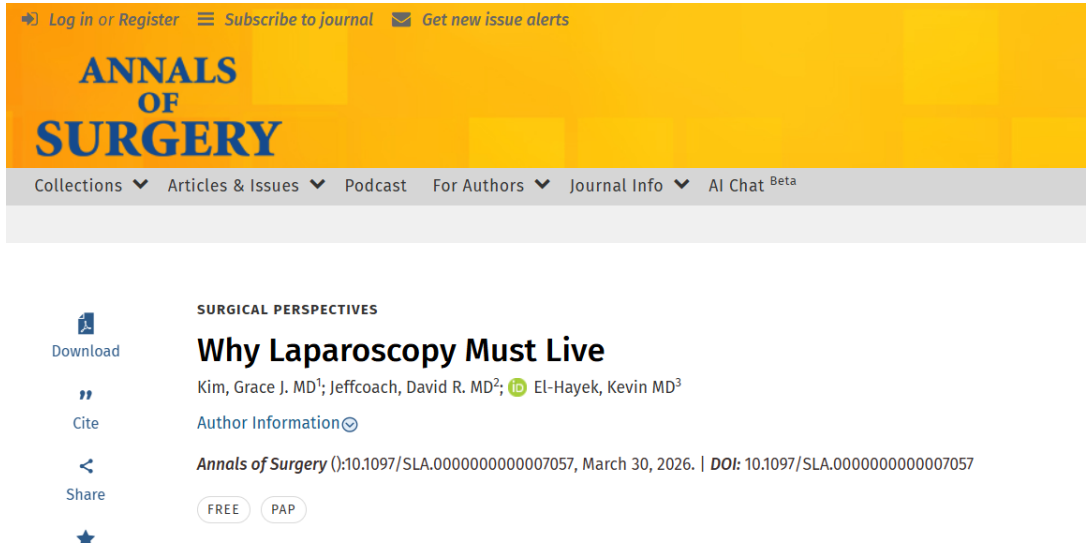
Health services research
Original research

Current issues and future considerations for the wider implementation of robotic-assisted surgery: a qualitative study

Louisa Lawrie [1], Katie Gillies [1], Loretta Davies [2], Jared Torkington [3], John McGrath [4], Richard Kerr [5], Arul Immanuel [6], Marion Campbell [1], David Beard [2]
Correspondence to Dr Louisa Lawrie; louisa.lawrie1@abdn.ac.uk

Technology Availability and the Need for Dual Competency

- Robotic platforms are **not universally available**, even in **high-income countries (HICs)**.
- More than **9,900 da Vinci robotic systems** are installed worldwide, yet **many hospitals**:
  - **Do not** have a robotic system, or
  - Cannot provide it in **every operating room for every procedure**.
- If robotic systems become unavailable during surgery, **conversion to laparoscopy or open surgery** may be required.
- Therefore, **Dr. Brent Matthews(President of the Society of American Gastrointestinal and Endoscopic Surgeons)** recommends that surgeons develop **dual competency in both laparoscopic and robotic surgery** to ensure patient safety.



Global Impact of Declining Laparoscopic Expertise

- Replacing **laparoscopy with robotic surgery** may lead to a **decline in laparoscopic expertise** and innovation worldwide.
- Fewer laparoscopic surgeons means **reduced opportunities for training and education**.
- **Surgeons may lose proficiency** in important laparoscopic skills such as:
  - **Intracorporeal suturing**
  - **Knot tying**
- These skills are particularly important in **LMICs**, (Low- and Middle-Income Countries) where surgical staplers, clips, and advanced energy devices are not always available.


Trust

Open access | Review article | First published online April 13, 2021

Barriers to training in laparoscopic surgery in low- and middle-income countries: A systematic review

Ellen Wilkinson, Noel Aruparayil, [...], and David Jayne +2 View all authors and affiliations

Volume 51, Issue 3 | https://doi.org/10.1177/0049475521998186

Contents | PDF/EPUB | Cite | Share options | Information, rights and permissions | Metrics and citations


World J Gastrointest Surg. 2017 Jan 27;9(1):13–18. doi: 10.4240/wjgs.v9.i1.13

Practice, training and safety of laparoscopic surgery in low and middle-income countries

Maryam Alfa-Wali [1,2], Samuel Osaghae [1,2]

Author information | Article notes | Copyright and License information

PMCID: PMC5237818 PMID: 28138364

Training Pathway for Residents – Current trends

Introduction During Early Residency
– Early exposure to **robotic surgery principles and system components**
– Basic understanding of robotic technology and operating room setup

Stepwise Exposure to Robotic Procedures
– Progressive learning through **structured training programs**
– Observation and participation in robotic operations

Participation as Bedside Assistant
– Assisting in **patient positioning, trocar placement, and robotic docking**
– Gaining familiarity with robotic instruments and workflow

Gradual Console Experience
– Performing selected surgical steps at the console under supervision
– Progressive increase in responsibility until **independent robotic performance**

Article | Literature Review

Training and learning robotic surgery, time for a more structured approach: A systematic review

January 2012 · BJOG An International Journal of Obstetrics & Gynaecology 119(2):137-49
DOI:10.1111/j.1471-0528.2011.03139.x
Source · PubMed

Investment in Surgical Training and Expertise

Successful implementation of **robotic surgery** requires **significant investment in surgical training and expertise**.

The transition from **traditional surgery to robotic surgery** involves a **steep learning curve**, requiring surgeons to develop **new technical skills** and adapt to a **different surgical environment**.

Traditional surgical training pathways usually include **years of residency training followed by subspecialty fellowship**. However, these programs **may not adequately prepare surgeons for the complexities of robotic surgery**.

Therefore, **specialized robotic surgery training programs** are necessary to equip surgeons with the **skills and knowledge needed to perform robotic procedures safely and effectively**.

Evolution of Surgical Training Curricula

Developing surgical curricula is **not a new challenge**, especially since the introduction of **laparoscopic surgery in the 1990s**.

In **1997**, the **Society of Gastrointestinal and Endoscopic Surgeons (SAGES)** introduced the **Fundamentals of Laparoscopic Surgery (FLS)** program.

FLS is an **evidence-based and validated skills training program** that became widely adopted.

In the **United States**, completion of **FLS** is a **prerequisite for the American Board of Surgery (ABS) certification examination**.

SPECIAL SECTION: COMPETENCY—WHEN, WHY, HOW? · Volume 135, Issue 1, P21-27, January 2004

Download Full Issue

Development and validation of a comprehensive program of education and assessment of the basic fundamentals of laparoscopic surgery

Jeffrey H Peters, MD · Gerald M Fried, MD · Lee L Swanstrom, MD · ... · Bruce Schirmer, MD · Kaaren Hoffman, PhD · the SAGES FLS Committee ... Show more

Affiliations & Notes · Article Info

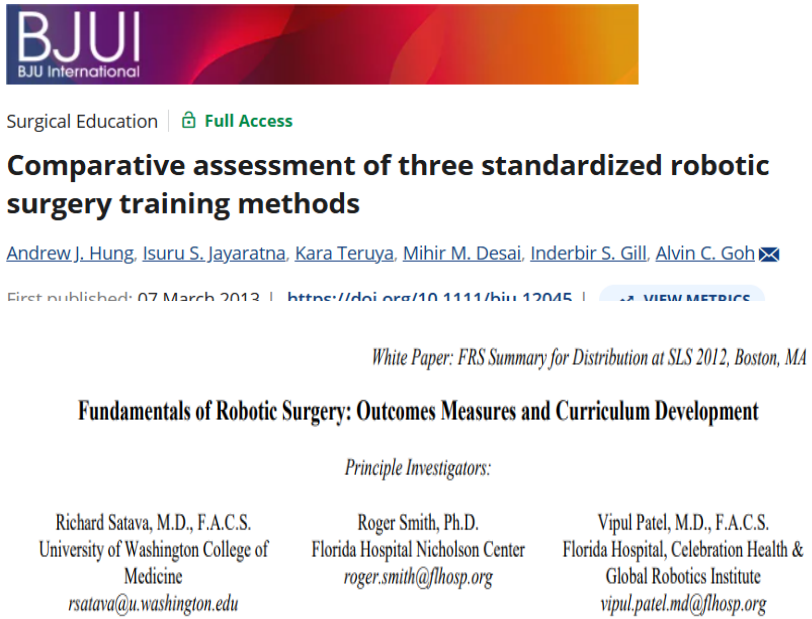
Development and Assessment of Robotic Surgery Curricula

Although **FLS** is effective for **minimally invasive surgical training**, it **does not include robotic surgery skills**, highlighting the need for **new validated robotic curricula**.

Many robotic training programs aim to **develop curricula analogous to FLS**, using it as a **benchmark**.

A major challenge is the **absence of a gold standard assessment tool** in robotic surgery training.

Some studies propose **Cross-Method validity**, comparing different training methods using tools such as the **Global Evaluative Assessment of Robotic Skills (GEARS)**.



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Surgical Education | Full Access

Comparative assessment of three standardized robotic surgery training methods

Andrew J. Hung, Isuru S. Jayaratna, Kara Teruya, Mihir M. Desai, Inderbir S. Gill, Alvin C. Goh

First published: 07 March 2013 | https://doi.org/10.1111/biu.12045 | VIEW METRICS

White Paper: FRS Summary for Distribution at SLS 2012, Boston, MA

Fundamentals of Robotic Surgery: Outcomes Measures and Curriculum Development

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International Comparison of Robotic Surgery Curricula

While no global consensus curriculum exists, many national and institutional programmes share similar technical components. The table below summarises well-documented curricula and frameworks, illustrating the consistent inclusion of simulation and assessment tools, but highlighting a common omission—structured training in team communication and human factors.

Table 1 **Comparison of Key International Robotic Surgery Training Frameworks**

Framework / Source	Simulation Modalities	Assessment Tools	Didactic / Online Learning	Team & Communication Training	Notes
FRS (Fundamentals of Robotic Surgery)	VR, dry lab, video	Structured (GEARS-like)	✓ core module set	✘ Not formally included	Validated, structured early skills framework
UCSF/UCLA/ Urology ERUS programmes	VR, dry, cadaveric	Variable (OSATS, logbooks)	✓ specialty-specific	✘ Limited inclusion	Fellowship-level or advanced training pathways
GEARS / R-OSATS (assessment tools only)	Any	✓ performance scoring	✘ Not a full curriculum	⚠	Widely used within curricula, not standalone
Rahimi et al. review (2024)	All types	Variable across centres	✓ common	✘ not widely implemented	Systematic review of residency/ fellowship curricula
Walshaw et al. (2025, IJS)	VR, cadaveric, wet lab	✓ validated instruments	✓ often present	✘ mostly absent	Identified lack of standardised team training globally
IMRA (imrasurgical.com)	VR, Video, Hydrogel	GEARS, RACE	✓ Foundations and Course Specific	✓ Separate Non-Technical Session	Multiplatform multimodal hydrogel based curriculum

Sources: Rahimi et al., Surg Endosc 2024; Walshaw et al., Int J Surg 2025.

Note: This table provides a representative overview and is not intended to be comprehensive or exhaustive.

The current landscape of robotic surgery training

There are essentially **five levels** of robotic surgical education:

- **Basic robotic orientation**
- **Simulation and psychomotor skills**
- **Structured clinical/procedural training**
- **Fellowship-level competency training**
- **Credentialing/certification and independent practice**

The major weakness in the current system is that these levels are often **not connected into one longitudinal pathway**.

Major Robot-Assisted Surgery Training Curricula

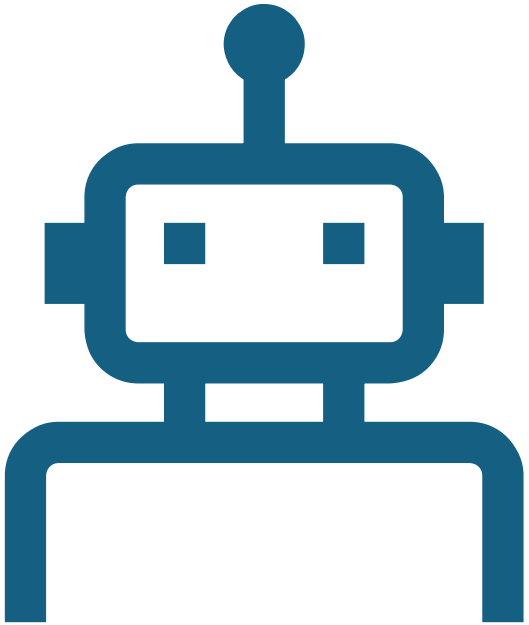
1. Fundamental Robotic Surgery (FRS)

- The **FRS curriculum** is a validated, internationally recognised structure designed to **teach** and **evaluate** the basic skills required for robotic surgery.

It focuses on core competencies such as:

- Instrument manipulation
- Camera control
- Suturing and knot tying
- Basic robotic console skills

The program **integrates simulation training** with **objective assessment methods** to evaluate surgical performance.



Fundamentals of Robotic Surgery (FRS) – Overview

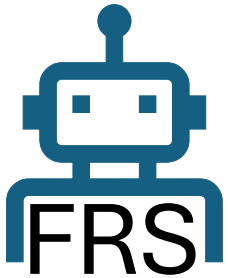
- **Two groups** are developing curricula under the title **Fundamentals of Robotic Surgery (FRS)**:
  - **Florida Hospital Nicholson Center Group** (large multicenter project)
  - **Orlando Group** (presented at SAGES 2012 meeting)
- **FRS – Florida Hospital Nicholson Center**
  - A **large multicenter project**.
  - Developed by **over 24 international robotic surgery experts** over two years.
  - Curriculum content determined through **consensus conferences involving 14 surgical societies**.

Original Article | Full Access

Fundamentals of robotic surgery: a course of basic robotic surgery skills based upon a 14-society consensus template of outcomes measures and curriculum development

Roger Smith, Vipul Patel, Richard Satava

First published: 26 November 2013 | https://doi.org/10.1002/rcs.1559 | VIEW METRICS



Curriculum Structure

- The curriculum was designed around **25 main outcome measures** identified by expert consensus.
- The **teaching curriculum includes 4 modules** covering:
  - Module 1 — Introduction to Robotic Systems
  - Module 2 — Didactic Robotic Surgery
  - Module 3 — Psychomotor Skills
  - Module 4 — Team Training & Communication (FRS recognizes that robotic surgery is **not simply a surgeon-at-the-console activity**.)
- The curriculum is designed to be **robot-independent**, anticipating future robotic platforms.

Outcomes Measures defined by the FRS group

Pre-operative	Intra-operative		Post-operative
System settings	Energy sources	Eye-hand instrument	Transition to bedside
Docking	Clutching	coordination	assistant
Ergonomic	Camera control	Atraumatic tissue handling	Undocking
positioning	Instrument exchange	Cutting	
Robotic trocars	Foreign body	Fine & blunt dissection	
OR set-up	management	Needle Driving	
Closed loop comms	Multi-arm control	Suture handling	
Situation awareness	Wrist articulation	Safety of operative field	
Respond to system	Knot tying		
errors			

White Paper: FRS Summary for Distribution at SLS 2012, Boston, MA

Fundamentals of Robotic Surgery: Outcomes Measures and Curriculum Development

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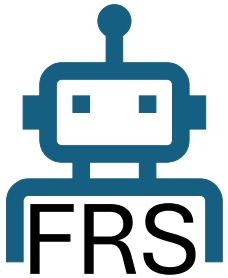

Curriculum Structure

- **Proficiency-Based Progression:**
- Traditional surgical education has historically been:
  - **Time-based → Case-based → "See one, do one, teach one."**
- Modern robotic education is moving toward:
  - **Competency-based / proficiency-based progression.**
- The trainee does **not progress simply because he/she has completed 10 hours or 20 cases**.

Instead:

- **Train → Assess → Reach benchmark → Progress.**

- n **July 2025**, ownership of FRS transferred from the Institute for Surgical Excellence (ISE) to the **Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)**.

- At **SAGES 2026**, FRS was specifically presented as:
- a newly acquired program **under development, aimed at providing a competency standard similar to FLS and FES.**

Orlando FRS Group

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International Journal of Surgery

Volume 13, January 2015, Pages 115-123

Review

An over-view of robot assisted surgery curricula and the status of their validation

Rebecca A. Fisher, Prokar Dasgupta, Alex Mottrie [1], Alessandro Volpe [2], Mohammed S. Khan, Ben Challacombe, Kamran Ahmed

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A small group from the Colon and Rectal Clinic of Orlando presented a short curriculum at the SAGES Annual Meeting 2012

Conducted a literature review on:

Fundamentals of Laparoscopic Surgery (FLS)

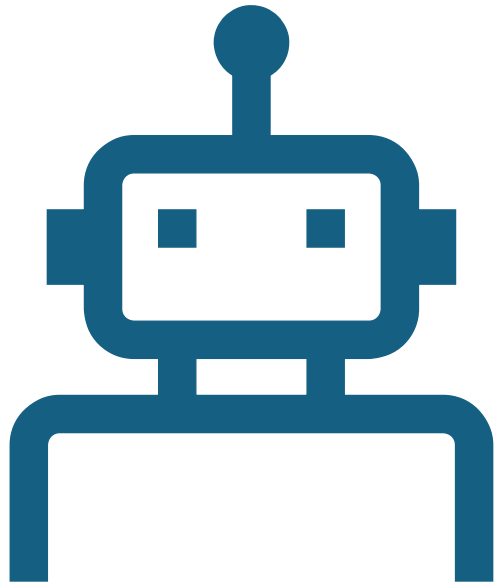
Robotic surgery training

Studied the **da Vinci Si Skills Simulator** at a local center

Identified **five main technical tasks** in robotic surgery

Aim:
→ To develop a curriculum **analogous to FLS** for robotic surgery

The curriculum is based on **five simulated tasks:**



1.Camera Targeting
2.Peg Board
3.Ring Walk
4.Energy Dissection
5.Suture Sponge

•These tasks are derived from the **da Vinci Si Skills Simulator**

•The program was developed with the intention of creating a **device-dependent robotic surgery curriculum**

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International Journal of Surgery
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2. FSRS: Fundamental Skills of Robotic Surgery

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International Journal of Surgery

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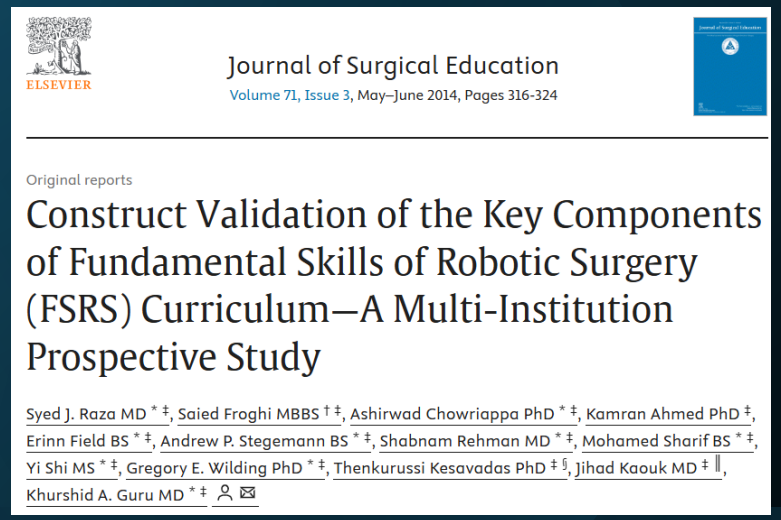
- **Background:**
- Developed by an international team at Roswell Cancer Institute, Buffalo, NY
- Based on expert robotic surgeons' opinions
- Assessed using the **Robotic Skills Assessment Score (RSA Score)**
- Validated and implemented at Roswell Park Cancer Institute
- **Course Structure:**
- Composed of **16 tasks** divided into **4 modules**
- Each task includes:
  - Three levels of difficulty
  - Followed by an evaluation stage
- Developed with input from:
  - Robotic surgery experts
  - Virtual reality simulation engineers

Training, Assessment & Validation

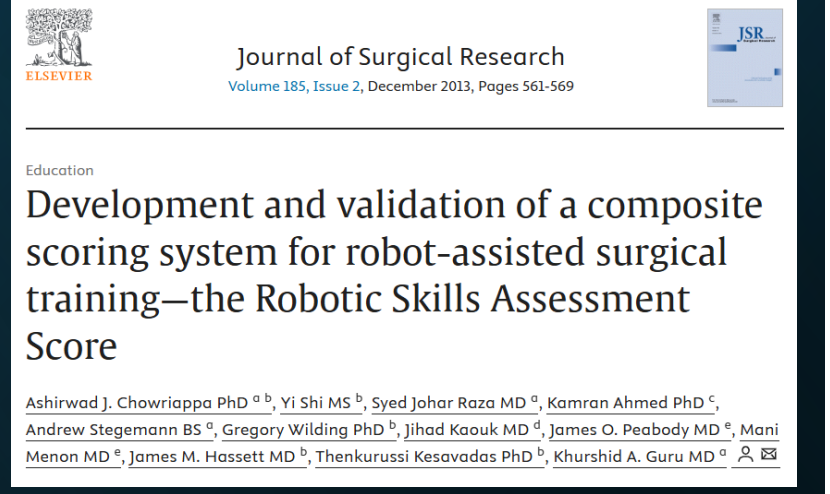


Journal of Surgical Education
Volume 71, Issue 3, May–June 2014, Pages 316-324

Original reports

Construct Validation of the Key Components of Fundamental Skills of Robotic Surgery (FSRS) Curriculum—A Multi-Institution Prospective Study

Syed J. Raza MD [*] [‡], Saied Froghi MBBS [†] [‡], Ashirwad Chowriappa PhD [*] [‡], Kamran Ahmed PhD [‡], Erinn Field BS [*] [‡], Andrew P. Stegemann BS [*] [‡], Shabnam Rehman MD [*] [‡], Mohamed Sharif BS [*] [‡], Yi Shi MS [*] [‡], Gregory E. Wilding PhD [*] [‡], Thenkurussi Kesavadas PhD [‡] [§], Jihad Kaouk MD [‡] [‖], Khurshid A. Guru MD [*] [‡]



Journal of Surgical Research
Volume 185, Issue 2, December 2013, Pages 561-569

Education

Development and validation of a composite scoring system for robot-assisted surgical training—the Robotic Skills Assessment Score

Ashirwad J. Chowriappa PhD [a] [b], Yi Shi MS [b], Syed Johar Raza MD [a], Kamran Ahmed PhD [c], Andrew Stegemann BS [a], Gregory Wilding PhD [b], Jihad Kaouk MD [d], James O. Peabody MD [e], Mani Menon MD [e], James M. Hassett MD [b], Thenkurussi Kesavadas PhD [b], Khurshid A. Guru MD [a]

- **Simulation Platform:**

  Training delivered using the **Robotic Surgical Simulator (RoSS)**

- **Training Approach:**

  No operating room training within the course

  Serves as a **foundation before mentored clinical training**

- **Assessment (RSA Score):**
- Measures:
  - Task completion time
  - Instrument dexterity
  - Error rate
  - Operative safety
- Differentiates clearly between novice and expert performance
- **Validation & Application:**

  Demonstrated effectiveness in randomized studies

  Incorporated into structured **robot-assisted training programs (RAST)**

ASMBS START Program Overview (2025–2026)

- The **ASMBS Surgical Technique and Advanced Robotics Training (START) Program** is currently available for the **2026–2027 academic year**.

- National robotics training program for bariatric surgery fellows.
- Combines:
  - Virtual faculty-led didactic sessions
  - Local mentorship by experienced robotic bariatric surgeons
  - Hands-on training at a dedicated robotics facility
- Designed for fellows enrolled in Fellowship Council–approved bariatric fellowships. Maximum of **45 fellows annually**. Focus on safe and effective use of the **da Vinci Xi robotic platform** in bariatric and metabolic surgery. Supported by **ASMBS** with educational grant funding from **Intuitive Surgical**.

Program Structure & Eligibility

- The structure includes:
- **Before training :** Virtual didactic preparation.
- **During training**
  - faculty-led teaching
  - robotics training facility
  - hands-on experience
  - experienced robotic bariatric faculty
- **After training**
  - post-course case review
  - video presentation
  - discussion with faculty
  - capstone session
  - transition-to-practice resources
  - graduation.
- It also includes local mentoring by an experienced bariatric robotic surgeon.

Program Structure & Eligibility

It represents a shift from:

- "Attend a robotic course."

  to:

- "**Create a longitudinal robotic bariatric educational pathway.**"

IFSO Training in Robotic Bariatric and Metabolic Surgery

- The (IFSO) has incorporated robotic surgery training into its educational framework through multiple structured initiatives rather than a single standardized fellowship program.
- IFSO provides robotic bariatric exposure mainly through **pre-congress hands-on courses, advanced workshops, and simulation-based training modules** held during its annual and regional congresses.

These training activities typically include:

- Robotic system setup and docking techniques
- Step-by-step robotic sleeve gastrectomy and gastric bypass
- Live and video-based operative demonstrations
- Dry-lab and simulation-based hands-on practice
- Training on revisional bariatric procedures and advanced robotic applications
- In addition, IFSO supports **Young IFSO educational programs and international observerships**, which increasingly incorporate robotic surgery training within high-volume metabolic and bariatric centers.
- Overall, IFSO promotes a **competency-based, exposure-driven model** for robotic bariatric surgery training rather than a single unified curriculum.

Conclusion:

A modern robotic bariatric training

FOUNDATION: FRS

ROBOTIC COMPETENCY

Simulation + proficiency benchmarks

BARIATRIC COMPETENCY

Procedure-specific modules.

CLINICAL TRAINING :Mentored OR progression

ASSESSMENT: Objective competency assessment

INDEPENDENCE: Supervised independent cases

CERTIFICATION :Robotic Bariatric Surgery Fellowship Certificate

CONTINUOUS PROFESSIONAL DEVELOPMENT: Outcomes + video review + maintenance of competency

Thank you

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