COMMITTEE: Scientific Forum

TOPIC: Discussing the implementation and legalization of robotic surgery and AI in national healthcare departments and medical research.

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POSITION: President

Table of contents:

Personal Introduction

Dear Delegates,

My name is Georgia Papadas, I am 17 years old, and I will be your president in the 2025 MUN session. I am truly honored to have been given the chance to work with you this year in the Scientific Forum committee with my co-chair Alexandre Bellone. I hope that this study guide will help you get a clear and thorough understanding of the topic as well as help you gather information and arguments for the debates to come.

During this long weekend we are going to discuss three fundamental topics that concern us all including the implementation and legalization of robotic surgery and AI in national healthcare departments and medical research. In my opinion, through this precise subject we will find much knowledge regarding the latest technology application in the healthcare field. This matter can't be unnoticed and based on its importance it should generate a strong debate with the results of improving the actual positions.

Introduction

As technological progress kept up, the possibility of implementation in healthcare of artificial intelligence and robotic surgery became a strong debate. Because even if this prospect can bring us many upgrades such as enhanced precision in surgical procedures, optimized patient care and accelerated medical research, an analyzation of the ethical consequences has been shared by many. Their use and laws bring big worries about morals, rules, and money that countries need to deal with to make sure all people get fair and good healthcare systems.

Complex medical operations have been transformed by robotic surgery because it improves accuracy by up to 50%, lowers human error by up to 40%, and speeds up recovery. Healthcare systems are undergoing a revolution that enhances patient outcomes because of AI-powered algorithms helping with AI-assisted diagnostics and reducing misdiagnosis rates, treatment planning, and patient monitoring. AI-driven research also speeds up drug discovery by 70%, which results in quicker therapeutic advancements. All things considered, incorporating AI into healthcare increases productivity by 60%, reduces operating expenses, and expands access to high-quality medical treatment.

However, AI healthcare centers need to take strong cybersecurity measures and data protection laws to prevent misuse and ensure that robotic surgery and AI applications meet safety, efficacy, and ethical standards. Furthermore, AI-driven analysis of surgical data can improve techniques, and accelerate clinical trials, leading to better treatments

and innovation. In 2020, 1.12 million robotic-assisted surgeries were performed in the U.S. alone, with over 5,500 da Vinci Surgical Systems installed in hospitals (Market.us, 2025).

The goal of this study guide is to examine robotic surgery and artificial intelligence in national healthcare systems and medical research. When creating rules that address accessibility, cost-effectiveness, and patient safety in the rapidly changing medical scene, delegates are urged to take into account the harmony between technological innovation and human oversight.

Definition of key words

Robotic Surgery: a surgical procedure that is performed using robotic systems, often controlled by a surgeon, to enhance precision, flexibility, and control during operations.

Artificial Intelligence (AI) in healthcare: the use of machine learning algorithms, neural networks, and data analysis to assist in diagnosing diseases, predicting patient outcomes, automating administrative tasks, and improving medical procedures.

Legalization: the process of enacting laws and regulations to govern the use of AI and robotic surgery in healthcare, ensuring compliance with ethical, safety, and medical standards.

Medical Ethics: a branch of ethics that examines the moral principles governing medical practice, including patient autonomy, informed consent, beneficence, and non-maleficence.

Regulatory Framework: the set of laws, guidelines, and policies established by government or health authorities to monitor and control the implementation of AI and robotic technologies in healthcare.

Data Privacy: the protection of patients' medical records and personal information from unauthorized access, crucial in AI-driven healthcare systems that rely on vast amounts of data.

Cost-Effectiveness: the economic evaluation of AI and robotic surgery technologies, assessing whether their benefits justify their implementation costs in public healthcare systems.

Informed Consent in AI Surgery: the process by which patients are educated about the risks, benefits, and limitations of AI-assisted medical procedures before agreeing to treatment.

Telemedicine: the remote diagnosis and treatment of patients using digital communication tools, often incorporating AI for consultations, monitoring, and decision support.

General overview

Robotic surgery and AI: Implementation and legalization

Causes

- **Medical Advancements and Efficiency**

The increasing capabilities of AI and robotic surgery have revolutionized healthcare, offering higher precision, reduced human error, and faster recovery times for patients. The concept of surgery itself dates to ancient civilizations with the first practitioner being Sushruta, an Indian physician from 600 BCE. He authored *Shruta Samhita*, a medical text detailing surgical technique. Over the centuries, figures like Hippocrates and Galen of Pergamon contributed to the evolution of surgery, making it safer and more effective. Later, in 1985, Dr. Yik San Kwohk, developed the *PUMA 560*, the first robotic-assisted surgical system, used for neurological purposes. After this discovery, NASA and Standford University took on and developed early AI systems by continuing research into robotic surgery. Nowadays, many nations seek to integrate these technologies to improve surgical outcomes and reduce workload burdens on medical professionals.

- **Shortage of Medical Professionals**

Several countries face a shortage of skilled healthcare workers, particularly in underdeveloped areas, where access to specialized medical care is limited. Factors such as aging populations, increasing healthcare demands, and the migration of medical professionals to more developed regions have intensified this crisis. In rural areas, patients often need to wait a long time or must travel great distances to receive proper medical attention. In a case where a doctor is unavailable, it creates a serious problem, especially in less developed countries where access to skilled surgeons is already limited. Availability of highly trained medical professionals is inconsistent, and patients may face delays in critical surgeries, leading to complications.

- **Need for Higher Precision and Reduced Human Error**

Human error in surgery can lead to complications, prolonged recovery, and even fatalities. Medical professionals have limits and can get tired after long hours of surgery. In delicate procedures like neurosurgery and microsurgery, a surgeon needs to be prepared, focused, and in peak condition to ensure the best possible outcome for the patient, which is not always the case. And that has a negative impact on the surgeon's esteem and the patient's health.

- **Increasing Healthcare demands in the economic field**

With rising global populations and aging demographics, the demand for healthcare services is increasing. Traditional healthcare systems struggle to keep up, leading to longer wait periods, overpopulated hospitals, increased patient risks, and results in worse healthcare quality. Although the initial investment in robotic surgery and AI is high, the long-term economic benefits make them attractive to governments and healthcare institutions.

- **Pandemic and Crisis Response**

The COVID-19 pandemic highlighted the importance of technology in managing healthcare crises as it accelerated the adoption of AI and advanced surgical techniques to address the challenges posed by global health emergencies. AI-powered algorithms were used to identify COVID-19, predict disease outbreaks, and analyze vast amounts of clinical data, allowing healthcare systems to respond proactively.

Consequences

The implementation of robotic surgery and AI in the healthcare field can benefit both patients and workers, but it can also have a negative impact.

- **AI's help during the pandemic**

During the COVID-19 pandemic, AI-assisted tools helped in diagnostics, patient tracking, and medical research, while robotic systems were used for contactless procedures and sanitization. According to the National Insitute of health (NIH), "*Numerous studies have explored using artificial intelligence (AI) and machine learning (ML) to detect COVID-19 through the analysis of chest X-rays and CT scans. These investigations have demonstrated promising accuracy levels, ranging from 84.3% to 100%, suggesting the potential utility of AI in clinical settings".* This accelerated the adoption of AI and robotics in national healthcare strategies.

- **Enhancing efficiency and access to healthcare**

Robotic surgery allows for greater precision, reducing human errors, and improving patient outcomes. AI assists in diagnosis and treatment planning with higher accuracy. AI can analyze vast amounts of medical data quickly, enabling faster diagnoses and treatment recommendations, and reducing the workload on healthcare professionals. Finally, AI-driven diagnostics and robotic surgeries can be deployed in remote areas, allowing patients to receive quality care without needing to travel long distances.

- **Reduction of recovery time and human fatigue**

Minimally invasive robotic surgeries lead to shorter hospital stays, faster patient recovery, and reduced post-surgical complications. Unlike human doctors, AI and robots do not experience fatigue, ensuring consistency and reducing risks associated with human limitations.

- **Job Displacement and Workforce Concerns**

Automation and AI could replace certain healthcare roles, leading to job losses and requiring medical professionals to adapt to new technologies. As a result, AI-driven healthcare could reduce human interaction, impacting the doctor-patient relationship and emotional aspects of medical care.

- **Cybersecurity Risks**

AI systems and robotic surgical tools can be vulnerable to cyberattacks, putting patient data and even living at risk if compromised. And this excessive dependence on AI might lead to reduced critical thinking among medical professionals, increasing risks if the technology fails.

Case Study: The use of AI to boost cancer detection

The best way to treat cancer or many other health conditions is to discover them early. ‘C the Signs’ is an artificial intelligence program that scans medical records (also known as GP records) to increase the likelihood of spotting cancers. This analyses a patient’s medical record to pull together their past medical history, test results, prescriptions and treatments, as well as other personal characteristics that might indicate cancer risk, such as age and family history. This tool also prompts patients to ask about any new symptoms,

and if it detects any data that indicates a higher risk of a particular type of cancer, then it recommends tests and a clinical pathway.

Artificial intelligence that scans GP records to find hidden patterns has helped doctors detect significantly more cancer cases. As claimed by The Guardian article, 'C the Signs' is used in about 1,400 practices in England – about 15% – and was tested in 35 practices in the east of England in May 2021, covering a population of 420,000 patients' . Whereas 'The rate of cancer detection rose from 58.7% to 66.0% at GP practices using the "C the Signs" AI tool by 31 March of 2022'.

Bea Bakshi, the specialist who created the system with her colleague Miles Payling, said: "*Our system has detected over 50 different types of cancers. The key thing is that it's not only an earlier diagnosis, but a faster diagnosis.*" Bakshi developed the tool after meeting a patient in hospital who had been given a late diagnosis of pancreatic cancer and died three weeks later. "*Why are patients with cancer being diagnosed so late?*", she asked. And that was the story behind the formation of the 'C the Signs' program.

Global Cancer Mortality Overview (2000–2025), according to The American Cancer Society

Year	Estimated Total Cancer Deaths	Most Common Cause of Death	Other Top Fatal Cancers
2000	7.0 million	**Lung cancer** (~1.2M)	Stomach, Liver, Colorectal, Breast
2005	7.6 million	**Lung cancer**	Liver, Colorectal, Stomach, Breast
2010	8.2 million	**Lung cancer**	Liver, Stomach, Colorectal, Breast
2015	9.6 million	**Lung cancer**	Liver, Colorectal, Stomach, Breast
2020	10.0 million	**Lung cancer** (~1.8M)	Colorectal (~935K), Liver, Stomach, Breast
2022	9.7 million	**Lung cancer** (~1.82M)	Colorectal, Liver, Stomach, Breast

The amount of cancer deaths kept increasing from 2000 to 2015 until it reached its peak in 2020. Covid-19 had a pandemic impact on the cancer's deaths whereas it disrupted cancer detection and treatment, many people skipped or delayed screenings due to lockdowns, fear, or overloaded hospitals. And some people who were diagnosed with cancer died from COVID-19 instead, especially older or immune-deficient individuals. In 2022 the estimated total cancer deaths started decreasing and that can be attributed to the implementation of AI and robotic programs.

Case Study: University of Minnesota Medical School: Robotic Surgery

The surgical field is increasingly turning to artificial intelligence to enable robotic-assisted procedures that are safer and more efficient. To make this a reality, the university of Minnesota has set up the project *Database of High-Quality Robotic Surgery Video and Kinematic Performance*, which will aim to 'mimic the surgical field', 'automate tasks' and 'train a surgical robot to complete a live synthetic test environment for surgical training'.

The data collection and AI components of the project for the University of Minnesota are of utmost importance. For the purposes of model training, the project collects video data and kinematic performance metrics from real-life surgeries. These data sets allow for the modeling of intricate robotic movements at a level of detail necessary for accuracy, which robotics seek to achieve as they evolve technologically. The kinematic performance data of the tools provide information such as the speed, force, and direction movement of the instruments. All these assists in the automation of tasks like robot arms that necessitate precision and accuracy.

The project is led by Elliot Arsoniadis, a Medical School faculty member from the Department of Surgery, who outlines the strategic direction for the future of robot-assisted surgeries. Dr. Arsoniadis said: "*Our initial goals are to automate some surgical performance of basic level tasks, such as tying a knot or closing an incision*". He makes very clear that their mission is to '*continue these developments well into the future where robotic performance can mimic tasks as a skilled assistant'. "I do roughly 30 to 50% of intra-abdominal surgeries using some robotic modality,*" Dr. Arsoniadis said. "*There are learning curves to all of it, but it is most rewarding to build these skills for decades to come*."

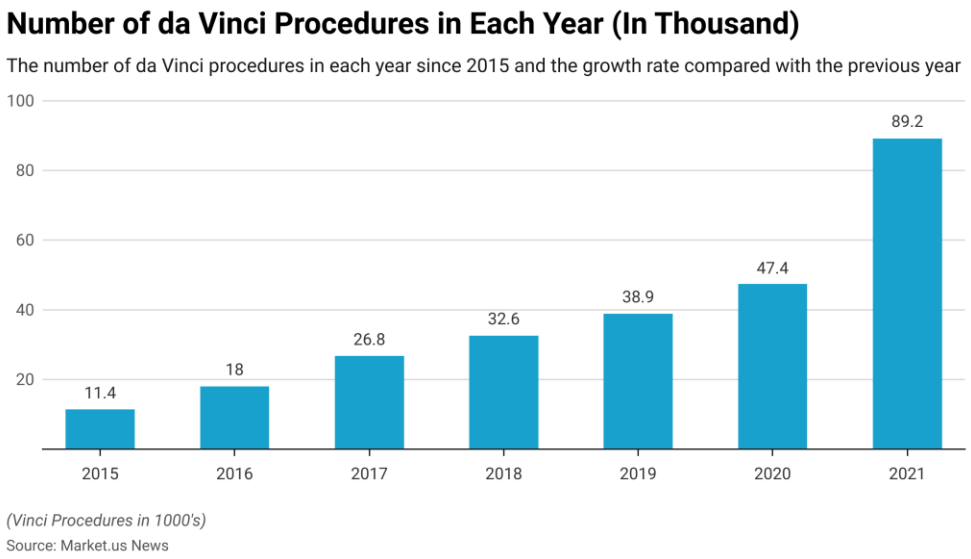
Case Study: Sandra Sultzer's death from robotic surgery

In September 2021, Sandra Sultzer underwent a colon cancer surgery at Baptist Health Boca Raton Regional Hospital in Florida. The surgeons utilized the da Vinci surgical robot developed by Intuitive Surgical. The procedure, intended to be minimally invasive, was performed using the robotic system controlled by the surgeon. After the surgery, Sandra developed severe abdominal pain and fever. Later clinical examinations revealed that the da Vinci robot had caused a thermal injury to her small intestine. This injury necessitated additional surgeries and treatments. Unfortunately, in February 2022 Sandra passed away due to the complications from the injury.

Harvey Sultzer, Sandra's husband, claims that Intuitive Surgical (the developer of the robot) was aware of similar issues with the da Vinci system but failed to adequately warn patients or ensure proper training for surgeons. According to the article Medical Buyer, Harvey Sultzer is '*suing the medical giant Intuitive Surgical seeking over $75,000 in damages for his wife's death*'. He claims that his wife Sandra Sultzer's death was caused

by the surgical robot da Vinci. However, the article highlights that 'the surgical robot is marketed for its unparalleled precision "*beyond the limits of the human hand*" and minimally invasive nature, "*designed to provide surgeons with natural dexterity while operating through small incisions*"'.

As reported by Indiatimes, Sandra Sultzer's wasn't the first lawsuit claiming injuries from this robotic device. The article says: '*In a 2014 financial report submitted to the Securities and Exchange Commission, Intuitive disclosed facing approximately 93 lawsuits, all alleging personal injuries or death resulting from surgical procedures involving the da Vinci Surgical System*.'



This case underscores ongoing concerns about the safety and regulation of robotic surgical systems, particularly regarding their design flaws and the adequacy of training provided to medical professionals.

Concerned countries and organizations

Countries

United States of America: leader in medical AI and robotic surgery.

Germany: strong healthcare system, cutting-edge medical technology sector.

France: advanced in healthcare innovation, a bit cautious but progressive on AI ethics.

United Kingdom: big investments in AI and healthcare reforms.

Japan: pioneer in robotics, aging population demands healthcare automation.

South Korea: high-tech hub, major investments in medical AI and robotics.

Canada: progressive healthcare system, focused on ethical AI integration.

Switzerland: home to major medical research institutions, heavy on AI ethics and innovation.

India: emphasizes the need to address healthcare inequalities before prioritizing high-cost technologies like robotic surgery and AI.

Brazil: remains cautious about implementing AI and robotic surgery in national healthcare departments because of financial constraints and limited public health infrastructure.

South Africa: urges that any push for AI in healthcare must be accompanied by global funding and training support to avoid healthcare gaps.

Nigeria: expresses concern that legalizing advanced technologies like robotic surgery may benefit only few while avoiding basic healthcare needs.

Mexico: highlights the importance of strengthening its healthcare infrastructure and regulations before integrating AI systems.

Indonesia: calls for an inclusive approach that prioritizes accessibility and affordability in healthcare departments.

Egypt: believes that without international cooperation and financial aid, adopting robotic surgery may widen the gap between public and private healthcare.

China: leads in AI research but it stresses that implementation of AI in healthcare must be balanced with supervision based on ethical standards and national health priorities, especially in rural areas.

Russia: strong in AI research, interested in national tech sovereignty, including healthcare AI.

Organizations:

IBM (IBM Watson Health): has contributed significantly to AI-assisted diagnostics and personalized treatment, raising global interest in how AI can support healthcare decision-making.

World Health Organization (WHO): emphasizes equitable access to healthcare technologies and thinks that AI and robotic surgery are a strong health safeguard for the future.

International Society for Robotic Surgery (ISRS): promotes research, training, and international collaboration to ensure safe, standardized, and effective use of robotic surgical techniques.

European Research Council (ERC): funds pioneering research projects in medical AI and robotics, supporting innovation while encouraging it.

Siemens Healthineers: develops advanced AI-driven diagnostic and surgical tools and supports public–private partnerships to expand access to high-tech medical care globally.

UN involvement

The United Nations has been carefully watching how AI and robotic surgery are changing healthcare. Through groups like the World Health Organization and UNESCO, the UN helps set global standards so countries can use these new technologies in a responsible way. They really emphasize that this progress should be guided by ethics, safety, and fairness, making sure that new innovations respect human rights and are available to everyone. Its advice and guidelines play a big role in shaping healthcare policies around the world, encouraging countries to work together as technology keeps transforming medicine.

Back in 2018, the World Health Organization (WHO) introduced its Digital Health Strategy to help countries start using digital tools in healthcare in a smart and responsible way. Then in 2020, WHO built on that with the Global Strategy on Digital Health, which focuses on making sure new technologies like AI are used safely, fairly, and in a way that works for everyone.

A year later, in November 2021, UNESCO stepped in with a major set of ethical guidelines on AI, encouraging countries to make sure AI is used in ways that respect human rights and protect people. UNESCO's Director-General, Audrey Azoulay, stated, "*The world needs rules for artificial intelligence to benefit humanity. The Recommendation on the ethics of AI is a major answer. It sets the first global normative framework while giving States the responsibility to apply it at their level."*

WHO Director-General Dr. Tedros Adhanom Ghebreyesus summed up the UN's position well in 2021, saying, "*Digital technologies, including artificial intelligence, have the potential to revolutionize healthcare (…) but only if we prioritize safety, ethics, inclusivity,*

and equitable access for all." UNESCO added that AI needs to be "*transparent, accountable, and inclusive*" so people can trust it and benefit from it.

Overall, the UN is not here to make laws for every country, but to help them figure out how to handle big changes like AI in a way that's safe, ethical, and fair. Through its guidance and global cooperation, the UN is helping make sure these powerful technologies truly improve lives without leaving anyone behind.

Latest developments

- In 2000, the company *Intuitive Surgical* receives approval for the da Vinci Surgical System, marking the first widespread robotic surgery system.
- In 2016 Google DeepMind partners with the United Kingdom for AI-based diagnostics in eye disease and cancer, raising early concerns about data privacy and leading to later reforms.
- In 2021, the European Union proposes the Artificial Intelligence Act, classifying AI in healthcare as "high-risk" and requiring strict oversight.
- In 2022, South Korea introduces national guidelines through its Ministry of Food and Drug Safety for the approval of AI-powered medical devices and robotic systems.

Issues

Data privacy

Previous attempts to solve the issue:

- 1996: enactment of HIPAA (Health Insurance Portability and Accountability Act) in the United States establishing patient health information protection in digital healthcare.

- 2000: early adoption of robotic surgical systems with limited AI-specific data regulation.

- 2012: introduction of ISO 13485, emphasizing secure data handling in medical device certification.

- 2018: enforcement of Europe's GDPR (General Data Protection Regulation), imposing strict patient data privacy and algorithmic rules globally.

- 2023: Europe adopts the AI Act, enforcing strict rules on high-risk AI systems, including surgical AI.

Possible solutions:

One of the most important steps is making sure there are clear, strong rules about how patient data is handled. Hospitals and researchers need to follow laws, which protect patient privacy. Before using anyone's health data in AI or robotic systems, patients should be fully informed and give their clear permission. This helps build trust and keeps people in control of their own information.

Then, just like locking your phone keeps your messages safe, healthcare systems need to lock up patient data using strong encryption. That means the data is protected while it's stored, while it's being shared, and even when AI systems are being used. It adds a strong layer of security so that hackers or unauthorized users can't get in.

Finally, when AI is used during robotic surgery, doctors and patients need to get educated in how it's making decisions. That's why it's important to use explainable AI systems that can show what they're doing and why. Keeping a record of each decision also makes it easier to spot mistakes and correct them.

Malfunction and inadequate training in robot surgery (For example: da Vinci robot surgery system)

Previous attempts to solve the issue:

- The U.S. FDA (Food and Drug Administration), a federal agency that is responsible for protecting public healthcare, asked companies to closely monitor robotic surgery systems after they were released and to publicly report any problems or complications to help ensure patient safety.

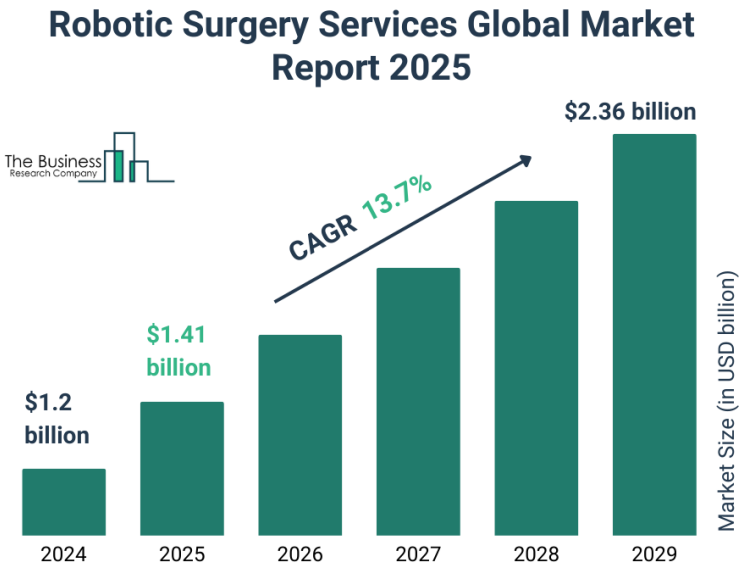
- Intuitive Surgical introduced mandatory simulation-based training and surgeon certification to reduce user error and improve surgical outcomes.

- The da Vinci system received hardware and software updates to fix known issues, for example: system errors, and lack of feedback during surgery.

Possible solutions:

Several strategies can be used to mitigate the risks connected to robotic surgical systems, such as the da Vinci robot. To guarantee that only highly skilled and experienced surgeons are permitted to perform robotic procedures, hospitals should first impose more strict training and certification requirements. Standardized protocols for robotic surgery, including the requirement to report complications and results, can also be established by national healthcare authorities. To lower the likelihood of malfunction, manufacturers should keep refining the software and design of these systems and be open and honest about any possible hazards. Finally, raising patient awareness through more transparent informed consent procedures can guarantee that people are fully aware of the part robotic technology plays in their surgeries as well as the level of experience of their surgeon.

Annex:



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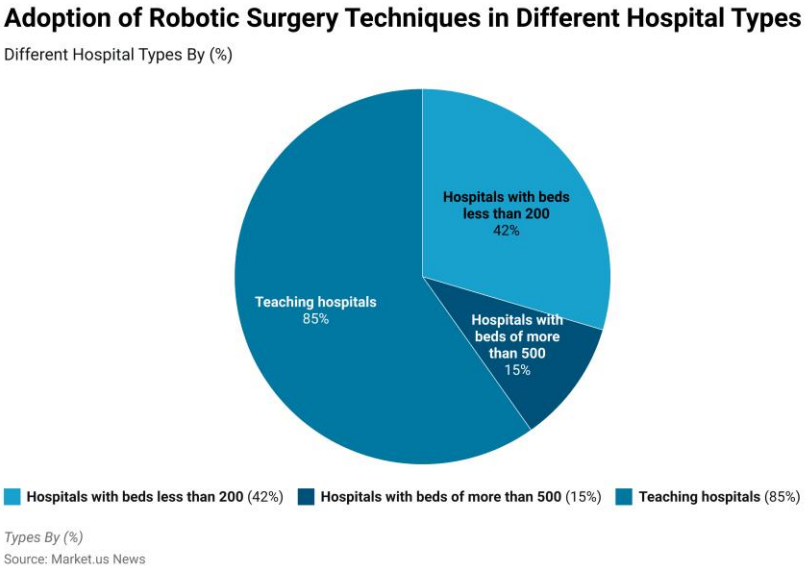

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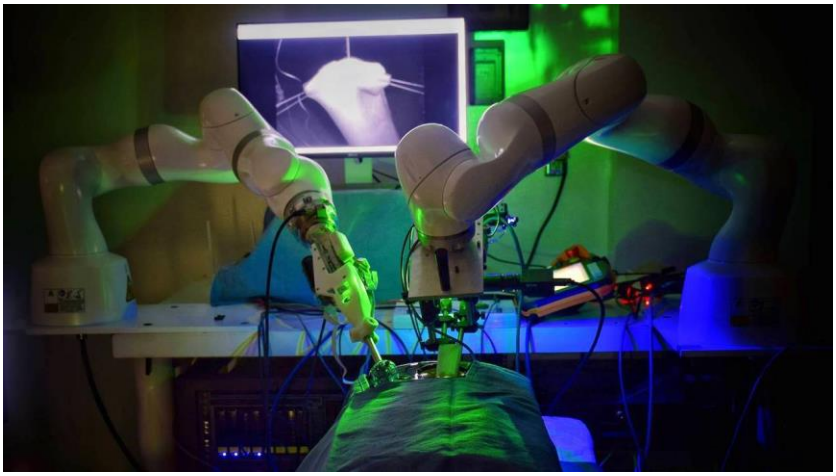

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