




Original Article

Evolution and Current Challenges of Gastrointestinal Endoscopy in Nigeria: Insights from a Nationwide Survey



Yusuf Musa^{1*} , Abubakar Sadiq Maiyaki², Yusuf Shehu Umar³, Pantong Mark Davwar⁴, Kolawole Oluseyi Akande⁵, Chinwe Philomena Onyia⁶, Kenechukwu Chukwuemeka Okonkwo⁷, Muhammad Manko⁸ and Adamu Alhaji Samaila⁹

¹Department of Internal Medicine, Federal Teaching Hospital, Jibia bypass, Katsina, Nigeria; ²Department of Internal Medicine, Usman Danfodio University Teaching Hospital, Sokoto, Nigeria; ³Department of Internal Medicine, Murtala Muhammad Specialist Hospital/Aminu Kano Teaching Hospital, Kano, Nigeria; ⁴Department of Internal Medicine, Jos University Teaching Hospital, Jos Plateau, Nigeria; ⁵Department of Internal Medicine, College of Medicine, University of Ibadan, Oyo, Nigeria; ⁶Department of Internal Medicine, University of Nigeria Teaching Hospital Enugu, Enugu, Nigeria; ⁷Department of Internal Medicine, Federal Medical Centre Owo, Ondo, Nigeria; ⁸Department of Internal Medicine, Ahmadu Bello University/Ahmadu Bello University Teaching Hospital Zaria, Kaduna, Nigeria; ⁹Department of Internal Medicine, Aminu Kano Teaching Hospital/ Bayero University, Kano, Nigeria

Received: February 06, 2024 | Revised: October 19, 2024 | Accepted: December 24, 2024 | Published online: December 25, 2024

Abstract

Background and objectives: Gastrointestinal endoscopy has revolutionized the entire practice of gastroenterology worldwide, including Nigeria. Endoscopy was introduced in Nigeria more than four decades ago, and it has been a story of varying successes and challenges. This study explored the various experiences of endoscopists, the challenges they face, and the efforts put in place to maintain the practice in Nigeria.

Methods: This cross-sectional survey was conducted from October to December 2023 among endoscopists practicing in Nigeria. It involved a 30-part self-administered online questionnaire that inquired about individual experiences in endoscopy practice. These included qualifications, competency, facility settings, challenges faced, and innovations employed to address them. At the end of the survey, responses were analyzed using descriptive statistics, Chi-square, and likelihood ratios at the 0.05 level of significance.

Results: A total of 41 respondents participated in the survey from 19 states across the six geopolitical zones of Nigeria, with a mean age \pm standard deviation of 43 ± 7 years. Male respondents made up 80.5%, with Nigerian-trained gastroenterologists via the residency program constituting the predominant population, and an average endoscopy experience of five to nine years (39.02%). Most of the respondents work in public institutions (73.17%), with 43.9% working in at least two centers. There was an average of five endoscopists and three to seven endoscopy centers per state. Most centers perform 11–12 upper and four to five lower GI endoscopies per week, respectively, with a predominance of diagnostic procedures. The most common endoscopic intervention was variceal band ligation. The most common challenge faced was the high cost of procedures, accessories, and maintenance of endoscopes.

Conclusions: Endoscopy practice cuts across all the zones and most states of the federation. Both diagnostic and therapeutic procedures are available in most centers. However, the practice is faced with a myriad of challenges, mainly poor financing and inadequate training, among others. As a result, some innovations were locally developed to ease the practice and prevent it from collapsing.

Keywords: Endoscopy; Colonoscopy; Advancements; Innovation; Challenges; Therapeutic interventions.

***Correspondence to:** Yusuf Musa, Gastroenterology and Hepatology Unit, Department of Internal Medicine, Federal Teaching Hospital, Murtala Muhammad Way Opposite Jibia Bypass Katsina, Katsina 890280, Nigeria. ORCID: <http://orcid.org/0000-0001-7283-8310>. Tel: +234-8060661115, E-mail: yusuf.musa@nmpcn.edu.ng

How to cite this article: Musa Y, Maiyaki AS, Umar YS, Davwar PM, Akande KO, Onyia CP, et al. Evolution and Current Challenges of Gastrointestinal Endoscopy in Nigeria: Insights from a Nationwide Survey. *J Transl Gastroenterol* 2024;2(4):177–185. doi: 10.14218/JTG.2024.00010.

Introduction

Gastrointestinal endoscopy is an essential resuscitative procedure in clinical medicine. However, its availability, accessibility, and affordability are limited in developing low-income countries, mak-

ing clinical practice more challenging, with a consequent rise in morbidity and mortality. Furthermore, diagnostic endoscopy is the usual service available in most African countries, with few providing advanced procedures.¹

Gastrointestinal endoscopy evolved over time from the first half of the 20th century, with the development of flexible gastroscopy, colonoscopy, and pediatric endoscopy.²⁻⁶ Improvements and advancements later included enhanced image visualization, signal leakage prevention, improved tip control, creation of suction and water channels, and longer insertion lengths. Other developments include tissue retrieval channels for endoscopic accessories for various interventions, endoscopic retrograde cholangiopancreatography (ERCP), enteroscopy in the early 1970s, and endoscopic ultrasound (EUS) in the early 1980s.^{3,5}

Ablative treatments with argon plasma coagulation, electrocoagulation, laser ablation, photodynamic therapies, cryoablation, and radiofrequency ablation were also introduced. Other techniques include endoscopic fundoplication, endoscopic suturing, mucosal resection, and radiofrequency ablation. Endoscopic bariatric balloon deployment, sleeve gastrectomy, and other non-surgical anastomoses are well-established procedures, while gastrojejunal food diversion and duodenal resurfacing for insulin resistance are still in trial.^{3,5} Due to the difficult nature of scoping, small intestine capsule endoscopy was developed—a device that transmits live images of the gut to an external receiver.^{3,5}

In the late 1990s, endoscopic surgeries were conceptualized, leading to the invention of natural orifice transluminal surgery, peroral endoscopic myotomy, and peroral pyloromyotomy for lesions beyond the gastrointestinal tract lumen.^{3,5} Artificial intelligence is now incorporated in newer scopes, making lesion detection and scope navigation more seamless.^{3,5}

Many training centers have been developed throughout Europe and America by top global professional organizations in endoscopy practice, such as the American Society for Gastrointestinal Endoscopy and the European Society for Gastrointestinal Endoscopy. These societies align endoscopic practice with technological advancements through training endoscopists using real-time patients and simulations.³

Africa lacks adequate GI endoscopic facilities. Many centers in sub-Saharan Africa (SSA) face scope maintenance problems, frequent machine breakdowns, and a shortage of bioengineers to repair damaged machines.⁶ Most African countries also suffer from a lack of adequately trained personnel to operate endoscopy centers, particularly for advanced procedures such as ERCP and EUS, with South Africa and Egypt being exceptions.^{1,6} A study involving over 300 healthcare workers in various GI units across more than 90 facilities from Kenya, Zambia, Ethiopia, and Malawi revealed that nearly 60% of the respondents were performing therapeutic endoscopy despite challenges such as machine scarcity and manpower shortages. However, most centers were reported to have only 1 to 10% of the operational capacity compared to what is obtainable in developed countries.⁷

Unlike in most developed countries, where advancements in gastrointestinal endoscopy overshadow many surgical and radiological procedures, Nigeria and other SSA countries are far from meeting global targets. These drawbacks are the result of numerous challenges facing healthcare, including poor government policies, out-of-pocket health financing, and poverty.⁸ Similarly, most SSA countries have very few gastroenterologists, with only Nigeria and South Africa having more than 100, compared to Europe, Australia, and North America. Additionally, endoscopists from most African countries report inadequate exposure of trainees to

advanced endoscopic procedures such as ERCP and EUS.⁹

An endoscopy unit usually has functional areas such as the waiting area, procedure suite, consulting area, and recovery area, while support areas include the scope processing area, store, seminar rooms, and offices. The procedure suite contains necessary equipment and resuscitation materials for optimal operation of the unit.^{10,11}

Quality of endoscopy is assessed via the use of informed consent, appropriateness of requests, pre-procedural fasting, risk stratification, patient history, endoscopist competence, early neoplasia detection capability, second duodenal intubation, a 7-minute intubation-to-extubation time (for upper GI), and captured images. Other factors include the use of standard reporting terminologies for lesion description integrated into an electronic record system that captures complications, histological outcomes, patient remarks, and possible recommendations.¹² Biopsy is rated using endoscopists' biopsy rate indices, such as the Seattle and Sydney protocols, eight random biopsies for chronic diarrhea, or interval biopsies of four per 10 cm of colonic segment for evaluating diffuse colonic inflammation. The use of sedation is another requirement. Complications are recorded at 0.5–0.05%, with mortality rates of 0.05% for gastro-duodenoscopy cases.¹² For colonoscopy, adequacy of bowel preparation, a cecal intubation rate of more than 95% for screening and 90% for diagnostic procedures, an adenoma detection rate (ADR) of at least 20% for men and 30% for women, a scope withdrawal time of about 6 m for “negative-results” screening colonoscopy, and an attempt at polypectomy when a pedunculated polyp is seen are considered essential benchmarks.¹³

Endoscopy practice was introduced in Nigeria four decades ago, mainly in the first-generation tertiary hospitals, namely University College Ibadan (in the mid-1970s), Ahmadu Bello University Teaching Hospital Zaria, Obafemi Awolowo University Teaching Hospital Ile-Ife, Lagos University Teaching Hospital (from the late 1970s to early 1980s), and Enugu in the mid-1980s. More centers emerged in the 1990s and 2000s, focusing mainly on upper GI endoscopy.¹⁴ Despite its large population, Nigeria has only about 200 centers performing endoscopy, with approximately 110 endoscopists. Close to 50% of these endoscopy centers are located in Lagos, and only one public center is performing ERCP.^{1,6}

Nigerian endoscopists work in both public and private institutions.¹⁵ Diagnostic endoscopy was the primary practice, with few therapeutic interventions performed in some centers. Notable interventions included band ligation of esophageal varices, sclerotherapy, foreign body retrieval, and percutaneous endoscopic gastrostomy feeding tube placement.¹⁴ Endoscopy for pediatric patients began in the mid-2010s, with most upper GI indications being abdominal pain, anemia, dysphagia, foreign body ingestion, and caustic ingestion. Lower GI endoscopy in children was commonly performed for GI polyps, strictures, volvulus, diarrhea, anemia, per rectal bleeding, and suspected inflammatory bowel diseases.¹⁶ Studies in Nigeria have reported dyspepsia,¹⁷ peptic ulcer disease, hemorrhoids, and colonic cancers^{15,18} as common indications for GI endoscopy in adults. On the other hand, children in southern Nigeria were found to have abdominal pain and GI bleeding as the most common indications for endoscopy,^{16,19} with variceal band ligation being the most frequently reported intervention.¹⁶

The Nigerian Society of Gastroenterology and Hepatology, with the support of the World Gastroenterology Organization, has promoted and enhanced gastroenterology practice through training and research on both basic and therapeutic endoscopy in Nigeria. A national center located at Lagos University Teaching Hospital (Idi Araba) has been established, in collaboration with global professionals and experts in the field of gastroenterology, to improve the

quality of endoscopic practice.¹⁴

Though it started alongside other developing countries, endoscopy practice in Nigeria has faced many challenges, too numerous to mention. These challenges have made practice in such unique situations more difficult, requiring significant sacrifices and improvisation from established best practices. In this article, we intended to explore the experiences, challenges, advancements, and innovative methods developed by Nigerian endoscopists to keep the practice on track.

Thus, the main aim of this study was to assess Nigeria's current level of endoscopy practice, considering the various advancements, challenges, and innovative approaches adopted to sustain the practice.

Materials and methods

Study design/location/population/Eligibility Criteria

The study was a cross-sectional observational survey conducted among clinicians performing gastrointestinal endoscopy across the six geopolitical zones of Nigeria from October 2023 to December 2023. All clinicians performing gastrointestinal endoscopy in all Nigerian geopolitical regions were contacted to participate in the study. Therefore, all Nigerian clinicians performing gastrointestinal endoscopy who volunteered to participate were included.

Definition of terms

ADR refers to the percentage of identification of at least one histologically confirmed adenoma or cancer in an average-risk, asymptomatic patient presenting for the first time for screening colonoscopy. Caecal intubation rate (CIR) defines the percentage of colonoscopists who are able to visualize the caecum or reach an anastomosis during colonoscopy.^{20,21}

Study protocol

The study examined the structure of endoscopy practice among endoscopists from various parts of Nigeria.

Survey instrument

A thirty-question questionnaire, divided into six sub-sections (demographics, working experience, structure of the endoscopy suite/procedures available, innovations, and challenges in endoscopic practice), was used. The questionnaire was composed mostly of multiple-choice questions, with open-ended questions for age, gender, specialty, state of practice, and geopolitical zone of the country. The demographic sub-section inquired about basic information such as age, gender, state, and region of practice. Questions on work experience covered the form of postgraduate medical training and years of endoscopic practice as a specialist. The components of the endoscopy suite were captured in another sub-section, which included the number of trained clinicians and nurses in the primary center of practice, the presence of facilities like a procedure room, adjustable trolley, resuscitation gadgets, scope processing room, availability of a scope maintenance unit, patients' toilets, type of endoscopic tower in use, and the average costs of procedures conducted in the center. The cecal intubation rate and adenoma detection rate were also recorded. The procedures available at the primary center of practice were evaluated, including basic diagnostic upper and lower GI endoscopy, basic interventions such as variceal band ligation, sclerotherapy, argon plasma coagulation, and hemo-clipping. Advanced therapeutic interventions such as polypectomy, PEG tube insertion, EMR, ESD, and endoscopic ultrasound were also evalu-

ated. The availability of capsule endoscopy and ERCP was also assessed. The last section explored various innovations employed to sustain the practice and overcome the challenges encountered in routine practice. The instrument was set to allow only one submission per respondent, without an option to allow for response editing after submission. All questions were made compulsory to prevent incomplete data submissions.

Procedure for data collection

Data was collected using an anonymous, self-administered questionnaire, which was distributed through doctors' forums and personally via phone calls, emails, and other social media groups for those intending to participate in the study. Only those endoscopists who showed interest were eventually briefed about the details of the study. After pilot testing the questionnaire for clarity by the primary authors, the survey was subsequently shared through various doctors' blogs and contacts, resulting in snowball sampling.

Data analysis

The data entries from the questionnaire were transferred to an Excel sheet and checked for completeness. A serial number was assigned to each response for easy identification and recall. A coding guide was developed based on the variables and responses to aid data analysis. The IBM SPSS software (version 20) was used to facilitate data analysis. Descriptive statistics, including means and standard deviations, were used to summarize continuous variables, while proportions, percentages, and ratios were used for categorical variables. The association between categorical variables was assessed using chi-square or likelihood ratios. A *p*-value of less than 0.05 was considered significant at a confidence interval of 95%.

Results

Socio-demographic characteristics of respondents

Out of about 120 endoscopists contacted, 41 doctors responded from 19 states across the six geopolitical zones of Nigeria. The mean age \pm standard deviation was 43 ± 7 years, with the youngest respondent being 32 years old and the oldest 65 years old. Males were the predominant respondents (80.5%), and the majority were gastroenterologists trained through conventional residency programs in Nigeria. Details of the demographic attributes are shown in [Table 1](#). A predominant percentage of respondents came from the North-western region (48.78%), while the South-south had the lowest percentage. Details of regional distribution are shown in [Figure 1](#).

Endoscopy experience among the respondents

Most of the respondents had an average endoscopy experience of five to nine years (39.02%), followed by 10 to 14 years of experience (24.39%), then one to four years (19.51%), with only 9.76% having more than 15 years of experience. However, 7.3% of the respondents had less than one year of endoscopy experience.

Similarly, most respondents perform endoscopy primarily in public health institutions (73.17%), with about 43.9% performing procedures in at least two different centers, 26.8% in three centers, and 19.5% in one center. However, 7.3% of the respondents perform endoscopy in more than three centers.

Characteristic of endoscopic centers in various states of the federation

The respective states of respondents' domicile were reported to have a range of endoscopic centers, including public, private, and

Table 1. Demographic characteristics of respondents

Demographic attribute	Frequency (n = 41)	Percentage (%)
Age groups years		
30–39	12	29.3
40–49	23	56.1
50–59	5	12.2
≥60	1	2.4
Gender		
Male	33	80.5
Female	8	19.5
Specialty		
Gastroenterologist	35	85.4
General Practitioner	2	4.9
Surgeon	4	9.8
Nature of postgraduate training		
Residency in Nigeria	35	85.4
Residency outside Nigeria	1	2.4
Masters	2	4.88
Doctor of Medicine (MD)	1	2.4
PhD	1	2.4

faith-based centers. The number of centers ranged from one to more than 15, with an average of three to seven centers per state. Private centers predominated the overall endoscopy centers, followed by public centers, with faith-based centers being the least represented.

The average number of qualified endoscopists per state was five, with most centers reporting two to four qualified endoscopists (53.66%) in their state of domicile. The number of endoscopists ranged from two to 20.

General characteristics of endoscopy centers

About 24.4% of respondents reported having at least two qualified endoscopists in their respective primary centers, with about 58.5% having between two to three trained endoscopic nurses. Details are shown in Table 2. Most respondents (85.37%) reported having a reception desk, procedure room or suite, and patient toilets in their endoscopy units. Similarly, the availability of emergency resuscitation drugs, a scope maintenance unit, and storerooms was reported in 46.34% of centers. A scope processing room, recovery room, and adjustable procedure couch were reported to be available in 43.9% of the centers. However, facilities such as changing rooms, offices, and endoscopic accessories for advanced therapeutic procedures were only reported by a few respondents.

The most common endoscopic tower used by most respondents was Olympus (78.1%) of both the 100 and 200 series, such as Evis Exera CV 160, 165, 180, 190, Optera 170, and Evis Lucera CV 240 and 260 versions. Other types of scopes used were Pentax, Karl Storz, Fujifilm, and Sonoscape. Only seven respondents reported having more than one endoscopic tower in their primary centers.

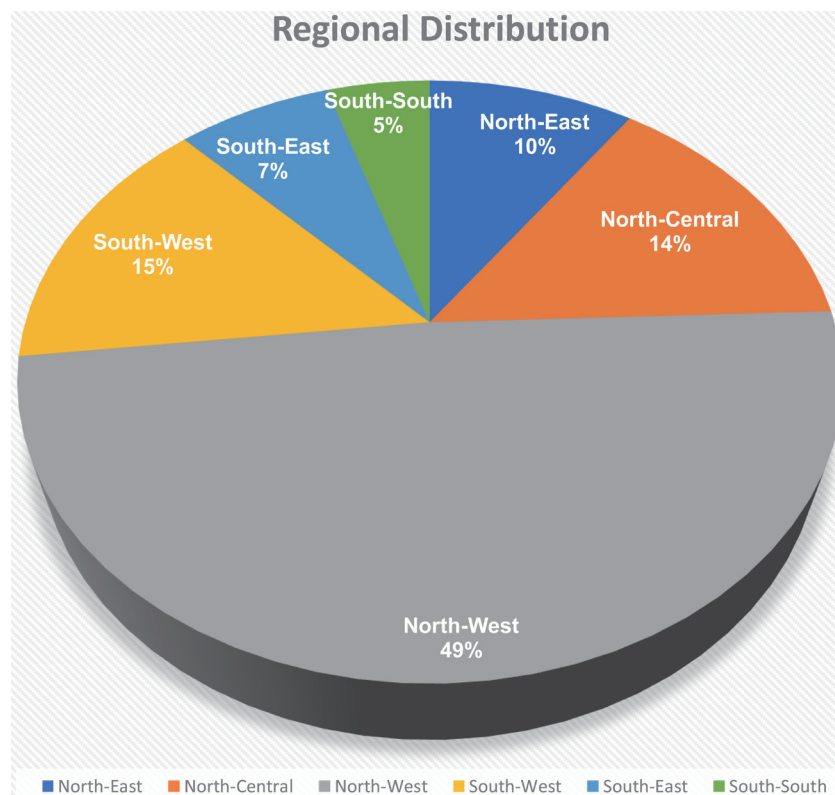


Fig. 1. Regional distribution of the respondents.

Table 2. Staff composition of respondents' endoscopy centers

Designated staff per endoscopy unit	Frequency (n = 41)	Percentage (%)
Number of qualified endoscopist		
One	5	12.2
Two	10	24.4
Three	5	12.2
Four	10	24.4
Five	9	21.95
None	2	4.88
Number of trained endoscopy nurse		
One	2	4.88
Two	13	31.71
Three	11	26.83
Four	7	17.1
Five	2	4.88
Ten	1	2.44
None	5	12.2

Cost of endoscopy procedures

The cost of a basic upper GI endoscopy was reported to range from 7,000 to 100,000 Nigerian Naira, equivalent to about five to 71 US dollars according to the current exchange rate as of January 2024. Similarly, the range of charges for lower GI endoscopy was 10,000 to 150,000 Naira, which equals seven to 107 US dollars per colonoscopy procedure. Most centers charge less than 30,000 Naira (less than 21 US dollars) for upper GI endoscopy and between 30,000 to 49,000 Naira (21 to 35 US dollars) for lower GI endoscopy. There is a statistically significant difference in price among the six geopolitical regions of the country (likelihood ratio = 45.396; 42.494, and $p < 0.0001$ for upper and lower GI endoscopies, respectively).

Diagnostic procedures performed per center

The average number of upper GI endoscopy procedures performed weekly by the respondents was 11 to 12, with a range of two to 50. Similarly, the average number of lower GI endoscopies performed weekly per center was four to five colonoscopies. There was no statistically significant association between the number of procedures and the country region (likelihood ratio of 47.898, p -value 0.987). The detailed number of procedures performed per center is shown in Table 3.

About 76% of the respondents reported their respective CIRs ranging from 50 to 99%, with 90% as the modal CIR and 89.2% as the mean value. However, about 24% had no such record.

Similarly, the ADR was only reported by about 32% of the respondents, with values ranging from 5% to 35%. The modal values were 25% and 15%, with an overall average value of 18.7%.

Therapeutic procedures performed per center

The most common interventions performed by the respondents were endoscopic variceal band ligation (87.8%), polypectomy (63.4%), and foreign body retrieval (56.1%). Argon plasma coagulation, and facilities for Hemospray, cautery, heater probe, and

Table 3. Range of basic endoscopic procedures performed per center

Procedure type	Number of procedures performed		Frequency (n = 41)	Percentage (%)
	Numbers per week			
Upper GI endoscopy				
	<5		6	14.63
	5–9		12	29.27
	10–14		12	29.27
	15–20		5	12.20
	>20		5	12.20
	Not sure		1	2.44
Lower GI endoscopy				
	<5		25	60.98
	5–9		11	26.83
	≥10		3	7.32
	Not sure		2	4.88

GI, gastrointestinal.

endoscopic ultrasound were reported in 2.44% each, and cumulatively referred to as "others" in Figure 2.

Challenges and innovations

Endoscopy practice in Nigeria is fraught with challenges from various angles. The most commonly reported challenges by the respondents were the cost of machines and individual procedures (80.49%), and inadequate modern machines (41.46%). Other challenges such as the non-availability of standard bowel preparation agents, power outages, poor accessibility to endoscopic facilities, and out-of-pocket payment for procedures were the least mentioned. About 20% of respondents reported various innovations to cater to the myriad challenges faced in their respective practices. Details of challenges and innovations are shown in Table 4.

Discussion

Endoscopy practice has been in Nigeria for over four decades but is still not very well developed compared with what is obtainable in developed nations, due to myriad reasons.¹⁴ Our study revealed that most respondents were young gastroenterologists working in at least two or more centers, with an approximate endoscopy experience of five to 14 years. This underscores the scarcity of endoscopists in the country to meet the immediate needs of available endoscopy centers. The scarcity is multifactorial, with the most common factors being the massive exodus of medical professionals from the country for greener pastures and inadequate centers for postgraduate training. Similarly, the number of endoscopy centers and endoscopists per state reiterates the degree of deficiency concerning this life-saving procedure in the country. With an average of three to seven centers and two to four qualified endoscopists per state, it is estimated that there is about one endoscopy center per million population per state and about one endoscopist per two million population per state, according to 2020 Nigerian statistics (<https://www.nigerianstat.gov.ng>). This is similar to previously reported figures from Nigeria and the West-African Sub-region^{14,22} but very different from what was reported in South Africa.²³

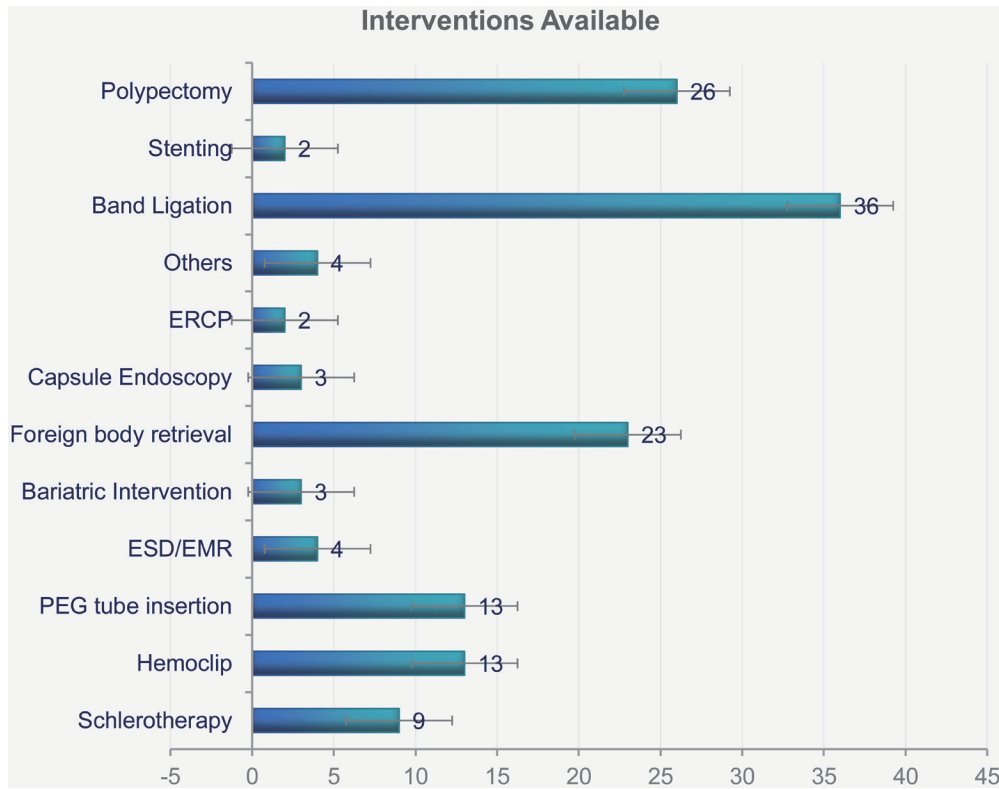


Fig. 2. Various therapeutic interventions available in centers.

Most endoscopy suites from the primary centers of the respondents were reported to have at least a procedure room, reception desks, and patients’ toilets, but very few were reported to have the most basic components to make an ideal suite.^{11,24} Similarly, most

of the machines used were branded older versions of Olympus, manufactured about 20 years ago or more, with the latest (Exera III CV 190) among them being at least 12 years in global markets. This limits the utilization of the latest technology facilitating le-

Table 4. List of challenges and innovations in endoscopy practice among respondents

Challenges and innovation	Frequency (n = 41)	Percentage (%)
Challenges		
Cost of Machine and procedure	33	80.49
Non-availability of scope maintenance centers	9	21.95
Inadequate Training for Therapeutic techniques	13	31.71
Inadequate trained personnel	3	7.32
Limited accessories for interventions	3	7.32
Poor acceptability of the procedure	6	14.63
Old machines without replacement	13	31.71
Others	4	9.75
Innovations		
Use of 50% glucose as sclerosant	1	2.44
Band Reloading	2	4.88
Empiric Treatment for H-Pylori after some endoscopic findings	3	7.32
Improvise vital signs monitor	1	2.44
Use of adjunct such as 20% Mannitol and Epsom salt	3	7.32
Extending time for bowel preparation to improve the quality	2	4.88

sion detection and possible intervention in most of these centers. This finding may partly be due to the cost of these and newer versions of scopes, as well as inadequate hands-on training to utilize the facilities attached to these newer machines. Hence, the available option is the use of older machines that are cheaper and easier to operate.

The average cost of an endoscopy procedure in Nigeria was estimated to be between \$5 and \$110 Nigerian naira equivalent, a value that seems very little from a global perspective. However, due to multiple factors surrounding healthcare delivery in the country, this amount is unaffordable for many Nigerians, despite being far from what is obtainable in Europe, America, and the Middle East. This is because most Nigerians access healthcare via out-of-pocket means, coupled with the biting poverty level, poor health financing, and a dwindling economy. This revelation has a bidirectional impact on endoscopy practice in the nation. Firstly, the meager amount paid for the procedure is inadequate to maintain the machines, let alone procure newer ones to sustain the process for future generations. The cost of a gastroscope is about \$25,000, with annual maintenance of about \$1,200, while a colonoscope costs about \$34,000, with annual maintenance of about \$1,600.^{25,26} This excludes many other expenses such as a video processor, light source, scope processor, computer set, and software, among others. Secondly, there is the purchasing power of the average Nigerian, whose daily income is far below the poverty line,²⁵ struggling to cater for food and shelter, let alone afford an expensive procedure like endoscopy.

Close to 60% of respondents reported a total number of upper GI procedures between five and 14 and fewer than five colonoscopies per week per center. This makes an annual cumulative upper and lower GI endoscopy count of about 260 to 720 and fewer than 260 per center, a grossly inadequate figure for the corresponding populations. These figures include both diagnostic (the mainstream procedure) and therapeutic ones. This finding is much lower than those recorded in South Africa,²³ Ethiopia,²⁷ and Spain,²⁶ where a minimum of 2,000 procedures are performed per annum. However, a lower figure was reported from centers in Uganda, with a monthly procedural frequency of eight to 18, comprising mainly diagnostic upper GI endoscopy.²⁸

The most common therapeutic upper GI intervention was endoscopic variceal band ligation for patients with portal hypertension, followed by the retrieval of foreign bodies from the upper GI. Similarly, polypectomy was the most common intervention performed during colonoscopy. However, only a few respondents reported the availability of endoscopic mucosal resection, endoscopic submucosal dissection, endoscopic bariatric intervention, endoscopic ultrasound, capsule endoscopy, and ERCP, which were reported by one to three respondents each. The above findings clearly imply the deficiency faced by the whole country regarding these life-saving interventions. There are currently two centers with functioning ERCP, one each for public and private sectors, both located in the South-Western region of the country. Hence, any condition warranting ERCP intervention involves traveling hundreds of miles to access such a facility. Moreover, some newer endoscopic surgical interventions, such as natural orifice transluminal surgery and peroral endoscopic myotomy, were not reported by any of the respondents. These findings portray the deficient nature of endoscopic practice in the country, exacerbated by myriad challenges of various kinds.

The practice of gastrointestinal endoscopy comes with drawbacks. The leading problems reported by the endoscopists were the cost of machines, maintenance of the machines, inadequate training

for most advanced endoscopic interventions, old machines characterized by frequent breakdowns, and poor-quality images that may miss important pre-malignant lesions, thereby adding to the already existing problem. A complete gastrointestinal endoscopy tower, comprising upper and lower scopes, video processor, light source, monitor, printer, trolley, washing unit, and other necessary accessories, costs about \$100,000 to \$120,000.²⁶ This amount may be hard to raise for most Nigerian centers based on the average reported charges per procedure in the country. The same challenges apply to various accessories used for endoscopic therapeutic interventions. Despite the cost of establishing and maintaining an endoscopy center, there is poor acceptability of the procedure among Nigerians. This is due to poor tolerability by patients stemming from false beliefs or misinformation from the public concerning the procedure, in addition to the widespread poverty ravaging the common man in the country.

Due to the persistent challenges faced, many endoscopists have tried hard to develop basic local techniques to mitigate the problems encountered in endoscopy practice in the country. Some of the reported innovations by the respondents include the use of adjuvant agents for bowel preparation, such as 20% mannitol, normal saline, Epsom salt, and Dulcolax. These help address the problem of availability and cost of standard agents with satisfactory outcomes. Similarly, some endoscopists treat *Helicobacter pylori* empirically based on endoscopic findings and epidemiology, due to the non-availability of diagnostic facilities. Band reloading is another innovative technique used to recycle the smart bands for variceal ligation. The reloadable bands are cheap and affordable for most patients, the majority of whom belong to the low socioeconomic class.

Our study has some limitations. The responses were not from all 37 states of Nigeria, including the Federal Capital Territory, though they cover more than 50% of the nation with representation from all geo-political zones. Similarly, this is an online survey, and although we had an appreciable response rate, some respondents left many questions unanswered. This makes it difficult to draw logical conclusions regarding certain matters. Hence, a more comprehensive survey involving the entire gastroenterology community would help address most of the missing gaps recorded in this study.

Conclusions

This cross-sectional survey provides valuable insights into the current state of gastrointestinal endoscopy practice in Nigeria. With 41 endoscopists participating from diverse regions, the data reveal a predominance of male practitioners, mostly trained through Nigerian residency programs, and a concentration of services in public healthcare settings. The survey highlights that endoscopic procedures, primarily diagnostic in nature, are actively performed across the country, with an average of 11–12 upper GI and four to five lower GI endoscopies conducted weekly at the surveyed centers.

Despite these advancements, the practice faces significant challenges, including high costs associated with procedures and equipment maintenance, as well as insufficient training opportunities. These barriers have hindered the full potential of endoscopy services in Nigeria.

Importantly, the research underscores the resilience and adaptability of Nigerian endoscopists, who have implemented innovative strategies to address these challenges. This adaptability is crucial for sustaining and enhancing endoscopy practices in the face of

financial constraints and training deficits.

It is therefore recommended that the following measures be put in place to improve endoscopy practice in the country. Such measures include:

Addressing Financial Barriers: There is a critical need for increased funding and resource allocation to support endoscopy services. This could be achieved through government intervention, private sector partnerships, or funding from international health organizations.

Enhancing Training Programs: Improving training opportunities for endoscopists is essential to build local expertise and ensure high-quality care. Emphasizing continuous professional development can help practitioners stay updated with best practices and new technologies.

Encouraging Innovation: The indigenous innovations identified in this study should be supported and further developed to enhance the efficiency and effectiveness of endoscopy services, potentially mitigating some of the financial and logistical challenges faced by practitioners.

In conclusion, while gastrointestinal endoscopy in Nigeria demonstrates meaningful progress, it is imperative to address the underlying challenges to optimize service delivery and patient outcomes. Continued collaboration among stakeholders is essential for fostering a sustainable and robust endoscopic practice in the country.

Acknowledgments

We acknowledge all members of society of gastroenterology and hepatology in Nigeria who spared their precious time to respond to our survey.

Funding

None.

Conflict of interest

None.

Author contributions

Study design (YM, ASM, YSU, PMD, KOA, CPO, KCO, MM, AAS), participation in data acquisition (YM, ASM, YSU, PMD, KOA, CPO, KCO, MM, AAS), analysis (YM), data interpretation (YM), drafting of the initial manuscript (YM), and revision of the article critically for important intellectual content (YM, ASM, YSU, PMD, KOA, CPO, KCO, MM, AAS). All authors agreed with the final edition of this manuscript.

Data sharing statement

The data used in support of the findings of this study are included within the article, no additional data available.

References

- [1] Asombang A, Bhat P. Endoscopy and Its Alternatives in Resource-Limited Countries in Africa. *Tech Innov Gastrointest Endosc* 2024; 26(3):283–297. doi:10.1016/j.tige.2024.06.004.
- [2] Rahman I, Patel P, Boger P, Rasheed S, Thomson M, Afzal NA. Thera-

- peutic upper gastrointestinal tract endoscopy in Paediatric Gastroenterology. *World J Gastrointest Endosc* 2015;7(3):169–182. doi:10.4253/wjge.v7.i3.169, PMID:25789087.
- [3] Groen PCDE. History of the Endoscope. *Proc IEEE* 2017;105(10):1987–95. doi:10.1109/JPROC.2017.2742858.
- [4] Adranel S, Ougenot JFM. History of Gastrointestinal Endoscopy and Pediatric Endoscopy. *Pediatric Gastrointestinal Endoscopy*. Amsterdam: Elsevier; 2006.
- [5] Ponsky JL. A History of Flexible Gastrointestinal Endoscopy. *Surg Clin NA* 2020;100(6):971–92. doi:10.1016/j.suc.2020.08.013, PMID:33128891.
- [6] Asombang AW, Alatishe OI, Aderonmu AA, Owojuyigbe AM. Teaching and pioneering endoscopic retrograde cholangiopancreatography at a tertiary center in Nigeria — Year 1 experience: The apprenticeship model — Is this a viable option for Africa? *Niger J Gastroenterol Hepatol* 2022;14:49–54. doi:10.4103/njgh.njgh_15_22.
- [7] Mwachiro M, Topazian HM, Kayamba V, Mulima G, Ogutu E, Erkie M, *et al*. Gastrointestinal endoscopy capacity in Eastern Africa. *Endosc Int Open* 2021;9(11):E1827–E1836. doi:10.1055/a-1551-3343, PMID:34790551.
- [8] Bhat P, Hassan C, Desalegn H, Aabakken L. Promotion of gastrointestinal endoscopy in Sub-Saharan Africa: What is needed, and how can ESGE and WEO help? *Endosc Int Open* 2021;9(7):E1001–E1003. doi:10.1055/a-1495-5215, PMID:34222621.
- [9] Thomson S, Hair C, Oyeleke GK. Outside the Training Paradigm: Challenges and Solutions for Endoscopy Provision in Resource-Limited Settings. *Tech Innov Gastrointest Endosc* 2024;26(3):270–282. doi:10.1016/j.tige.2024.06.002.
- [10] American Gastroenterological Association. The American Gastroenterological Association standards for office-based gastrointestinal endoscopy services. *Gastroenterology* 2001;121(2):440–443. doi:10.1053/gast.2001.26257, PMID:11487554.
- [11] Mulder CJ, Jacobs MA, Leicester RJ, Nageshwar Reddy D, Shepherd LE, Axon AT, *et al*. Guidelines for designing a digestive disease endoscopy unit: report of the World Endoscopy Organization. *Dig Endosc* 2013;25(4):365–375. doi:10.1111/den.12126, PMID:23701732.
- [12] Januszewicz W, Kaminski MF. Quality indicators in diagnostic upper gastrointestinal endoscopy. *Therap Adv Gastroenterol* 2020; 13:1756284820916693. doi:10.1177/1756284820916693, PMID:32477426.
- [13] Rex DK, Schoenfeld PS, Cohen J, Pike IM, Adler DG, Fennerty MB, *et al*. Quality indicators for colonoscopy. *Gastrointest Endosc* 2015;81(1):31–53. doi:10.1016/j.gie.2014.07.058, PMID:25480100.
- [14] Malu AO. Gastrointestinal endoscopy in Nigeria. *Niger J Gastroenterol Hepatol* 2020;12(2):33–39. doi:10.4103/2251-0079.302904.
- [15] Ismaila BO, Misauno MA. Gastrointestinal endoscopy in Nigeria—a prospective two year audit. *Pan Afr Med J* 2013;14:22. doi:10.11604/pamj.2013.14.22.1865, PMID:23503686.
- [16] Atimati AO, Ewah-Odiase RO, Irowa O. Paediatric Gastrointestinal Endoscopy in a Nigerian Tertiary Hospital. *Ann Heal Res* 2022;8(4):288–296. doi:10.30442/ahr.0804-05-180.
- [17] Odeghe E, Oluyemi A, Oyeleke G, Adeniyi O, Nwude V. Upper gastrointestinal endoscopy findings in adults with dyspepsia younger than 60 years in Lagos, Nigeria. *Niger J Gastroenterol Hepatol* 2023;15(2):38–42. doi:10.4103/njgh.njgh_11_23.
- [18] Musa Y, Abdulkadir YM, Manko M, Umar YS, Mohammed AN, Yusuf I, *et al*. A 10-Year Review of Colonoscopy at Aminu Kano Teaching Hospital, Kano Nigeria. *Niger J Clin Pract* 2021;24:1072–1076. doi:10.4103/njcp.njcp_497_20, PMID:34290185.
- [19] Adeniyi OF, Paed FMC, Health C, Lesi OA, Odeghe EA, Adekola O, *et al*. Upper gastrointestinal endoscopy in children: The Lagos University Teaching Hospital experience. *South African J Child Health* 2016;10(4):8–11. doi:10.7196/SAJCH.2016.v10i4.1116.
- [20] David K, Bertiger G, Brogadir S. Bowel preparation quality scales for colonoscopy. *World J Gastroenterol* 2018;24(26):2833–2843. doi:10.3748/wjg.v24.i26.2833, PMID:30018478.
- [21] Vargas-madrugal J, Alfaro-murillo O, Campos- C, Alvarado-salazar M, Madrigal-mendez A. Quality indicators in colonoscopy. *Acta Med Costarric* 2019;61(1):1–7.
- [22] Perl D, Leddin D, Bizos D, Veitch A, Dow JN, Bush-goddard S, *et al*. Endoscopic capacity in West Africa. *Afr Health Sci* 2016;16(1):329–338.

- doi:10.4314/ahs.v16i1.44, PMID:27358650.
- [23] Loots E, Chb MB, Sa FCS, Gastroenterology C, Surg SA, Clarke DL, *et al*. Endoscopy services in KwaZulu-Natal Province , South Africa , are insufficient for the burden of disease: Is patient care compromised? *S Afr Med J* 2017;107(11):1022–1025. doi:10.7196/SAMJ.2017.v107i11.12484, PMID:29262947.
- [24] Beg S, Ragunath K, Wyman A, Banks M, Trudgill N, Pritchard DM, *et al*. Quality standards in upper gastrointestinal endoscopy: a position statement of the British Society of Gastroenterology (BSG) and Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland (AUGIS). *Gut* 2017;66(11):1886–1899. doi:10.1136/gutjnl-2017-314109, PMID:28821598.
- [25] Ahmad DM, Lucero-Priso D. The new National Health Insurance Act of Nigeria: How it will insure the poor and ensure universal health coverage. *Popul Med* 2022;4(33):3–4. doi:10.18332/popmed/157139.
- [26] Loras C, Mayor V, Fernández-Bañares F, Esteve M. Study of the standard direct costs of various techniques of advanced endoscopy. Comparison with surgical alternatives. *Dig Liver Dis* 2018;50(7):689–697. doi:10.1016/j.dld.2018.03.002, PMID:29610018.
- [27] Bane A, Ahmed R, Seid A. Therapeutic endoscopy practice at a resource-limited setup: experience from a GI center in Addis Ababa, Ethiopia. *Res Sq* 2022. doi:10.21203/rs.3.rs-1258446/v1.
- [28] Doe MJ, Bua E, Obbo JSO, Bisso F, Olupot-olupot P, Regional M, *et al*. Upper gastrointestinal endoscopy findings in Mbale Regional Referral Hospital , Eastern Uganda: a 10-year retrospective analysis. 2021;21(2):919–926. doi:10.4314/ahs.v21i2.54, PMID:34795752.