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Evaluation of Medical Imaging Technologies (MRI AND CT-SCAN) for Interaction and Communication in Health Workers-Patient Relationship

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Abstract
Magnetic Resonance Imaging (MRI) produces detailed images of the human body, while Computed Tomography (CT) scans use X-rays and computer processing for similar imaging purposes. This study applied Diffusion of Innovation Theory to evaluate how health workers interact and communicate with patients regarding these technologies. Using a mixed-methods approach**,** the study combined a quantitative survey and qualitative in-depth interviews. A sample of 387 health workers was drawn from 3,431 hospitals and health facilities with MRI and CT scan equipment across Anambra, Enugu, and Imo States**.** Findings revealed that while 50.4% of health workers regularly communicated with patients about imaging diagnoses and results, 49.6% rarely or never did so**.** Patient anxiety emerged as the most common challenge in these interactions, followed by medical language barriers (28.7%)**.** Additionally, only 18.9% of health workers spent 30 minutes or more explaining imaging results to patients. To address patient concerns, health workers employed strategies such as emotive communication (77%)**,** pausing consultations when anxiety arose (16.3%)**,** and referring patients to psychologists (6.7%)**.** The study recommends establishing dedicated points of contact where patients can seek further explanations before imaging procedures. The use of visual aids (e.g., diagrams, images, or videos) should be encouraged to enhance patient understanding. Furthermore, integrating digital technologies**,** such as patient portals and mobile apps, could improve patient-centered care and communication in medical imaging.

Key words: Medical imaging technologies, Interaction, Communication, Health Workers, Patients, MRI, CT-Scan

Introduction

Technology continues to drive significant advancements across various sectors, including healthcare, where innovations have improved service delivery and patient outcomes. Medical imaging technologies such as Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans have revolutionized disease diagnosis and treatment, enhancing healthcare efficiency while reducing the burden on practitioners. However, the effectiveness of these technologies extends beyond their technical capabilities to the quality of health worker-patient communication, which influences patient understanding, emotional response, and overall treatment adherence.

Lorenzetti *et al.* (2014) highlight that modern healthcare is unthinkable without technological innovations such as antibiotics, anesthetics, prostheses, and diagnostic imaging. The integration of digital health solutions, including eHealth and mHealth applications, has further transformed healthcare by improving access to information, facilitating remote consultations, and enhancing provider-patient interactions (Batta, Udousoro & Abubakar, 2015). While these innovations promote efficiency, patient engagement and communication remain critical to ensuring optimal healthcare experiences. Poor interaction between healthcare providers and patients—particularly in the use of imaging technologies—can lead to confusion, anxiety, and even treatment abandonment.

Effective patient-provider communication is essential in medical imaging settings, where patients often experience anxiety over procedures, results, and their implications. Kazeem (2023) asserts that technology-driven healthcare should prioritize not only efficiency but also patient safety and engagement. When patients fully understand the necessity and process of imaging procedures, their cooperation and adherence to medical advice improve. However, traditional one-way communication patterns, where patients passively receive instructions, may create psychological distress, reducing their willingness to undergo essential imaging tests.

Existing studies (Lorenzetti *et al*., 2014; Batta, Udousoro & Abubakar, 2015) have extensively examined the impact of technology on healthcare efficiency, access, and innovation, with a focus on digital health solutions such as eHealth and mHealth. These studies highlight how technological advancements improve healthcare delivery, but they often overlook the communication dynamics between healthcare providers and patients in medical imaging contexts. While some research has explored patient anxiety during diagnostic procedures, there is limited empirical evidence on how health workers accommodate patient concerns, communicate imaging results, and address emotional or psychological barriers during the imaging process. This study fills this gap by examining the nature and effectiveness of health worker-patient communication in MRI and CT scan procedures.

Statement of the Problem

The integration of medical imaging technologies, such as MRI and CT-Scan, into healthcare services has transformed the way healthcare workers interact and communicate with patients. However, the effective utilization of these technologies in facilitating patient-centered communication and improving health outcomes remains a significant challenge. Specifically, in Southeast Nigeria, where healthcare infrastructure and resources are limited, the adoption and effective use of medical imaging technologies in healthcare settings are hindered by inadequate training, poor infrastructure, and socio-cultural barriers. As a result, patients often experience poor communication, inadequate information sharing, and limited involvement in decision-making processes, ultimately affecting their satisfaction with healthcare services and health outcomes.

Studies have shown that an increase in quality care with the use of health technologies for healthcare delivery system will result in efficient healthcare in the country. However, there seems to be few studies, if any, which investigated interaction and communication between healthcare providers and patients in the South-Eastern region of Nigeria during the usage of these specific technologies like MRI and CT-Scan. Although studies abound in Nigeria on the integration of ICTs and other technological innovations like mobile health in Nigeria's healthcare system to enhance quality of service, only a few attempts have linked the MRI and CT-Scan with health

communication. There was no investigation on how the health practitioners in the country interact and communicate with patients while using MRI and CT-Scan known to the researcher. Thus, this research bothered on providing data on how Nigerian health workers interact and communicate with patients while using medical imaging technologies like MRI and CT-Scan.

Research Questions

The following research questions guided the study:

1. What are the communication dynamics between health workers and patients facilitated by medical imaging technologies (MRI and CT-Scan)?
2. What are the impacts of verbal and non-verbal communication cues in healthcare interactions during medical imaging technologies (MRI and CT-Scan)?
3. To what extent do medical imaging technologies (MRI and CT-Scan) facilitate or hinder empathetic communication between health workers and patients?
4. In what ways do medical imaging technologies (MRI and CT-Scan) influence communication styles and strategies employed by health workers in patients interactions?
5. How do medical imaging technologies (MRI and CT-Scan) influence patient-centered communication and shared decision-making between patients and health workers in healthcare settings?

Conceptual Clarification: MRI and CT scan

Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) Scan are both advanced medical imaging techniques used to examine the inside of the human body. MRI works by using powerful magnets and radio waves to create detailed images of soft tissues like the brain, muscles, and organs (Katti, *et al*, 2011). Unlike X-rays, MRI does not use radiation, making it a safer option, especially for repeated scans. It is particularly useful in diagnosing conditions related to the nervous system, joints, and internal organs. However, MRI scans take longer, can be uncomfortable for people who fear enclosed spaces, and are not suitable for patients with metal implants like pacemakers (Katti, *et al*, 2011).

On the other hand, a CT scan uses X-ray technology to capture cross-sectional images of bones, blood vessels, and organs. It is widely used in emergency situations because it produces quick results, helping doctors detect injuries, internal bleeding, or strokes within minutes (Al-Sharify, *et al*. 2020). CT scans are excellent for examining bone fractures, lung diseases, and tumours, but they expose patients to radiation, which can be harmful if used frequently. Some CT scans require a contrast dye to highlight certain areas, though this may cause allergic reactions in some patients (Al-Sharify, et al. 2020). Despite these risks, CT scans remain a valuable diagnostic tool due to their speed, affordability, and ability to scan patients with metallic implants.

Review of Empirical Studies

Medical imaging technologies, particularly Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans, play a crucial role in modern healthcare by facilitating accurate diagnosis and treatment planning. However, the interaction and communication dynamics between healthcare workers and patients in the context of these imaging technologies remain underexplored. Existing literature has predominantly focused on the technological efficacy, accessibility, and adoption of medical imaging, with limited emphasis on how these technologies

shape healthcare provider-patient communication and relationships. Several studies have examined the impact of digital health technologies on healthcare service delivery. For instance, Murugesu *et al.* (2022) investigated challenges in communicating with low health-literate patients, finding that healthcare providers often struggle to convey complex health information. While this study highlights communication barriers in healthcare, it does not specifically address medical imaging interactions, where patients often experience anxiety, uncertainty, and a lack of direct engagement with healthcare workers. Similarly, Akeju *et al.* (2022) and Ebenso *et al.* (2021) explored digital health interventions for maternal and child healthcare in Nigeria, revealing how eHealth tools improve patient outcomes. However, their focus on maternal health interventions does not account for the communication challenges inherent in radiological procedures, where patients may have limited understanding of imaging results and expectations.

Existing literature has also examined patient-provider relationships in general healthcare settings but with little attention to radiological environments. Ineji and Ogar (2021) explored how digital media enhances transparency and efficiency in healthcare delivery, showing that online health communication fosters better relationships between doctors and patients. However, medical imaging technologies like MRI and CT scans involve brief, often impersonal interactions, where communication may be constrained by the technical nature of the procedure. Moreover, the role of radiographers and imaging technologists in patient communication remains underexplored, raising concerns about patient anxiety, informed consent, and overall satisfaction. Some studies, such as Addo and Agyepong (2020), have highlighted infrastructural challenges and ICT limitations in healthcare, noting how technical barriers can impede effective service delivery. In the context of medical imaging, these challenges extend to the communication process, where healthcare workers may lack the training or tools to explain imaging results adequately. Olofin *et al.* (2020) found that while health information technology improves efficiency, inadequate IT training for healthcare workers limits its full potential. This aligns with concerns in radiology, where miscommunication between radiologists, referring physicians, and patients can result in misinterpretations, delayed diagnoses, or increased patient anxiety.

Despite the extensive body of research on digital health, patient-provider interactions, and technological adoption in healthcare, few studies have critically examined how medical imaging technologies influence communication and relationships between healthcare workers and patients. The present study seeks to address these gaps by evaluating the role of MRI and CT-scan technologies in shaping the interaction and communication dynamics between healthcare workers and patients.

Research Hypothesis

H_0: Optimized interaction and communication during the use of MRI and CT-Scan enhances quality healthcare.

H_1: There is no relationship between quality healthcare and optimized interaction and communication during the use of MRI and CT-Scan.

Theoretical Framework

This study adopts the Diffusion of Innovation (DOI) Theory, developed by Everett Rogers in 1983, to explain the spread and adoption of technologies (Miller, 2015). The theory describes how new ideas, technologies, or behaviours are introduced, communicated, and eventually accepted within

a society. According to Rogers, diffusion goes beyond the introduction of an innovation; it involves factors that influence its acceptance, including the perceived benefits, communication channels, and the social systems that facilitate or hinder its adoption. In the context of this study—Evaluation of Medical Imaging Technologies (MRI and CT-Scan) for Interaction and Communication in Health Worker-Patient Relationships—the DOI theory helps to explain the differences in the adoption and use of these imaging technologies.

While MRI and CT scans have significantly improved medical diagnosis and treatment, their effectiveness depends on how well they are integrated into healthcare communication and interaction. Factors such as cost, awareness, technical expertise, and availability impact their adoption and usage. Health communication plays a vital role in ensuring that these technologies are properly utilised to enhance patient care. The dissemination of information through training programs, digital platforms, and professional collaboration can improve the understanding and use of MRI and CT scans in healthcare settings. Effective adoption of medical imaging innovations can enhance health worker-patient interactions, improving communication and diagnostic accuracy. When healthcare practitioners are well-informed about the capabilities and benefits of these technologies, they can use them more efficiently, leading to better patient satisfaction and improved health outcomes.

Research Methodology

This study employed a quantitative survey research design. The survey method was used to collect statistical data through questionnaire, allowing for the generalisation of findings. The study focused on three randomly selected states—Anambra, Enugu, and Imo—where data was gathered from 3,431 health workers across various hospitals and diagnostic centres. A sample size of 400 was determined using Comrey and Lee's (1992) ranking and proportionally distributed across the three states. Convenience sampling was adopted to accommodate the demanding schedules of health workers. Data collection instruments included structured questionnaires with 20 items designed to align with the research objectives and semi-structured. The data were analysed using descriptive statistical tools with the aid of SPSS.

Data Presentation

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Table 4.1: Demographic Characteristics of Respondents (N = 387)

Variable	Category	Frequency	Percent (%)	Valid Percent (%)
Gender	Male	185	47.8	47.8
	Female	202	52.2	52.2
Age Group	30–40	157	40.6	40.6
	41–50	143	37.0	37.0
	51–60	87	22.4	22.4
Designation	Doctors	56	14.5	14.5
	Nurse	98	25.3	25.3
	Radiologist	233	60.2	60.2
Years of Practice	0–5 Years	90	23.3	23.3
	6–10 Years	129	33.3	33.3
	11–15 Years	70	18.1	18.1
	18–20 Years	51	13.2	13.2
	Over 20 Years	47	12.1	12.1
Type of Hospital	Specialist	68	17.6	17.6
	Maternity	98	25.3	25.3
	General	106	27.4	27.4
	Anaesthetic	43	11.4	11.4
	Neurosurgery	50	12.9	12.9
	Psychiatric	22	5.7	5.7
Ownership	Government	12	3.1	3.1
	Private	375	96.9	96.9
Mode of Work	On Hire	382	98.7	98.7
	Hospital Owner	5	1.3	1.3
Hospital Existence (Years)	0–5	18	4.7	4.7
	6–10	46	11.9	11.9
	11–15	60	15.5	15.5
	16–20	102	26.3	26.3
	20 and Above	161	41.6	41.6

The demographic characteristics of the respondents provide critical context for evaluating the use of medical imaging technologies (MRI and CT-Scan) in enhancing interaction and communication within the health worker–patient relationship. Of the 387 respondents, a slightly higher proportion were female (52.2%) than male (47.8%), suggesting gender inclusiveness in the study. The majority were between 30–40 years (40.6%), followed by 41–50 years (37.0%), indicating a predominantly middle-aged workforce likely to be active in service delivery and familiar with modern imaging technologies. Most respondents were radiologists (60.2%), who are directly involved in MRI and CT-Scan operations, thereby enhancing the relevance of their insights. Furthermore, a substantial portion (56.6%) had 10 years or less of practice experience, implying relatively recent exposure to technological advancements. The highest number of respondents worked in general (27.4%) and maternity hospitals (25.3%), predominantly in private facilities (96.9%), where newer imaging technologies are more likely adopted. The vast majority were employed health workers (98.7%), not hospital owners, and many of the hospitals have operated for over 20 years (41.6%), indicating established healthcare settings. These demographic insights provide a balanced and credible base for understanding how MRI and CT-Scan technologies impact communication and interaction between health workers and patients in the South-East region.

The analysis of communication dynamics between health workers and patients regarding medical imaging technologies (MRI and CT-Scan) revealed varying interaction frequencies and challenges. Only 5.2% of health workers communicated daily with patients about their diagnosis or imaging results, while 11.6% did so weekly, 33.6% monthly, 41.9% rarely, and 7.7% never communicated with patients on this matter. Regarding patients' understanding of their diagnosis or treatment after using medical imaging, 14.7% of health workers believed their patients had only 25% understanding, 32.6% estimated 50% understanding, 32.0% thought it was 75%, and 20.7% believed patients had full (100%) understanding. The major challenges faced in communicating medical imaging results included patient anxiety (33.8%), medical language barriers (28.7%), limited time (28.2%), and technical issues (9.3%). These findings highlight significant gaps in communication and comprehension between health workers and patients, emphasizing the need for improved patient engagement strategies in medical imaging.

The data revealed that visual aids are not widely utilised in communicating medical imaging results, as only 23.8% of health workers often use them, while 51.7% rarely do and 24.5% have never used them. However, the majority of health workers (77.5%) rely entirely on medical imaging results to explain diagnoses and treatments during patient interactions, while 22.5% use them in only half of their consultations. Regarding the time spent on explanations, 32% of health workers dedicate 10-20 minutes per consultation, 49.1% spend 20-30 minutes, 8.3% extend to 30 minutes-1 hour, and 10.6% exceed one hour, indicating variations in communication depth based on patient needs. The data indicated that medical imaging technologies play a significant role in fostering empathetic communication, as 66.7% of health workers feel that these technologies help them understand and acknowledge patients' emotions and concerns during consultations, while 33.3% do not share this view. Additionally, 88.9% of hospitals have ICTs for communicating with outpatients who underwent imaging diagnosis and treatment, whereas 11.1% lack such communication tools. In addressing patients' emotional or psychological concerns related to medical imaging, 77% of health workers rely on emotive communication, 6.7% refer patients to a psychologist, and 16.3% pause consultations when anxiety, fear, or uncertainty arises.

The data revealed that health workers employ various communication strategies when preparing patients for MRI or CT scans. Specifically, 28.7% provide a written form detailing the procedure, 40.3% inform patients orally before treatment begins, 20.1% educate them orally while the procedure is ongoing, and 10.9% proceed with the scan without prior communication. Additionally, 69.0% of health workers inform patients about the potential effects of MRI or CT scans, while 31.0% do not provide such information. The findings indicate varying levels of patient-centred communication and shared decision-making in medical imaging. While 51.2% of health workers inform patients alone about MRI or CT scan treatment options, 48.8% involve family members in decision-making during result discussions. Regarding patient involvement, 12.4% of health workers reported that all their patients felt informed, 34.9% said most did, 28.7% said few, and 24.0% stated that none felt informed. Additionally, 47.3% of health workers always provide personalized and understandable information, while 39.8% do so rarely, and 12.9% never provide such information. Communication challenges persist in integrating medical imaging technologies into healthcare services. Technical difficulties in patient communication were always experienced by 46.5% of health workers, rarely by 19.9%, and never by 33.6%. Furthermore, 89.4% encountered many patients struggling to understand medical imaging results due to medical

language barriers or limited health literacy, while 10.6% encountered only a few. Anxiety or distress in patients receiving imaging results was always observed by 72.4% of health workers, rarely by 24.5%, and never by 3.1%.

Hypothesis Testing

Null hypothesis H_{01}: Optimized interaction and communication during the use of MRI and CT-Scan enhances quality healthcare. (P>0.05).

Alternative hypothesis H_A: There is no relationship between quality healthcare and optimized interaction and communication during the use of MRI and CT-Scan. (P<0.05).

		How frequent do you use visual aids (e.g., images, diagrams) to communicate with patients on their imaging results and diagnosis that needed imaging?	How many of your patients reported feeling more informed and involved in their medical imaging after discussing with you?
How frequent do you use visual aids (e.g., images, diagrams) to communicate with patients on their imaging results and diagnosis that needed imaging?	Pearson Correlation Sig. (2-tailed)	1	
How many of your patients reported feeling more informed and involved in their medical imaging after discussing with you?	Pearson Correlation Sig. (2-tailed)	.144* .018	1

*. Correlation is significant at the 0.05 level (2-tailed).

Decision: Since P<0.05, the alternative hypothesis H_A was accepted. It followed therefore that optimized interaction and communication during the use of MRI and CT-Scan enhances quality healthcare. (r = 0.144; P=0.018).

Discussion of Findings

The results indicate that only 51.2% of health workers inform patients directly about medical imaging procedures, while 48.8% involve family members in shared decision-making. This aligns with the broader argument by Murugesu et al. (2022) that healthcare providers face challenges in effectively communicating complex medical information to low health-literate patients. However, while their study focused on general healthcare communication barriers, this research specifically highlights similar difficulties within radiology. Unlike standard medical consultations, where patient education and dialogue are more extensive, MRI and CT scan interactions tend to be brief and procedural, making effective communication even more crucial. The findings suggest that shared decision-making is still underutilized in radiological services, reinforcing Ineji and Ogar's (2021) assertion that digital health interventions often enhance transparency but do not always translate to improved patient engagement.

This study reveals that only 12.4% of health workers reported that all their patients felt informed and involved in their medical imaging process, while 24.0% indicated that none of their patients felt informed. This supports previous research by Akeju *et al.* (2022) and Ebenso *et al.* (2021), who found that digital health interventions improved patient outcomes in maternal and child health. However, the effectiveness of such interventions in radiology remains questionable, as

medical imaging results are often technical and difficult for patients to interpret. Unlike maternal health services, where digital tools facilitate education and follow-up care, medical imaging interactions remain largely provider-driven, leaving patients with limited understanding of their conditions. Furthermore, the findings align with Olofin *et al.* (2020), who noted that while health information technology enhances efficiency, inadequate IT training among healthcare workers creates gaps in communication. In the case of MRI and CT scans, healthcare workers may lack the training or resources to explain imaging results in layman's terms, leading to patient dissatisfaction and anxiety.

A significant proportion (46.5%) of healthcare workers reported always experiencing technical difficulties when communicating medical imaging results, while 89.4% encountered many patients struggling with medical language barriers or limited health literacy. This aligns with Addo and Agyepong's (2020) findings on infrastructural challenges and ICT limitations in healthcare. In the context of medical imaging, these challenges are further exacerbated by the technical nature of radiological interpretations. Unlike standard medical diagnoses that involve more interactive explanations, MRI and CT scan results are often communicated indirectly through referring physicians, creating gaps in direct patient engagement. Additionally, the study's findings confirm Olofin *et al.*'s (2020) argument that miscommunication between healthcare providers and patients can result in delayed diagnoses and increased anxiety. This study extends their argument by demonstrating that medical imaging procedures, in particular, present unique communication barriers due to their reliance on highly specialised terminology and limited direct interaction between radiologists and patients.

The study also found that 72.4% of health workers always encountered patients experiencing anxiety or distress when being informed about their imaging procedures or results. This supports Murugesu *et al*.'s (2022) claim that healthcare providers struggle to convey complex information effectively, leading to patient uncertainty and fear. However, while Murugesu *et al.* focused on general healthcare communication, this study provides a more targeted perspective by revealing that the impersonal nature of radiological procedures contributes significantly to patient anxiety. Unlike regular consultations where patients interact with their doctors throughout treatment, radiological examinations often involve minimal interaction, making patients feel disconnected and uninformed.

The Diffusion of Innovation Theory (Rogers, 1962) helps contextualise these findings. According to this theory, the adoption of new medical technologies, such as MRI and CT scans, follows a pattern in which early adopters (healthcare institutions) integrate these innovations before fully addressing communication challenges. While medical imaging has improved diagnostic accuracy, the communication strategies surrounding its implementation remain underdeveloped. This study highlights a gap in the diffusion process—while the technology itself has been widely adopted, healthcare workers have not been adequately trained to communicate its implications effectively to patients.

Conclusion

This study has highlighted significant gaps in communication between healthcare providers and patients in the context of medical imaging technologies, particularly MRI and CT scans. While these technologies have improved diagnostic accuracy and healthcare efficiency, their

implementation has not been accompanied by sufficient attention to patient-provider communication. The findings reveal that many patients feel uninformed about their imaging procedures, experience anxiety, and struggle to understand the medical language used in radiological explanations. Additionally, healthcare workers face technical difficulties in communicating imaging results and often lack adequate training to simplify complex medical information for patients. It is evident that while digital health technologies have enhanced healthcare service delivery in various fields, radiological communication remains a challenge. The impersonal nature of MRI and CT scan procedures, coupled with limited direct interaction between radiologists and patients, contributes to these communication barriers.

Recommendations

1. Health practitioners should consider using digital communication tools, such as patient portals or secure messaging, to communicate with patients and facilitate access to medical imaging results and other health information.
2. Health practitioners should use patient-centered communication strategies, such as asking open-ended questions and actively listening to patients' concerns.
3. Hospitals should standardize communication protocols for informing patients about medical imaging technologies' procedures, risks, and benefits.
4. Health practitioners should involve family members or caregivers in the communication process, as desired by the patient, to provide emotional support and facilitate understanding.
5. Hospitals should provide point of contact for patients to interact with designated health workers who will offer detailed explanation before imaging.

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