Adequate Use and Implementation of Robotic Assisted Surgery (RAS) in Nigerian Healthcare: A Conceptual Literature Review Approach.

OGUOMA IKECHUKWU STANLEY[1], UKA KANAYO KIZITO[2], EBELE PRECIOUS OKEMBA[3], CHUKWU ALPHONSUS CHEKWUBE[4], NWANKWO CHEKWUBE GEORGINA[5], AJERO CHUKWUKA EVANS[6]

[1] Department of Computer Science, University of Agriculture and Environmental Science (UAES) Umuagwo, Nigeria

[2, 6] Faculty of Physical Sciences, Department of Computer Science, Imo State University, Owerri, Nigeria

[3] University of Kent, United Kingdom

[4] Faculty of Medicine, Health and Life Sciences, Swansea University, Wales

[5] Chukwuemeka Odumegwu Ojukwu University Nigeria

Abstract*- This study was motivated due to the identified problems and issues surrounding the implementation and adoption of artificial intelligent (AI) and its adoption to reduce if not all the rate of health challenges associated with surgery handling witnessed in our healthcare centres especially during emergency situations when the professional surgeon are not within the healthcare centre. The problems includes: poor technological infrastructure in the healthcare centres, there is no documented use of any of the past utilized surgical robot in the history of Nigerian medicine, negligence of those in power to provide basic tools/training to support use of RAS in the healthcare, lack of AI industry to support/provide easy training and implementation of RAS in the healthcare The western world such as United State of America, United Kingdom and china as mentioned in the study has invested so much in their healthcare systems while Africa (eg. Nigeria) is still battling with corrupt a practice which has caused the increase of mortality rate of their citizens. The aim is to assess the use of robotic assisted surgery (RAS) within and outside Nigeria while the objectives of this research is to assess the use of RAS in Nigerian healthcare centres, to assess traditional methods of surgery and adoption of RAS, to outline the significance of RAS Nigerian healthcare for better health delivery and accurate outcome, to outline the other health application areas RAS can be used in treatment and to state advantages and disadvantages of the use of RAS in Nigerian healthcare. The study adopted conceptual review of literature publications, journal studies, magazine, social media discussions and medical professional discussions on use and significance of RAS with more emphasis to application and adoption of RAS in Nigeria and how prepared artificial intelligence in Nigeria is seen compared to other counties. The result was able to show the various limitations on the use of RAS and its complications when applied in surgical operation and also reviled that Nigerian has no plans on the adoption of RAS and AI industry that could help in production and maintenance of AI system such as RAS and hence suggest that National computer society of Nigeria (NCS), ministry of health , ministry of technologies and other robotic organizations in Nigeria should team up to ensure that computer aided devices (RAS) are provided and provide adequate training and asses to tools for personnel's and healthcare centres to use.

***Indexed Terms*- Artificial Intelligence, Robotic Assisted Surgery (RAS), Robotic Use in Nigerian Healthcare**

I. INTRODUCTION

The old, boring ways of doing things have given way to more exciting, modern, and useful ways of life. The medical field is not exempt from this trend. Historically, surgery was almost always seen as a capital offense. The use of rudimentary instruments, a deficiency of disinfectants and antibiotics, and an absence of anesthetics to induce unconsciousness or sedation were the main causes of this. Patients have to suffer agonizing pain while undergoing surgery while awake and conscious. Later, infections and complications will claim the lives of many individuals. The likelihood of success is significantly higher than it was in the past when procedures were carried out while the patient and the surgeon engaged in lighthearted conversation about their favorite musical groups, soap operas, or football teams. In fact, in cases like appendectomies, where surgery is not immediately necessary, patients can choose to have it done. A developing trend in the medical field is the combination of cutting-edge technology and surgical procedures. This is the route that many wealthy nations are taking. One of these developments is artificial intelligence, which has improved surgical precision by utilizing robotic equipment. Using these technologies during surgery improves reliability. A portion of these robots are intended to evaluate patient medical records' pre-operation data in order to direct the surgeons' tools during the procedure.

One of the newest surgical techniques that the pediatric urology community has swiftly embraced is robotic aided surgery (RAS). Robotic surgery, often known as robotic aided surgery, is the term used to describe any surgical procedure performed with the assistance of robotic technology. Robotic aided surgery was developed in an attempt to overcome the limitations of currently available minimally invasive surgical techniques and enhance the abilities of physicians doing open surgery. Instead of controlling the instruments directly, the surgeon does dissection, hemostasis, and resection using a direct telemanipulator or computer control in robotically assisted minimally invasive surgery [1]. With the use of a telemanipulator, one can manipulate objects that are too heavy, hazardous, small, or otherwise challenging to manipulate manually by sending finger and hand motions to a robotic device that is located far away [2]. Additionally, according to the National Library of Medicine [3], a telemanipulator is a surgical device that is augmented by computers and is operated by a surgeon while sat at a control panel.

The operating field is displayed to the surgeon in three dimensions. The entire surgical field is visible to the surgeon thanks to the LCD screen, which shows a picture from a camera inside the robotic arm. The tools used for surgery operate in immediate succession in response to the surgeon's hand gestures. Small incisions are required to provide access to the surgical site for the tools and their cameras, and virtual mentoring is the practice of an experienced surgeon teaching a beginner in a remote location how to execute a new operation or use a new surgical equipment while the trained neurosurgeon stays in their own private facility.

With modern telemanipulators, like the da Vinci Surgical System, the surgeon are now able to operate from a distance and execute photorealistic immediate time procedures from an operator center that is separate from the operating table. Figure 1 below depicts the da Vinci Surgical System, while Figure 2 below illustrates the manner in which physicians use it and how they do so from various locations.

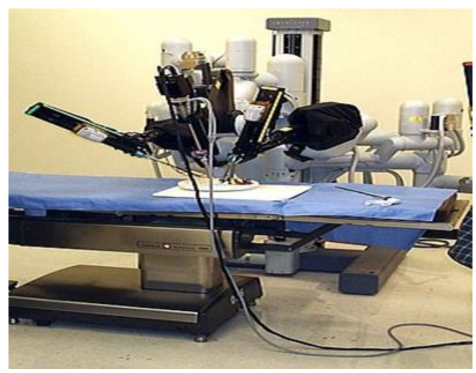

Figure 1: A robotically assisted surgical system used for prostatectomies, cardiac valve repair and gynecologic surgical procedures

(Source: https://en.wikipedia.org/wiki/Robot-assisted_surgery)

Source: Appeal/ZUMAPRESS.com and https://www.gettyimages.com/photos/da-vinci-robot da vinci surgical system showing the system and position of the surgical table where the patient will lay.

Figure 1: Pectoral view of da Vinci Surgical System (Source: Appeal/ZUMAPRESS.com and https://www.gettyimages.com/photos/da-vinci-robot)

da vinci surgical system: Operating room, prostate cancer robotic surgery, Da Vinci surgical robot, urology. Hospital Policlinica Gipuzkoa, San

Source: https://www.gettyimages.com/photos/da-vinci-robot

Source: https://www.gettyimages.com/photos/da-vinci-robot

The screen above shows the patients inner part of the body where the operation is ongoing by the surgeon

Figure 2: Pectoral view of da Vinci Surgical System in action by the surgeon
(Source: https://www.gettyimages.com/photos/da-vinci-robot)

From figure 2 above, Dr. Sandeep Samant (left) inserts the head within the da Vinci Surgical System at Methodist University Hospital in order to execute a robotic throat surgery. (Source: The Commercial Appeal/ZUMAPRESS.com)

Source: https://www.gettyimages.com/photos/da-vinci-robot

Source: https://www.gettyimages.com/photos/da-vinci-robot

Figure 3: da Vinci Surgical System in action by the surgeons and nurses
(Source: https://www.gettyimages.com/photos/da-vinci-robot)

The robotic arms positioned next to the person being treated are attached to execute endoscopic-like operations with end-effectors inserted via trocars, which are surgical instruments with a three-sided cutting point encased in a tube that are used to remove liquid out the cavity of the body.

Figure 4: Surgical trocars (Source: Wikipedia: https://en.wikipedia.org › wiki › Trocar)

According to the [4], surgical assistants and scrub nurses are often still needed at the tableside to help with tasks like changing effector devices, increasing suction, or momentarily retracting tissue with endoscopic grasping instruments. In computer-controlled systems, a physician uses a computerized system to guide the robotic arms and their end-effectors and transmit control data, but telemanipulators are still a possibility for input. The computer technique has the potential to enable remote surgery and even AI-assisted or automated surgeries by doing away with the requirement that the surgeon be physically present on campus to perform the treatment.

Additionally, memory devices are required by the device, which are essential to the successful completion of the robot-assisted surgery. The memory storage systems are able to perform multiple functions based on the patient's physical record. Furthermore, according to the [4], they can offer accurate data to detect calibration offsets indicating storage drive system misalignment, data life, and other factors. The majority of people on the planet, including those employed by health organizations, reside in places without access to telecommunications infrastructure, and it's unlikely that this will change very soon. Innovation is required to provide these groups with access to efficient emergency care interventions from a variety of existing sites, eliminating the need to wait for antiquated or untrained procedures to address such cases. Every facet of human existence has embraced the use of artificial intelligence (AI), and the medical field is no exception. Thus, the primary driving force behind this study is the necessity for novel medical health systems like robotic assisted surgery (RAS) that can encourage the use of computers and save lives regardless of the surgeon's geography and to determine the key RAS application areas and to encourage the adoption of computer-aided surgery and related technologies in Nigerian communities. Every study has its limitation or research gap which further study has to provide by adopting a new approach so as to provide or solve the identified problem. This is to say an identified problem indicates a limitation of a particular study. Therefore, assessing the lack of use or application of robotic assisted surgery (RAS) and other artificial intelligent tools in Nigerian healthcare systems has been identified as the major problem facing the successful operation or surgery practices on patients in the entire nation either due to the following: Poor technological infrastructure in the healthcare centres, there is no documented use of any of the past utilized surgical robot in the history of Nigerian medicine, negligence of those in power to provide basic tools/training to support use of RAS in the healthcare and lack of AI industry to support/provide easy training and implementation of RAS in the healthcare. Nevertheless, adequate use and implementation of RAS in Nigerian healthcare sector cannot be over emphasized as its significance is huge, therefore the aim of this research is to assess the use of robotic assisted surgery (RAS) in Nigeria by investigating areas RAS has been used, intended to be applied within the Nigerian healthcare sector, assess traditional methods of surgery and adoption of RAS and outline the significance and application areas of RAS in Nigerian healthcare for better health delivery and accurate outcome.

II. LITERATURE REVIEW/RELATED STUDIES

The August 1942 Robert Heinlein tale "Waldo" featured brain surgery and explained the idea of employing conventional hand grips to handle manipulators and cameras of various sizes down to sub-miniature. The Arthrobot, created and deployed for the first time in Vancouver in 1984, was the first robot to help with surgery [5]. With the help of this robot, the patient's leg may be moved and positioned with vocal commands. James McEwen, a biomedical engineer, Dr. Brian Day, a group of engineering students, and Geof Auchinleck, a UBC engineering physics graduate, were all intimately involved. On March 12, 1984, the robot was utilized in an orthopaedic surgical procedure at the Vancouver, British Columbia, hospital. In the first twelve months, more than sixty arthroscopic surgeries were carried out, and in 1985, a National Geographic movie about industrial robots was produced. With the help of this robot, the patient's leg may be moved and positioned with vocal commands. James McEwen, a biomedical engineer, was closely involved in the Robotics Revolution, which featured the gadget. A medical laboratory robotic arm and a surgical scrub nurse robot that could hand operative equipment on voice command were two other comparable robotic devices created at the same time. Some of them are demonstrated in action in a YouTube video titled Arthrobot: The World's First Surgical Robot [6].

During a neurological surgery in 1985, the Unimation Puma 200 robot was utilized to guide a needle for a brain biopsy while under CT guidance [7]. PROBOT, created by Imperial College in London in the late 1980s, was subsequently employed in prostate surgery. This robot's small size, accuracy, and lack of weariness for the surgeon were its advantages. More control and precision in surgical procedures were made possible with the introduction of computer-controlled surgical instruments in the 1990s. The FDA approved the da Vinci Surgical System in 2000 for use in surgical procedures, making it one of the most important innovations of this era [10]. Now, Surgeons may execute complex surgeries with more control and accuracy thanks to the da Vinci system, which uses robotic arms to operate surgical equipment [8]. The introduction of the ROBODOC in 1992 brought about a revolution in orthopedic surgery as it could help with hip replacement surgeries. In 2008, the FDA approved the latter as the first surgical robot [9]. With close collaboration with IBM, Integrated Surgical Systems' ROBODOC could precisely mill femur fits for hip replacements. The ROBODOC was designed to take the place of the earlier technique that involved using a mallet and broach/rasp to carve out a femur for an implant. SRI International, Intuitive Surgical (da Vinci Surgical System), Computer Motion (AESOP, ZEUS robotic surgical system), and SRI International have contributed to the advancement of robotic systems [11]. Robert E. Michler conducted the first robotic surgery at The Ohio State University Medical Center in Columbus, Ohio [12]. Additional advancements in the application of robotically assisted surgery have been made, and these comprise: The Versius Surgical Robotic System was released in 2019 and is a rival to the Da Vinci surgical system. It maintains to have been more flexible and versatile, with independent modular arms that are "quick and easy to set up." AESOP was a breakthrough in robotic surgery when it was first introduced in 1994. ZEUS was introduced economically in 1998 and started the idea of telerobotics or telepresence surgery where the surgeon is at a distance from the robot on a console and operates on the patient. Because of its compact size, it may be used in almost any operating room and is adjustable so that the user can sit or stand [13].

2.1 USES/APPLICATION OF ROBOTIC ASSISTED SURGERY (RAS)

Telemanipulator-assisted computer-assisted surgery has mostly been developed for highly precise procedures. Computer-assisted surgery is currently being used for a variety of treatments where several small incisions must be made by the surgeon. The following are some of the most popular uses for laparoscopic and minimally invasive procedures:

1. Urology for aggressive laparoscopic prostatectomy: Nissen fundoplication (gastrointestinal antireflux surgery), laparoscopic cholecystectomy (removal of the gall bladder)
2. Mitral valve replacement, atrial septal defect correction, and internal mammary artery (IMA) mobilization for coronary artery bypass grafting (CABG) are among the cardiac and thoracic surgical procedures performed by patients.

2.1.1 OTHER AREAS OF RAS IN HEALTHCARE

The application area for the use of RAS includes:

1. Ophthalmology Ophthalmology is still in the early stages of robotically assisted surgery. Nonetheless, a few robotic systems, such the following, are effective at performing surgeries: Vitreoretinal operations are performed with the PRECEYES Surgical System. A surgeon is able to telemanipulate this single-arm robot. The device mounts to the head of the surgical table and, with the aid of an easy-to-use motion controller, increases surgeon accurateness. While not

intended for use in retinal treatments, the da Vinci Surgical System uses telemanipulation to perform ex-vivo corneal surgeries including pterygium repairs.
2. Heart: Here are a few instances of heart surgeries supported by robotic surgery systems: correction of an atrial septal defect: the closure of a hole between the heart's two upper chambers, Repairing the mitral valve stops blood from flowing backward into the upper chambers of the heart when the heart contracts. Coronary artery bypass surgery involves rerouting blood flow to the heart by avoiding clogged arteries.
3. Thoracic: In thoracic surgery for mediastinal diseases, pulmonary pathologies, and more recently, difficult esophageal surgery (such as the da Vinci Xi system, which is utilized for lung and mediastinal mass removal), robotic surgery has become increasingly common. This minimally invasive technique can be used as a substitute for open thoracic surgery and video-assisted thoracoscopic surgery (VATS). While VATS is the less expensive option, the robotic-assisted technique has comparable perioperative outcomes and offers advantages like enhanced dexterity and seven-degree-of-freedom 3D visualizations.
4. Bone: While there are other robotic systems used in orthopedic surgery, ROBODOC is the first active robotic system designed to carry out some surgical tasks during a total hip arthroplasty (THA). It is preoperatively programmed using information from CT scans, which enables the surgeon to select the ideal size and configuration for the implanted hip.
5. Spine: Beginning in the mid-2000s, robotic instruments were employed in minimally invasive spine surgery. As of 2019, the primary use of robotics in spine surgery has been restricted to the insertion concerning pedicle screws for spinal stabilization.
6. Transplant surgery: In the late 2000s, the first kidney transplants using full robotics were carried out. It might make kidney transplants possible for obese patients who would not otherwise be able to have one. The gadget emphasizes weight loss, but it's a recommended starting point.

2.2. DIFFERENT APPROACHES TO ROBOTIC SURGERY

There are various approaches in the use of robotic surgery systems which includes:

1. Supervisor-Controlled Surgical Systems

robotic surgical system that is supervisor-controlled. To perform each procedure, a considerable amount of preparation is needed. The surgeon and support crew first input a distinctive collection of instructions into the system that are specific to the patient and the procedure being done. This is achieved by employing three-dimensional medical imaging to map the body extensively. The system is then registered to match the patient's body to the mapping in the surgical system just before the operation begins. A robotic surgical system under supervisor supervision provides The medical professional positions the robot in the proper starting position and evaluates its movements. The robotic machine will carry out the surgery autonomously as soon as it begins. The surgeon will closely monitor the process and only become involved if essential (see picture 5 below). The most well-known prototype is the Integrated Surgical Systems-created ROBODOC system, which is frequently utilized in orthopedic procedures.

Figure 5: supervisor-controlled robotic surgical (Source: https://bme240.eng.uci.edu/students/10s/sgupta1/Developments.html)

2. Shared Control Robotic Surgical Systems

In this method, the robot assists in carrying out surgical procedures when needed, but the human surgeon performs the majority of the labor, actually manipulating the surgical instruments by hand. Using a method known as active constraint, the technology keeps an eye on the surgeon's motions and provides stability and support. Using this method, the surgeons teach the robot to identify regions of the operating field that are close, safe, prohibited, and bounded. The surgery's primary focus is on safe areas. Similar areas surround tissue that is soft that is prone to harm, and the boundary marks the start of soft tissue. The robot pulls back against the surgeon when they approach certain hazardous regions, or in certain situations, the robotic system actually locks up to stop any more injuries from occurring. Thus, the system restricts the usage of the surgical instruments to the proper location by forced feedback in the instruments. Similar to supervisor-controlled systems, the surgeon must set up the surgical field's boundaries before beginning the surgery.

3. Telesurgery Systems

Using this method, robotic arms are actually controlled by a surgeon. The robot essentially becomes the surgeon's extension. The structure of the system is made up of a separate viewing and control console and surgical arms located inside a surgical suite (see figure 6 below). Using handheld controllers within the console, the surgeon can operate the robotic arms while keeping an eye on the operative field in three dimensions. As necessary throughout the process, a different surgeon in the operating room replaces the robotic arms' instruments. The instruments are placed into the body through tiny incisions. The medical professional can proceed with surgery after this stage is finished. Through the use of the robot arm's greater range of motions, this technology enables surgeons to execute minimally invasive surgical procedures more quickly, precisely, and under control. The most popular type, the da Vinci Robotic Surgical System, improves the procedure by improving wrist dexterity and control of tiny instruments, as well as offering 3-D visualization deep into difficult-to-reach areas like the heart. A lot of the exceptionally skilled and challenging for humans to master techniques carried out by robot helpers also make it possible for more surgeons to do these treatments. More operations (such as valve and artery repairs) can now be performed without requiring lengthy recovery periods orcausing physical harm.

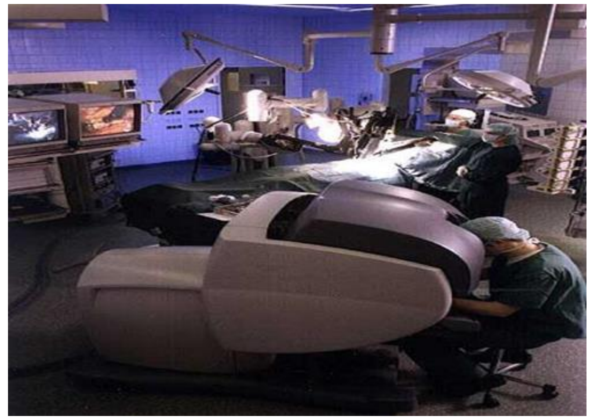

Figure 6: Telesurgery Systems (Source: https://bme240.eng.uci.edu/students/10s/sgupta1/Developments.html)

4. Robotic Radiosurgery Systems

Radiation therapy for malignancies is another application for robots. These devices employ robots to precisely target ionizing radiation beams at specific bodily sites. A map of the area that has to be treated is made when medical imaging first locates the tumor. The doctor then inputs a series of orders into the system to tell it how to administer the treatment. After the patient has registered with the system, the therapy can start and their body will be positioned correctly. The robot then precisely administers a number of doses to the tumor by following the instructions. This lessens the possibility of causing harm to the tissues nearby.

2.3 ASSESSMENT OF TRADITIONAL METHODS AND ADOPTION OF RAS

The adoption of surgical robots has contributed to significant advancements in remote, minimally invasive, and unmanned surgery possible. The use of robotics has reduced blood loss, pain, and restoration time; it has also allowed for smaller cuts, accurateness, and miniaturization; it has improved ergonomics through articulation beyond normal manipulation and three-dimensional magnification; and it has reduced hospital stays, blood decrease, blood donations, and pain medication use. The open surgery technique currently in use has many drawbacks, including limited access to the surgical area, lengthy recovery times, lengthy operation hours, blood loss, surgical scars, and marks. Each robot unit costs between $1 million and $2.5 million, and although the cost of the treatment is higher, the robot's disposable supply expenses are typically $1,500 per procedure. To operate the system, more surgical expertise is required [14]. Several feasibility studies have been conducted to assess the value of purchasing such systems. As it stands, views are very different. Although the producers of these systems offer learning, surgeons indicate that the learning curve is steep and that in order to become proficient with the technology, they must conduct 150–250 surgeries. Minimally invasive procedures can take up to twice as long as typical surgery during the training phase, which causes the operating room crowding and surgical personnel to keep victims under anesthesia for extended periods of time. According to patient surveys, the treatment was chosen because the patients anticipated less discomfort, better results, less blood loss, and decreased morbidity. larger levels of dissatisfaction and regret could be explained by larger expectations. Robot-assisted surgery provides the surgeon with superior control over the surgical instruments and an improved vision of the surgical site when compared to other minimally invasive surgery techniques. Furthermore, surgeons no longer have to stand the entire procedure, which reduces their rate of fatigue. The robot's computer program filters out hand tremors that occur naturally. Lastly, rotating surgery teams can employ the surgical robot continually [15]. When robotic controls are used instead of human help, laparoscopic camera positioning is also noticeably steadier and less prone to unintentional movements [16].

2.3.1 ADOPTION OF RAS IN NIGERIA

Robots are utilized to do minimally invasive surgery, which results in greater precision and fewer complications, as past research have indicated. They are employed in operations where the surgeons must make precise and complex movements. As mentioned earlier in this study, the da Vinci System is a unique robotic system made by Silicon Valley-based Intuitive Surgical and authorized for use by the US Food and Drug Administration (FDA) in 2000. It is arguably the most sophisticated surgery robot available today. The robot, which is being hailed as a breakthrough in minimally invasive surgery, has several benefits when utilized in the operating room. Unfortunately, though, Nigeria does not currently have any surgical robots in use. Furthermore, no surgical robot has ever been used in Nigerian medical history that is known to exist. However, since its debut in 2015, South Korea has built a surgical site and uses of the da Vinci system. The introduction of robots for surgical practice in Nigeria appears like a pipe dream due to the numerous issues presently plaguing the country's healthcare system, which the Nigerian government must address before using RAS in the country's healthcare system.

3.1 METHODOLOGY OF STUDY

Research methodology is an approach or step taken by a researcher to solve an identified problem. This study adopted the conceptual review of literatures publications, journal studies, magazine and medical professional discussions on use and significance of RAS with more emphasis to implementation and adoption of RAS in Nigerian healthcare and how prepared artificial intelligence in Nigeria is seen compared to other counties shown in figure 3.1 below.

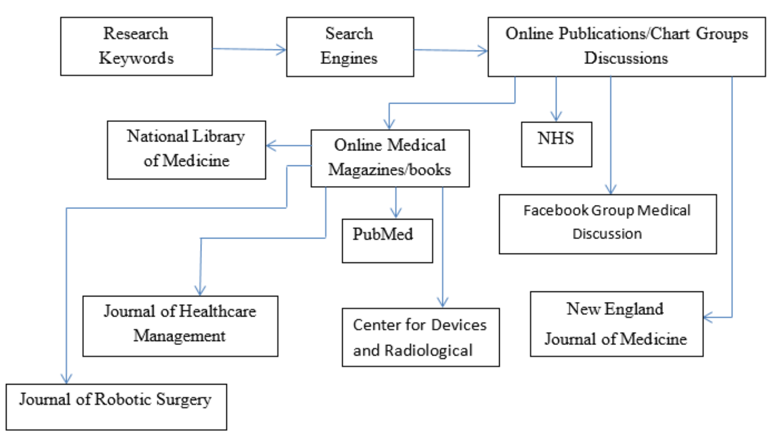

Figure 3.1 Adopted research methodology (Source: Fieldwork 2023)

3.2 COMPLICATIONS ON THE USE OF RAS

The side effects list for robotic procedures includes nerve damage, lasting harm, reoperations, visceral damage, and conversion of the procedure to an open procedure. Of the 75 hysterectomies performed using robotic surgery between 2000 and 2011, 34 resulted in permanent damage, and 49 in visceral morbidity.

1. Permanent damage, nerve damage, and visceral harm were all more common after prostatectomies. The majority of surgeries suffered some form of damage or harm, although very few actually needed to be converted to open procedures or required a second operation in a range of specializations. For instance, one patient had a second procedure after receiving seven coronary artery bypass grafts. To guarantee that the medical community is better informed about the safety of this new technology, it is crucial that issues are noted, recorded, and assessed [17].
2. It is challenging to assign blame in the event that a robot-assisted surgery goes wrong, and the level of safety associated with this procedure will determine how quickly and widely it is adopted.
3. Mechanical failure: The possibility of system and device breaking down mechanically is one disadvantage of using robotic surgery. A study was carried out at a single institute between July 2005 and December 2008 to examine the mechanical malfunctions of the da Vinci Surgical System. Four da Vinci surgical systems were employed to perform 1797 robotic procedures throughout this time. There were forty-three (2.4%) mechanical failure cases, consisting of twenty-four (1.3%) mechanical failure or malfunction cases and nineteen (1.1%) devices malfunctioning incidents.
4. Furthermore, two laparoscopic and one open conversions totaling 0.17% were carried out. As a result, there was very little likelihood of a mechanical malfunction or failure, and there was also extremely little risk of a conversion to an open or laparoscopic surgery.

3.3 LIMITATIONS OF RAS

Nevertheless, there are several problems with the use of robotic surgery in clinical settings today. For example, certain robotic systems in use lack haptics, which prevents force or touch feedback. There is no feeling of interaction between the patient and the device. To strengthen the communication between the surgeon and the tissue, Asensus Surgical has created the Senhance robotic system with haptic feedback lately [18]. Furthermore, because the devices that are now in use are only intended for single-quadrant applications, the robots may be very bulky, have instrumentation limits, and present challenges for multi-quadrant [20]. Studies showing long-term outcomes are better than those after traditional laparoscopic surgery are scarce, according to the American Congress of Obstetricians and Gynecologists [19]. Articles in the recently established Journal of Robotic Surgery typically focus on the experiences of a single surgeon [21].

4.1 RESULTS

The adoption of the conceptual research methodology approach shown in figure 3.1 above in trying to identify/assess the use of robotic assisted surgery within and outside Nigerian healthcare which yield a responsive outcome by stating the various limitation areas and complication on the use of RAS in medical profession. This study also proves how poor healthcare funding in Nigeria has been with zero negligence to people's health and in the aspect of investing in AI industry to help improve people's health standards just as it has been done in other counties like United Kingdom. It is very bad to mention here in this study that Nigerian as a country has no plans to invest in their healthcare sector and enhance it with the current AI technologies to improve accuracy and hence reduce death mutuality rate. It is very difficult to access medical records indicating the presents of RAS usage in Nigerian healthcare and even without plans towards it implementation in the nearest future but rather those in power prefer luxurious cares and life style for their selfish interest instead of saving the peoples life's.

CONCLUSION

The study has outlined the various areas RAS can be applied in the medical field and has also presented its issues as regards to accuracy and dependency. Because internet marketing for medical devices is less regulated than that for pharmaceuticals, there are currently robotic surgery techniques being promoted and advertised online. One such technique is the removal of a malignant prostate, which has been a popular treatment through internet marketing.

Numerous websites that tout the advantages of this kind of treatment omitted to address the concerns and offered shaky proof for the use and use of RAS. The government and medical organizations are having trouble encouraging the creation of instructional materials that are impartial. Within the United States alone, a huge number of websites promoting robotic surgery neglect to identify any hazards related to these kinds of treatments, and hospitals that provide information tend to overstate benefits, mostly disregard risks, and are heavily influenced by the manufacturer of the device, finally, in Nigeria as of the time of these research, there is no robotic assisted surgery device that could enable surgeons perform surgery in the entire hospitals in Nigeria, therefore the (NCS) National computer society of Nigeria, (CPN) Computer Professionals of Nigeria, Ministry of Health , Ministry of Technologies and other robotic organizations in Nigeria should team up to ensure that aside computer aided devices (RAS) are provided and its implementation monitored and are put in use by all the healthcare center within the Nation.

REFERENCES

[1] Barbash GI, Glied SA (August 2010) "New technology and health care costs--the case of robot-assisted surgery". The New England Journal of Medicine. 363 (8): 701–704. doi:10.1056/nejmp1006602. PMID 20818872. S2CID 15596885

[2] Dictionary.com (2023) what is telemanipulator, accessed 2023 from https://www.dictionary.com/browse/telemanipulator.

[3] National Library of Medicine (NLM, 2004) telemanipulator accessed 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387765/

[4] Center for Devices and Radiological Health (2019) "Safety Communications – Caution When Using Robotically-Assisted Surgical Devices in Women's Health including Mastectomy and Other Cancer-Related Surgeries: FDA Safety Communication". www.fda.gov. Retrieved 6 March 2023

[5] *Lauterbach R, Matanes E, Lowenstein L (2017). Robotic surgery "Review of Robotic Surgery in Gynecology-The Future Is Here". Rambam Maimonides Medical Journal. 8 (2): e0019. doi:10.5041/rmmj.10296. PMC 5415365. PMID 28467761*

[6] *Day B (2014) Arthrobot - the world's first surgical robot, YouTube. Archived from the original on 21 December 2021. Retrieved 23/10/2023 from https://en.wikipedia.org/wiki/Robot-assisted_surgery*

[7] *Kwoh YS, Hou J, Jonckheere EA, Hayati S (1988) A robot with improved absolute positioning accuracy for CT guided stereotactic brain surgery". IEEE Transactions on Bio-Medical Engineering. 35 (2): 153–160. doi:10.1109/10.1354. PMID 3280462. S2CID 31260974*

[8] *Andellini M, Di Mauro R, Faggiano F, Derrico P, Ritrovato M (2019). PP187 Robotic Surgery, Any Updates?. International Journal of Technology Assessment in Health Care. 35 (S1): 72. doi:10.1017/S0266462319002757. ISSN 0266-4623. S2CID 214168249.*

[9] *Paul HA, Bargar WL, Mittlestadt B, Musits B, Taylor RH, Kazanzides P, et al. (1992). "Development of a surgical robot for cementless total hip arthroplasty". Clinical Orthopaedics and Related Research. 285 (285): 57–66. doi:10.1097/00003086-199212000-00010. PMID 1446455. S2CID 25245838.*

[10] *Intuitive Surgical (2021) surgical robot, da Vinci Surgical System, Intuitive Surgical from https://isrg.intuitive.com › static-files*

[11] Meadows M (2005). "Computer-assisted surgery: an update". FDA Consumer. Food and Drug Administration. 39 (4): 16–17. PMID 16252396. Archived from the original on 1 March 2009.

[12] McConnell PI, Schneeberger EW, Michler RE (2003). "History and development of robotic cardiac surgery". Problems in General Surgery. 20 (2): 20–30. doi:10.1097/01.sgs.0000081182.03671.6e

[13] *NHS (2018) New Versius robot surgery system coming to NHS gotten from BBC. 3 September 2018* and Retrieved 23 september 2023

[14] *Finkelstein J, Eckersberger E, Sadri H, Taneja SS, Lepor H, Djavan B (2010). "Open Versus Laparoscopic Versus Robot-Assisted Laparoscopic Prostatectomy: The European and US Experience"*

[15] Gerhardus D (2003). "Robot-assisted surgery: the future is here". Journal of Healthcare Management. 48 (4): 242–251.

[16] Kavoussi LR, Moore RG, Adams JB, Partin AW (1995). "Comparison of robotic versus human laparoscopic camera control". The Journal of Urology. 154 (6): 2134–2136.

[17] AORN (2017) Robotic Surgery: Risks vs. Rewards". AORN Journal. 106 (2): 186–157.. doi:10.1016/j.aorn.2017.05.007. PMID 28755672

[18] Spinelli A, David G, Gidaro S, Carvello M, Sacchi M, Montorsi M, Montroni I (2017). "First experience in colorectal surgery with a new robotic platform with haptic feedback". Colorectal Disease. 20 (3): 228–235. doi:10.1111/codi.13882. PMID 28905524. S2CID 11253068

[19] Breeden JT (2013). "Statement on Robotic Surgery". American Congress of Obstetricians and Gynecologists (ACOG).

[20] Herron DM, Marohn M (2008). "A consensus document on robotic surgery". Surgical Endoscopy. 22 (2): 313–325, discussion 311–312. doi:10.1007/s00464-007-9727-5. PMID 18163170. S2CID 6880837.

[21] Kolata G (2010). "Results Unproven, Robotic Surgery Wins Converts". The New York Times. Retrieved 11 March 2010.