ROLE OF RADIOGRAPHY IN INTENSIVE CARE UNIT

BY

OKHOMINA ESEOSASERE HOPE

BMS2010669

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE IN RADIOGRAPHY

DEPARTMENT OF RADIOGRAPHY

SCHOOLOF BASIC MEDICAL SCIENCES

UNIVERSITY OF BENIN.

SUPERVISOR: Mrs Olasuyi Kemisola

DATE: OCTOBER, 2025

CERTIFICATION

This is to certify that the research work for this project and the subsequent write up by Okhomina Eseosasere Hope with matriculation number BMS2010669 were carried out under my supervision.

Mrs. Fanny Igbenedion	……
(Head of Department)	(Signature and Date)
Mrs Olasuyi Kemisola	……
(Supervisor)	(Signature and Date)

DEDICATION

I dedicate this research project to my beloved parents, who instilled in me the desire to work hard and excel and supported me morally and financially.

ACKNOWLEDGMENT

All gratitude and appreciation to Almighty God who gave me the wisdom, courage, opportunity, and good health to undergo this study.

I would like to express my heartfelt gratitude to my supervisor, Mrs Olasuyi Kemisola for her guidance, patience, and valuable support throughout the project. Her insights and expertise were important in determining the direction and focus of this study. May God reward her and her family abundantly.

I would also like to express my sincere gratitude to all my lecturers, the HOD, Mrs. Fanny Igbenedion, our lecturers, and all non-academic staff may God bless you for the immense support to see this program became successful.

My heartfelt gratitude goes to my parents, for their care, love, support, prayers, sacrifice, and encouragement. My appreciation also goes to my siblings and relatives. My classmates and friends, I appreciate your support and prayers. Thank you.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Introduction: Radiography has a significant role in the diagnosis and treatment of patients in the Intensive Care Unit (ICU) that are in a critical condition. Nevertheless, it is true that radiographers do face technical and environmental problems that can have an impact on image quality and efficiency. This paper evaluated the functions and issues of radiographers in the ICU and identified the value of the radiographic imaging in diagnosis and clinical decision making.

Methodology: A cross sectional method was applied in this study. The self structured questionnaire was employed and the data analyzed using the Statistical Package of the Social Sciences (SPSS) version 29. The results were discussed in terms of frequency table, percentage and the inferential statistics including one sample t-test and Wilcoxon signed ranks test with 0.05 level of significance.

Findings: 100.0% and 45 (97.8) were respectively aware of radiographers roles in the ICU and had direct experience in the ICU. The most common imaging modality was portable X-ray with the highest percentage at 82.6 (chest radiography). Radiographic monitoring was reported to enhance patient monitoring (91.3) and alteration of treatment (97.8). The patient positioning (87.0%), risk of infection (15.2%), and space were among the major challenges. Radiographic imaging has a significant positive relation ($p < 0.05$) with clinical decision-making.

Summary: Radiographic imaging has a role in the diagnosis and management of patients in the ICU. Constant post graduate education, proper equipments and interprofessional collaboration should be essential in improving the ICU radiographic services.

Keywords: Radiography, intensive care unit, portable X-ray, patient care, diagnostic imaging, challenges, radiographers.

CHAPTER ONE: INTRODUCTION

1.1 Background to the study

Intensive Care Unit (ICU) is a special clinical facility fitted with modern monitoring and therapeutic devices, which are meant to handle patients with critical and life threatening conditions. Intensive care medicine is a very important aspect of tertiary healthcare, and in Nigeria, it was introduced at the end of the 1970s as a sub-specialisation of Anaesthesia (Ogunbiyi et al., 2021).

Imaging services are very necessary in the ICU and must be easily accessible. The unit must ensure there are sufficient storage and support of portable imaging equipments. Because of the complicated and unstable nature of the ICU patients, diagnostic imaging especially mobile X-rays, ultrasound, and computed tomography (CT) is commonly needed in order to make timely clinical decisions (Shbeer, 2024). Chest radiography is one of such modalities, which is an essential part of the first examination and further monitoring of the patient in a critical condition (El-Kholy and Gaballah, 2025). The American College of Radiology concurs with this idea and recommends that all patients receiving new endotracheal tubes, feeding tubes, vascular catheters, and chest tubes should have it immediately. Radiography plays a significant role in the treatment of ICU patients in different clinical settings (Tiwari & Gedam, 2019).

Despite the fact that CT scans are more accurately regarded to be a more detailed diagnostic instrument, there are a number of issues with these scans in the ICU. These are excessive costs, inadequate supply, delay in providing treatment as they await reports, possible nephrotoxicity, the risk of anaphylactic responses to contrast agents,

and logistical challenges of taking the critically ill patients around the hospital (Tewari et al., 2024).

Point of care ultrasound (POCUS) represents a radiation-free, bedside alternative to imaging, on the other hand. It is nowadays acknowledged as the fifth pillar of physical examination in critical care in addition to inspection, palpation, percussion, and auscultation (Vetrugno et al., 2024). It is important to note that, Escourrou and De Luco were the first to show that the lung ultrasound could decrease the number of chest X-rays and general radiation exposure, especially among preterm infants in the neonatal ICUs (Su et al., 2022). As a real-time imaging instrument, lung ultrasound (LUS) has been found useful in ICUs because it is safe, accurate, reproducible, and simple to perform (Tewari et al., 2024). Although it has proven to be effective in emergency departments, it is still being actively studied in the more complicated ICU setup (Tewari et al., 2024).

Nonetheless, radiologic imaging commonly applies in ICUs, and it is appropriate to have concerns regarding radiation exposure and safety of both patients and healthcare providers. This is particularly vital in the case of pediatric patients, who are more exposed to tissue damage caused by radiations compared to adults (Su et al., 2022). The process of optimization and standardization of radiologic procedures in the ICU is still being called upon, and the principle of ALARA (As Low As Reasonably Achievable) is highly observed to increase the safety of radiology (IAEA, 2014). Although radiographic services are commonly used in the ICU; especially handheld chest X-rays, there is a large gap in the research on the specific use of radiography, and the difficulties in providing quality imaging services under such high-pressure

settings. The knowledge of these functions and issues is paramount in enhancing the efficiency of workflow, service provision, and patient outcome enhancement.

1.2 Statement of research problem

Critically ill patients in the ICU often rely on imaging like mobile X-rays, ultrasound, and CT scans for timely diagnosis and treatment decisions (Shbeer, 2024). Though such procedures are widespread, the special purpose of radiography in the ICU is not strongly researched. These roles and challenges should be understood in order to enhance service delivery and patient outcomes in the ICU.

1.3 Research questions

i. What types of radiographic procedures are commonly performed in the ICU?
ii. What is the role of radiographers in ICU patient management?
iii. What challenges do radiographers face while performing ICU radiography?
iv. How can ICU radiographic services be improved?

1.4 Research hypothesis

H0 (Null Hypothesis):

Radiographic imaging does not play a significant role in diagnosing and making clinical decision in the ICU.

H1 (Alternative Hypothesis):.

Radiographic imaging has a considerable role in the diagnosis and clinical decision-making process in the ICU.

1.5 Aim and objectives of the study

The objective of the research was to evaluate the role and problems of radiography in Intensive Care Unit (ICU). Objectives include;

i.To determine the general radiographic interventions performed in the ICU.

ii.To access the role of the radiographer in patient care in the ICU.

iii.To identify the issues of ICU imaging radiographers experience.

iv.To suggest management measures on the enhancement of radiographic services in the ICU.

1.6 Significance of the study

This paper will emphasize the importance of radiographers in the ICU and advance the necessity of constant education, more effective guidelines, and cross-professional cooperation. The results will contribute to the evidence-based practice and will improve the quality of radiographic services provided to critically ill patients.

1.7 Scope of the study

The target population of the study was radiology department with radiographers in the hospital having the ICU. It discussed the practice of radiography in mobile, the role of radiographers, the problems, and recommendations on how to improve.

1.8 OPERATIONAL TERMS

- Radiography: The X-rays are used to create images of the inside of the body in the form of both fixed and mobile (portable) X-ray systems.
- Mobile radiography Mobile radiographic imaging is done by the X-ray machine that is taken to the bedside when in ICU.
- ICU (Intensive Care Unit): A section of hospital which is equipped with round the clock and intensive care to patients who are critically ill or unstable.

- Chest X-ray (CXR):The typical radiographic study conducted in the ICU to assess the lungs, heart and position of life support equipment (e.g. endotracheal tubes).
- Diagnostic yield:How much a radiographic investigation provides the information that can be used to generate a clinical diagnosis or affect treatment decisions.
- Clinical decision making: The stages of making decisions about patients and their treatment in the ICU based on diagnostic result (including radiographs).
- Image quality: This is the clarity and the diagnostic value of the radiographs usually measured by the resolution, contrast and the visibility of the structures.
- Radiographer: A certified medical worker that carries out radiographic tests and guarantees patient safety and quality of the image.
- Radiation dose: This refers to the level of ionizing radiation that a patient is exposed to during radiographic examination, particularly in critically ill patients who undergo frequent radiographic examination.
- Bedside imaging: Radiographic imaging performed at the bedside of the patient, which is frequently practiced at the ICU to prevent patient transportation.
- Tube and Line positioning: Is radiographic confirmation of appropriate placement of medical devices in the ICU patient (e.g., central lines, nasogastric tubes)?
- Turnaround time: This is the time interval between requesting a radiographic examination and availability of a report to the ICU care team.

- Interprofessional collaboration: The process of collaboration between radiographers, radiologists and clinicians of ICUs to maximize imaging provision and patient outcomes.

CHAPTER TWO

LITERATURE REVIEW

2.0: Introduction

The theoretical review addresses the tenets of radiographic imaging in intensive care unit, such as the contribution of radiography to the management and decision making process of very ill patients. The empirical review looks at the available research and corresponding literatures on the importance of radiography in the ICU.

2.1 Conceptual review

2.1.1 The Intensive Care Unit (ICU)

Intensive Care Unit (ICU) or the Intensive Therapy Unit is a specialized hospital unit that is meant to offer holistic and round-the-clock care to patients with severe and life-threatening conditions and injuries. Such patients frequently need special attention, life-support devices, and complicated treatment, such as life-support therapies and medications (Kalyanpur et al., 2023). The ICUs are usually divided in terms of the care level:

Level 1 ICU: Medical doctors are staffed, and these doctors have the general experience in critical care, but they might not have a formal training in intensive care medicine (Kalyanpur et al., 2023).

Level 2 ICU: Physicians supervising level 2 ICUs have specialized medical training in internal medicine, surgery, anesthesiology, pediatrics, or emergency medicine, some of which have formal training in ICU.

Level 3 ICU: It is the most critical care level. These units have the most advanced state-of-the-art management of the most critically ill. They have specialists on staff

who have specialized training in critical medicine care, and offer 24-hour in-house services by physicians, nurse practitioners, or critical care trainees (Marshall et al., 2017).

2.1.2 Importance of portable imaging in the ICU

Diagnostic imaging constitutes an important aspect of patient management in the ICU that may be a key element of diagnosis, treatment monitoring, and decision-making. Bedside chest radiography is one of the modalities that are highly essential. Research has shown that even the ICU chest radiographs taken up to 65 percent could make important or previously unknown discoveries to modify patient care (Jain et al., 2019).

2.1.3 Mobile ultrasound equipment

Mobiles ultrasound devices are small, sometimes in form of cart or handheld and are used to provide real time imaging with high frequency sound waves (WHO, 2016). These machines are popular in emergency, obstetrics, anesthesia, and critical care as a point of care imaging (Moore & Copel, 2011).

They become particularly critical in cases where instant bedside evaluation is needed like in cases of trauma evaluation or procedural advice (Moore and Copel, 2011). Mobile devices are also more mobile and available with wireless and battery powered features making them even more mobile and accessible.

Advantages of ultrasound:

i. It involves the use of non-ionizing radiation, which is safe to use repeatedly (WHO, 2016).

ii. Provides real-time imaging, which enables bedside diagnosis, and other interventions (Moore & Copel, 2011).

iii. Applicable in low resource and emergency environments.

2.1.4 Mobile X-Ray equipment

Mobile X-ray machines are radiographic devices that are portable and can be used to carry out diagnostic imaging at the bedside of the patient especially in emergency departments, intensive care units (ICUs), and operating theatres (Bontrager & Lampignano, 2018). The machines are usually a small X-ray generator, a control console, and computed radiography (CR) or digital radiography (DR) image acquisition detectors (Bushong, 2020). They come in particularly handy when the patient is hard or unsafe to transport, e.g., critical illness or infectious disease (Bontrager & Lampignano, 2018). Digital mobile X-ray systems lead to increased efficiency in the working process through the possibility to view and transfer images to PACS in real-time (Herring, 2021).

Advantages:

i. Eliminates the necessity to carry very sick, or contagious patients.

ii. Enables quick diagnosis and intervention in good time (Bushong, 2020).

iii. Digital systems offer superior quality of image using low radiation dose (Bontragger & Lampignano, 2018).

Limitations:

i. Poor positioning alternatives.

ii. Poor image quality relative to fixed systems (Herring, 2021).

2.1.5 Common indications for chest xray in the ICU

i.Evaluation of Central Venous Catheters, pacemakers, Circulatory assist devices.

ii.Acute respiratory syndrome disease (ARDS)

iii.Pulmonary edema

iv.Ventilator-associated pneumonia

v.Atelectasis

vi.Pulmonary thromboembolism

Goal selection (Godoy et al., 2012; Jain et al., 2019)

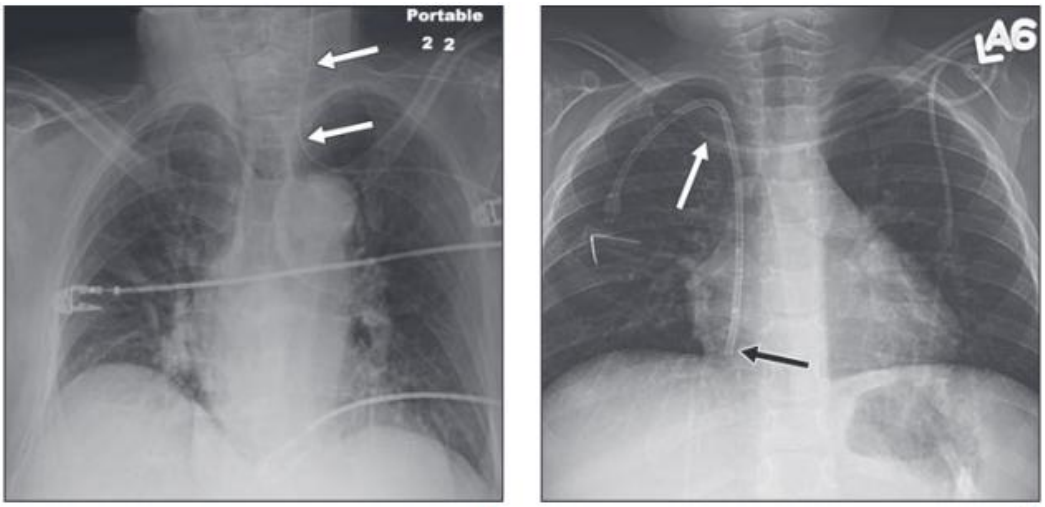


Figure 1: Showing CXR radiograph of patients with misplaced central venous catheters

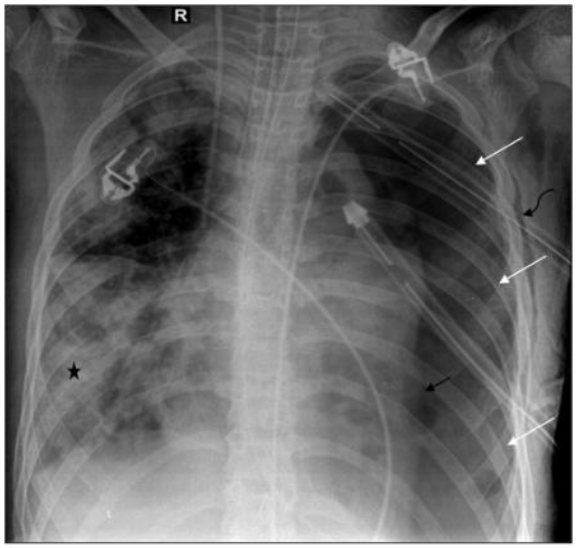


Figure 2: Showing a CXR radiograph of patient under treatment for ARDS with focal patchy consolidation in right mid and lower zone

2.1.6 Role of ultrasound in the ICU

The most recent use of ultrasound in critical care is that it is non-invasive, can be used at the bedside and can give real-time diagnostic results. Echocardiography is especially discussed as a useful and precise imaging method of assessing cardiac performance. It has been demonstrated that bedside echocardiography is instrumental in the early identification of dysfunction in the heart and it helps to make timely clinical decisions (Bhadane, 2023).

The last twenty years have seen a plethora of applications of ultrasound in critical care studies and clinical applications. Although ultrasound is operator-specific and is restricted in some aspects, it can be used to diagnose unstable patients relatively cheaply and safely within a relatively short time. It is not focused on ionising radiation which is considered one of its strengths as it can be reused and used on a long-term basis (Bhadane, 2023; Kamel et al., 2021).

2.1.7 Point of care applications

Point of care ultrasound (POCUS) has become increasingly common in the ICU for both diagnostic and procedural purposes. For example, lung ultrasound is progressively replacing some traditional imaging modalities due to its high sensitivity in detecting pneumothorax, pleural effusion, and pulmonary edema. Similarly, chest ultrasound has been shown to enhance the diagnosis of various thoracic pathologies (Rizk *et al.*, 2017).

Pleural effusion: On ultrasound, pleural effusion typically appears as an anechoic (dark) space between the parietal and visceral pleura (Figure 3)

Figure 3: Showing sonogram demonstrating pleural effusion

Pneumothorax: by ultrasound pneumothorax can be diagnosed by absent lung sliding, as presence of lung sliding and/or B lines rule out diagnosis of pneumothorax (Figure 4)

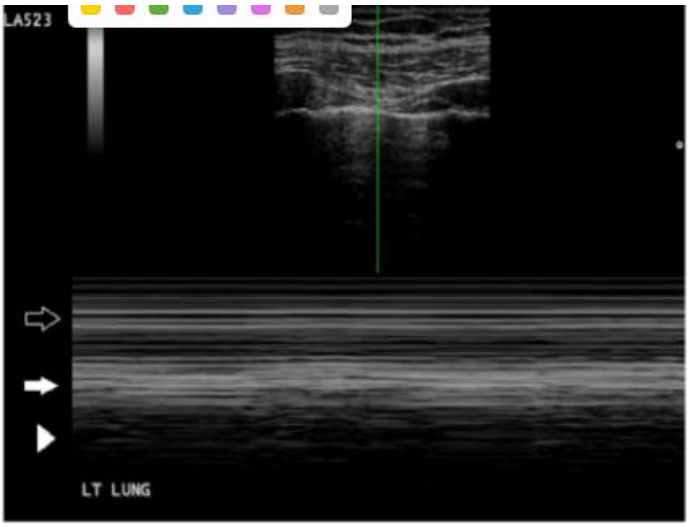


Figure 4: M-mode image of left hemithorax in a patient with pneumothorax

Lung consolidation can be diagnosed by ultrasound as an echo-poor or tissue like image

Figure 5: Showing a solid appearing pneumonia (asterisks)

2.1.8 Technological advances and future prospects in ICU imaging

Echography in brain imaging in intensive care unit

In the last years, due to new ultrasounds technology, echographic imaging of the brain parenchyma has been obtained not only in children, but also in adults. Several authors have found a good visualization of cerebral structures using transcranial B-mode ultrasounds through a transtemporal approach [transcranial sonography (TCS)] (Caricato, 2014).

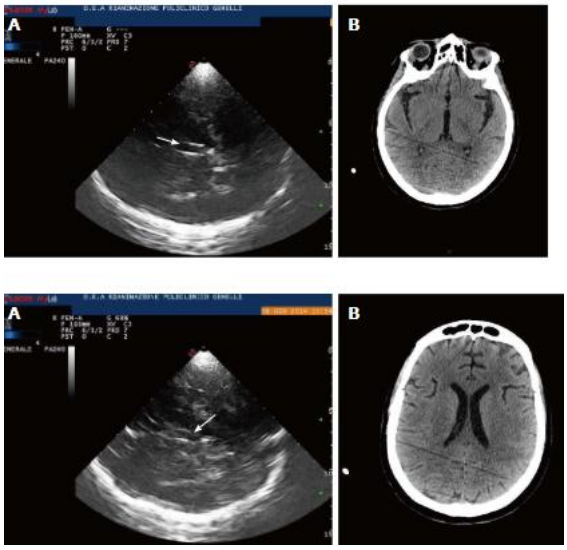


Figure 6: showing Diencephalic transverse scan. A small enlargement (12 mm) of third ventricle is shown

Indications for echography in ICU

- Intracranial haemorrhage
- Epidural and Subdural haemorrhage
- Midline shift
- Hydrocephalus
- Evaluation of intracranial hypertension

2.1.9 Radiographer's role in patient monitoring and positioning

Radiographers are essential members of the ICU because they are vital in providing the best positioning of patients to produce good diagnostic results without compromising patient safety and comfort. The correct placement is critical to effective imaging and can help avoid the potential development of complications, including pressure ulcers, nerve damage, and respiratory distress (Jones et al., 2019). The ability of the radiographer to handle the patient carefully and place him/her in the position that will not lead to the dislodging of tubes and catheters is extremely important in critically ill patients with limited motility, who are frequently connected to other life-support equipment (Smith and Lee, 2020).

Furthermore, radiographers aid in constant monitoring of patients undergoing the imaging process and tracking vital parameters and informing the ICU team about the response to any changes in the clinical condition (Brown et al., 2021). This position will be supported by a high level of knowledge about critical care protocols and collaboration with nurses and physicians in order to reduce patient risk.

2.1.10 Infection control and radiation protection in ICU imaging

The environment of ICUs is characterized by a high risk of healthcare-associated infections because patients have invasive devices and are immunocompromised (World Health Organization [WHO], 2022). Infection control by washing hands, wearing personal protective equipment (PPE), and disinfecting portable imaging equipment should be strictly followed by radiographers to avoid the cross-contamination (O'Hara et al., 2021).

The protection of radiations is also critical in the ICU environment as the patient might need a lot of imaging. The radiographers adhere to the principle of ALARA (As Low As Reasonably Achievable) and optimize exposure parameters and make

use of shielding to minimize the dose of radiation to patients and staff members (International Atomic Energy Agency [IAEA], 2014). The portable X-ray units have to be maintained and calibrated regularly to be safe (Sharma & Gupta, 2018).

2.1.11 Challenges in ICU radiography

Radiographic procedures are distinctly challenging at the ICU. The standard protocols may be complicated because of the instability of patients, the inability to access them because of life-support equipment, and the urgency of imaging (Miller et al., 2017). Image quality may be compromised by technical challenges including improper positioning of patients, motion artifacts and other related challenges. The presence of communication barriers is likely due to the tendency to sedate or intubate patients, and radiographers cannot obtain clinical updates without involving the ICU staff (Nguyen & Patel, 2019).

2.1.12 Teamwork in the intensive care unit

To provide quality care to patients, the cooperation of multidisciplinary staff members in the ICU should be ensured among physicians, nurses, respiratory therapists, and radiographers (Johnson et al., 2020). The role of radiographers is to organize imaging schedules, communicate the findings in timely fashion and aid in clinical decision-making. Effective communication makes the environment safer and enhances patient outcomes (Foster & Miller, 2021).

2.1.13 Teleradiology in the intensive care unit

One of the specialized branches in telemedicine is telera radiology, which has contributed so much to the clinical patient care since medical images can be transmitted and interpreted remotely (Kalyanpur et al., 2023). The technology enables

imaging studies that are conducted at the location of the patient, like in the ICU, to electronically transfer the studies to radiologists in other locations, enabling the provision of access to subspecialists, including neuroradiologists, pediatric radiologists, and musculoskeletal radiologists, who may be unavailable in the location (Kalyanpur et al., 2023).

Teleradiology is designed to ensure that the imaging studies that are being taken during off-hours or weekdays are timely reviewed, which will provide a timely diagnostic information that can be used immediately in making urgent clinical decisions (Kalyanpur et al., 2023).

Table 2.1: Modalities used in the ICU and common procedures

Modalities	Common procedures
Conventional xray	Babygram, chest xray, abdomen, upper and lower extremities,cystogram
Ultrasound	Abdomen, Obstetrics, Soft neck tissue, Venous Doppler, Lung assessent
Computed Tomography	Abdomen, Angiogram, Brain/head/skull, Perfusion Chest/Lung Facial bones/ maxillofacial, extremities
Nuclear Medicine	Angiogram Brain/head/skull Perfusion Chest/Lung Lower extremities Venogram Bone survey
Magnetic resonance imaging	Abdomen, Angiogram, Brain/head/skull Perfusion, Chest/Lung, extremities Spine. Obstetrics (Kalyanpur *et al*., 2023)

2.2 Emprical review

The empirical review of covers review of related literature and studies regarding the role of radiography in the intensive care unit.

Bhadane (2023) conducted a descriptive observational prospective casecontrol study in a tertiary pediatric ICU focusing on echocardiography's role in managing critically ill children, with medical intervention indicated in approximately 70% of cases and a mortality rate of 12%.

Islam *et al*. (2023) performed a retrospective descriptive analysis in Canadian ICUs evaluating the potential use of ultra-low field portable MRI to improve CT and MRI access. Their findings suggested that portable MRI could replace fixed CT in 21% and MRI in 26.5% of ICU cases.

Kalyanpur *et al*. (2023) reported a retrospective study on teleradiology in ICU patient care across 80 hospitals in the USA, interpreting 22,081 imaging studies remotely, mostly CT (47%) and radiographs (37.2%), with a mean turnaround time of approximately 45 minutes.

Cau *et al*. (2021) retrospectively compared CT patterns in ICU and non-ICU COVID-19 pneumonia patients, finding ICU patients showed more severe lung involvement, higher inflammatory markers, and distinct CT findings.

Gupta et al. (2021) carried out a prospective observational study in India of PICU children aged below 12 years to examine factors that were associated with increased rates of prescription of the chest X-ray, indicator, mechanical ventilation association, image quality, and radiation exposure. Most of the CXRs they found were on-demand and mechanical ventilation had a significant effect on the CXRs.

The study conducted by Ibrahim (2021) was a retrospective study that evaluated the predictability of CTPA hemodynamic indices of ICU admission and 30-day mortality in patients with pulmonary embolism. Strong correlations were observed between imaging variables, including MPA diameter and RV/ LV ratio and patient outcomes.

Karami *et al*. (2019) audited radiological protection practices in Iranian NICUs retrospectively, revealing poor beam restriction and minimal use of shielding during neonatal X-rays.

Al Shahrani and Al-Surimi (2018) conducted a cross-sectional survey of ICU clinical staff in Saudi Arabia on the routine use of daily chest X-rays. Most respondents supported a shift from routine daily imaging to on-demand chest X-ray policies in ICU settings.

Edison *et al*. (2017)) implemented a quality improvement project in a neonatal ICU to reduce radiation hazards by introducing protective gear, collimation, and positioning guidelines, achieving significant reductions in radiation hazard exposure.

Chen *et al*. (2012) retrospectively evaluated gallium 67 scintigraphy for detecting occult infections in ICU patients, identifying new infectious foci in 16.2% of cases, especially in bone and soft tissues, though no mortality difference was observed.

.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research setting

The study was conducted in radiology departments and centers within Benin city. University of Benin Teaching hospital which hadbed capacity of 360 when it was officially opened on May 12th, 1973, the UBTH of had over 900 be capacity as at August 2019 and still increasing. It is located at Ugbowo Lagos Road,Benin City, Nigeria. Edo Specialist Hospital is a central hospital build by the state government with over 200 beds that is operated by a leading private sector healthcare consultant. It is located at Plot 1 Sapele road Benin city, Edo state. Raytouch is a private diagnostic center located along First road, Benin city.

3.2 Study design

For this study, a cross-sectional study design was used to assess the role of radiographers in the ICU.

3.3 Target population

Licensed radiographers working at University of Benin Teaching Hospital, Edo specialist hospital and Raytouch diagnostic center.

3.4 Sampling technique/ Sample Size

A total of 46 radiographers participated in the study. Purposive sampling was used to select radiographers who had either worked, trained, or had direct clinical exposure to ICU imaging procedures at UBTH, Edo specialist hospital and Raytouch diagnostic center.

3.5 Instrument for data collection

A structured, self administered questionnaire was used. It consisted of five sections:

Section A: Demographic information (age, gender, level of experience).

Section B: Knowledge of ICU radiography.

Section C: Attitude and perception of ICU radiography.

Section D: Practices and challenges encountered during ICU imaging.

Section E: Role of technology (AI) in improving ICU radiography.

The questionnaire items included multiple choice, Likert scale, and open-ended questions.

3.6 Validity of instrument

Face validity and content validity ensured through review by the lead research supervisor.

3.7 Reliability of instrument

A pilot study was conducted among 10 radiographers not included in the final sample. The reliability of the questionnaire was determined using Cronbach's Alpha, yielding a coefficient of 0.761, showing good acceptable internal consistency of the likert scale items.

3.8 Method of data collection

The researcher personally administered the questionnaires to radiographers at University of Benin Teaching Hospital, Edo specialist hospital and Raytouch diagnostic center. Respondents completed and returned the forms voluntarily.

3.9 Method of data analysis

Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize responses. Reliability test (Cronbach's alpha) measured internal

consistency. Normality test (Shapiro-Wilk) assessed data distribution. Since data were not normally distributed, a non-parametric Wilcoxon Signed-Rank test was used to test the hypothesis (significance level: $p < 0.05$). Statistical package for social sciences (SPSS) version 29 was used for data analysis.

3.10 Ethical considerations

Ethical clearance was obtained from the University of Benin Teaching hospital ethical commitee. Participation was voluntary, and informed consent was obtained. All data was treated confidentially and anonymously. The request for ethical approval and ethical approval letters are attached as appendix II and III

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

From Table 4.1 below, the majority of respondents were within the 24-29 years age group 24 (52.2%). This was followed by 20 (43.5%) who were aged 30 years and above, while only 2 (4.3%) were between 18-23 years. About 28 (60.9%) of the participants were male, while 18 (39.1%) were female. About 31 (67.4%) were from the University of Benin Teaching Hospital (UBTH), 8 (17.4%) from Edo Specialist Hospital, and 7 (15.2%) from Raytouch Diagnostic Centre. Majority 18 (39.1%) of respondents were intern radiographers, 17 (37.0%) were radiographers with one to five years of experience, and 11 (23.9%) were chief radiographers with more than five years of experience.

Table 4.1: Demographic distribution of respondents

Variable	Category	Frequency (n=46)	Percentage (%)
Age (years)	18-23	2	4.3
	24-29	24	52.2
	30yrs and above	20	43.5
Gender	Male	28	60.9
	Female	18	39.1
Facility	UBTH	31	67.4
	Edo Specialist Hospital	8	17.4
	Raytouch Diagnostic Centre	7	15.2
Experience	Intern (<1 year)	18	39.1
	Radiographer (1-5 years)	17	37.0
	Chief Radiographer (above 5 years)	11	23.9

From Table 4.2 below, all respondents 46 (100.0%) acknowledged awareness of the radiographer's role in the ICU, and almost all 45 (97.8%) had ICU experience. About 45 (97.8%) agreed or strongly agreed that timely radiography improves patient outcomes, while 42 (91.3%) agreed that it reduces delayed diagnosis. Furthermore, 45 (97.8%) agreed that ICU imaging requires greater skill and expertise, and 46 (100.0%) recommended specialized ICU training for radiographers.

Table 4.2: Radiographers' roles and contributions in the ICU

Statement	Response	Frequency	Percentage (%)
Awareness of radiographer's role in ICU	Yes	46	100.0
Worked or trained in ICU	Yes	45	97.8
Timely radiography improves patient outcome	Agree	23	50.0
	Strongly Agree	22	47.8
Radiography reduces delayed diagnosis	Agree	22	47.8
	Strongly Agree	20	43.5
Radiography aids treatment modification	Agree	25	54.3
	Strongly Agree	20	43.5
Radiographers are members of ICU team	Yes	43	93.5
ICU imaging requires more skill than routine	Yes	45	97.8
Radiographers should receive ICU-specific training	Yes	46	100.0

All radiographers 46 (100.0%) confirmed that X-ray is the most used imaging modality in the ICU. Chest X-ray 38 (82.6%) was identified as the most frequently requested examination, mainly for evaluating lung pathology 26 (56.5%) or confirming tube/line placements (8.6%). Most respondents 35 (76.1%) agreed that patient immobility is the main reason for using portable radiography.(Table 4.3).

Table 4 3: Common radiographic procedures and practices in the ICU

Variable	Response	Frequency	Percentage (%)
Most common imaging modality	X-ray	46	100.0
Most frequent examination	Chest X-ray	38	82.6
	Chest & Abdominal X-ray	7	15.2
Purpose of chest radiography	Lung pathology	26	56.5
	Tube/line assessment	4	8.6
	All of the above	16	34.8
Reason for portable X-ray use	Patient immobility	35	76.1
	Accessibility	7	15.2
	Cost	4	8.7

A large majority 43 (93.5%) reported active involvement in infection control, while 39 (84.8%) acknowledged that radiation protection in ICU settings remains challenging due to limited space and patient condition. Lead aprons (27; 58.7%) were the most used protective device, though 14 (30.4%) combined aprons and shields. Nearly all respondents 45 (97.8%) confirmed assistance from ICU nurses or doctors during imaging (Table 4.4).

Table 4.4: Radiographers' contribution to patient care and infection control

Statement	Response	Frequency	Percentage (%)
Radiographers assist in infection control	Yes	43	93.5
	No	3	6.5
Radiation protection is challenging in ICU	Yes	39	84.8
	No	7	15.2
Common protective equipment used			
	Lead apron	27	58.7
	Apron and shield	14	30.4
	Shield only	5	10.9
Assistance from ICU staff during imaging	Yes	45	97.8
	No	1	2.2

Most respondents (40; 87.0%) experienced difficulty in patient positioning, largely due to patient condition (28; 60.9%), infection risk (7; 15.2%), and limited space (6; 13.0%). Despite these factors, 44 (95.7%) admitted to improvising to obtain quality images. Despite these factors, 44 (95.7%) admitted to improvising to obtain quality images, reflecting adaptability and dedication to patient care.

Table 4 5: Challenges encountered in ICU radiography

Challenge	Response	Frequency	Percentage (%)
Difficulty positioning patients	Yes	40	87.0
	No	5	10.9
	Not sure	1	2.2
Common challenge	Patient condition	28	60.9
	Limited space	6	13.0
	Infection risk	7	15.2
	Equipment limitation	5	10.9
Improvisation due to poor positioning	Yes	44	95.7
	No	2	4.3

Almost all respondents 45 (97.8%) emphasized the need for better collaboration among ICU staff, and 35 (76.1%) had undergone ICU related training. The most frequent recommendation for improving service delivery was adequate equipment provision 24 (52.2%), followed by regular training 11 (23.9%). Additionally, most respondents viewed Artificial Intelligence (AI) positively with 30 (65.2%) agreeing it reduces delays and improves image quality (Table 4.6).

Table 4 6: Recommendations and technological improvements

Recommendation	Response	Frequency	Percentage (%)
Improvisation due to poor positioning	Yes	44	95.7
	No	2	4.3
Need for better collaboration	Yes	45	97.8
Received ICU-specific training	Yes	35	76.1
	No	11	23.9
Suggested improvement	Provision of adequate equipment	24	52.2
	Training and retraining of staff	11	23.9
	Better collimation/protection	5	10.9
	Infection control measures	2	4.3
	No suggestion	4	8.7
AI improves accuracy of ICU imaging	Agree	23	50.0
	Strongly agree	9	19.6
AI reduces reporting delays	Agree	30	65.2
	Strongly agree	7	15.2
AI improves suboptimal image quality	Agree	30	65.2
	Strongly agree	7	15.2

From Table 4.7 below, There was good internal consistency (Cronbach's Alpha; 0.761), good internal consistency. Wilcoxon Signed Rank test confirmed that radiographic imaging has a statistically significant contribution ($p < 0.05$) to diagnosis and clinical decisions in the ICU.

Table 4 7: Cronbach's Alpha, One sample t test and Wilcoxon Signed Rank test

Test	Statistic
Cronbach's Alpha	0.761
One-Sample t-test	t = 19.520 p = 0.000
Wilcoxon Signed Rank Test	Z = -5.985, p = 0.000

.

4.2 Discussion

The ICU is a specialized environment that demands fast and accurate diagnostic intervention and collaboration between radiographers, doctors, nurses and healthcare assistants Imaging modalities such as portable X-ray and ultrasound, are vital for diagnosis, monitoring, and guiding clinical treatment. The present study show that 40 (87.0%) radiographers were aware of the radiographer's duty in ICU patient care, and 33 (71.7%) had previous ICU experience. The improtance of imaging in ICU wards is supported by Bhadane (2023), who reported that echocardiography influenced medical intervention in about 70% of pediatric ICU cases, and Ibrahim (2021), who found that computed tomographic pulmonary angiography (CTPA) indices helped to predict ICU admission and mortality in pulmonary embolism patients. These studies and the present findings collectively emphasize imaging is important in real time clinical decisions.

Imaging modalities and workflow efficiency in the ICU

Portable X-ray was the most common imaging modality in ICU radiography, 35 (76.1%) radiographers. Patient immobility (52.2%) was the primary reason for its use, confirming radiography's adaptability to critical care needs. Portable radiography ensures diagnostic continuity even when patient transfer is impossible. In hospitalslike UBTH there is a dedicated mobile xray equipment reserved for only ICU patients. This is because the equipment is availed at all times to be used and also due to infection control. Both studies by Gupta et al. (2021) and similar findings indicated that the majority of the chest X-rays in the pediatric ICU were conducted on request and especially in patients under mechanical ventilation. Similarly, Cau et al.

(2021) have stated that ICU patients with COVID-19 need serial chest CTs to track the progression of the disease and emphasized the inalienable value of imaging in the respiratory management.

Nevertheless, the situations in the ICUs of Nigeria are not similar to those described in the research of Cau and Gupta in the technologically advanced setting, as the limited mobility, insufficient imaging systems, and the number of radiographers per shift is a typical issue. Despite these problems, there was professional commitment and understanding of the impact of imaging on patient outcome by the radiographers. The study by Kalyanpur et al. (2023) also indicated that teleradiology has enhanced ICU workflow in the United States with an average turn around time of 45 minutes on interpretation of images. Though this form of efficiency has not been emulated in Nigeria since they lack the infrastructure but the concept of timing imaging is universal. In this survey, 31 (67.4) radiographers were strong that timely radiographic imaging enhances patient outcomes as it is consistent with the worldwide view that the speed of imaging has a direct influence in the clinical decision making. Most Benin Metropolis hospitals apply Teleradiology. An example in UBTH and other private centres is to send images to radiologists to review and report weekends and call hours. This has images of the ICU. Radiographic imaging plays an important role in diagnosis and treatment in the ICU ($p < 0.001$). Most of the respondents were greatly convinced that radiography is useful in assisting in making changes in treatment 32 (69.6%), identifying complications 28 (60.9%), and tracking progress 25 (54.3%). These findings confirm the theoretical assumption that radiography plays a crucial role in diagnosing, as well as in the continuous monitoring of therapy.

This is in accordance with the results of Bhadane (2023) and Ibrahim (2021), both of whom attributed positive patient management and survival to imaging results. On the same note, Chen et al. (2012) discovered that the occult infections were revealed by the use of the gallium-67 scintigraphy in 16.2% of cases in the intensive care unit, which allowed a specific treatment. This overlap of these studies indicates that imaging aids in improved outcomes in patients in the ICU. The key distinction lies in the mode employed, though advanced devices like CT, scintigraphy are more detailed, portable radiography is more feasible in the hospitals with limited resources and this is the reason it is predominant in this study.

Attitude and perception of radiographers toward ICU imaging

The respondents had a high positive attitude towards ICU radiography. Almost all the participants identified that imaging in the ICU needs more skills and care than with other imaging types, and 44 (95.7) indicated that it should have closer cooperation with the ICU staff. Radiography in ICU requires technical accuracy, collaboration and flexibility of situations. The views of radiographers align with the results presented by Gupta et al. (2021), as radiographers described themselves as part of the care team, which improves the workflow and safety of mobile imaging.

Radiation protection and infection control

Another issue that raised significant concern among 38 (82.6%) of the respondents was the issue of radiation protection in the ICU with 42 (91.3) of the respondents giving a response of active involvement in infection control. The results are in line with Karami et al. (2019), who found that shielding and collimation in neonatal ICUs was not optimized, and Edison et al., (2017) found that structured quality

improvement significantly decreased radiation exposure by using protective equipment and collimation policies.

The disparity between these results can be explained by disparities in the implementation of institution policies and the availability of resources. In Nigeria, the ICUs do not always have sufficient shielding equipment and dosimeters and the radiographers are left to rely on experience and judgment. The results highlight the serious necessity of a unified radiation safety training and logistical assistance in the Nigerian hospitals.

In this study, on demand imaging was chosen over regular daily chest radiographs by the respondents, which supports the results presented by Al Shahrani and Al-Surimi (2018), who recommended a change of policy to need based imaging. In both studies, increasing awareness on dose optimization and abandoning repetitive imaging with low yield was reported. Gupta et al. (2021), however, noted that a common practice in pediatric ICUs is the frequent use of chest X-rays because the patients have a need to monitor mechanical ventilation. The discrepancy is probably the difference in patient demographics and clinical requirements: the pediatric and ventilated patients require more intense imaging surveillance.

Technological advancements and artificial intelligence in ICU radiography

There was a high optimism of respondents with AI integration in the ICU imaging. Over 25 (54.3) strongly believed that AI is able to improve diagnostic accuracy and 23 (50.0) believed that it has the ability to decrease reporting delays. This is comparable to Islamic et al. (2023), who demonstrated that portable ultra low field MRI was able to substitute up to 26.5% of fixed MRI cases, and to Kalyanpur et al.

(2023), who revealed that digital teleradiology can enhance the turnaround time reported in U.S. hospitals.

They suggest that radiographers are recognizing the possibility of AI enhancing image interpretation, lessening the delay, and optimizing workflow. The gap in the level of technological adoption however is broad. As developed nations implement the AI-enabled diagnostic systems, traditional digital radiography remains the primary type of ICU in Nigeria. However, the interest in this paper shows that the respondents are willing to be technologically advanced, when infrastructural and policy supports can be provided.

Challenges encountered during ICU imaging

Limited space (20; 43.5) and infection risk were the most frequent issues that were reported 12 (26.1) and 33 (71.7) respectively. Due to the fact that patients bed are closely positioned, in certain facilities, xray equipment placement is normally complicated. Majority of patients carry leads around their chests, patients are intubated and equipped with various accessories which makes it difficult to position them despite the assistance of departmental portals and healthcare workers. These are in line with the results of Gupta et al. (2021), who found patient instability and limited area as impediments to quality imaging in ICUs. They also coincide with Cau et al. (2021) who reported that the severity of a disease and technical constraints influence imaging consistency in COVID-19 patients. Edison et al. (2017) also have shown that organized training and compliance with safety measures enhanced the outcome of radiation and infection control. Such a comparison with the Nigerian ICUs justifies why training and resources influence the quality of service delivery**.**

CHAPTER FIVE

5.1 Conclusion

Radiographic imaging and radiographers play significant role in the diagnosis and treatment in the ICU. Portable chest radiography is applied in the treatment of critically ill patients and the orientation of interventions and the identification of complications, including pneumothorax, displaced tubes, and pathology of the lungs. The involvement of radiographers in the ICU is through the practice of infection control, team cooperation, and acquisition of images promptly. Nevertheless, the limited space, improper placement because of patient condition, risk of infection and insufficient protective gear still prove to be barriers to good performance.

5.2 Limitations of the study

The researchers used a small sample of radiographers of 46, which is not a reflection of all radiographers in Nigeria and other hospitals that have ICU departments.

The sampling of hospitals and diagnostic centers was done, which could restrict the external validity of results.

Modalities: The research concentrated primarily on portable radiography, but had not evaluated the other imaging modalities of the ICU, such as ultrasound or CT, in detail.

The procedures in ICU were not directly observed which could have been a better source of information on real time issues.

5.3 Recommendations

1. Regular maintenance and availability of modern portable X-ray machines, radiation shields, and digital image processing systems in the ICU.

2. Radiographers should undergo continuous professional development and ICU-specific training to enhance competence in managing critically ill patients.
3. Better collaboration between radiographers, ICU nurses, and physicians should be promoted to ensure better patient outcomes and workflow efficiency.
4. Appropriate lead shields, aprons, and mobile barriers should be made readily available to minimize occupational radiation exposure.
5. Strict adherence to aseptic techniques, proper sanitization of equipment, and use of personal protective equipment (PPE) should be enforced.
6. Radiology departments should gradually integrate AI based image optimization and analysis tools to improve diagnostic accuracy and reduce reporting time.

5.4 Suggestions for further studies

1. Comparative studies between radiographers in tertiary hospitals and private diagnostic centers to evaluate differences in ICU imaging practices.
2. Assessment of ICU ultrasound and CT utilization and the radiographer's role in these modalities.
3. Evaluation of radiation dose optimization techniques during portable imaging in ICU environments.
4. Exploration of AI based decision support systems and their impact on image quality and turnaround time in ICU radiography.
5. Qualitative studies (interviews or observation) to gain deeper understanding of the practical and emotional challenges faced by radiographers in ICU imaging.

REFERENCES

Al Shahrani, A., & Al-Surimi, K. (2018). Daily routine versus on-demand chest radiograph policy and practice in adult ICU patients- clinicians' perspective. *BMC Medical Imaging*, *18*(1), 4. https://doi.org/10.1186/s12880-018-0248-6

Bhadane, P. H. (2023). Effectivity of functional echocardiography in paediatric intensive care unit: An observational study. *Sri Lanka Journal of Child Health*, *52*(1), 81. https://doi.org/10.4038/sljch.v52i1.10478

Bontrager, K. L., & Lampignano, J. P. (2018). Textbook of Radiographic Positioning and Related Anatomy (9th ed.). Elsevier Health Sciences.

Brown, M., Patel, S., & Johnson, R. (2021). Patient monitoring during radiographic procedures in critical care: Best practices. Journal of Radiologic Nursing, 40(3), 205-212.

Bushong, S. C. (2020). Radiologic Science for Technologists: Physics, Biology, and Protection (12th ed.). Elsevier.

Caricato, A. (2014). Echography in brain imaging in intensive care unit: State of the art. *World Journal of Radiology*, *6*(9), 636. https://doi.org/10.4329/wjr.v6.i9.636

Cau, R., Falaschi, Z., Paschè, A., Danna, P., Arioli, R., Arru, C. D., Zagaria, D., Tricca, S., Suri, J. S., Kalra, M. K., Carriero, A., & Saba, L. (2021). Ct Findings of Covid-19 Pneumonia in Icu-Patients. *Journal of Public Health Research*, *10*(3), jphr.2021.2270. https://doi.org/10.4081/jphr.2021.2270

Chen, W.-C., Tsai, K.-D., Chen, C.-H., Lin, M.-S., Chen, C.-M., Shih, C.-M., & Chen, W. (2012). Role of Gallium-67 scintigraphy in the evaluation of occult sepsis in the medical ICU. *Internal and Emergency Medicine*, *7*(1), 53–58. https://doi.org/10.1007/s11739-011-0739-8

Edison, P., Chang, P. S., Toh, G. H., Lee, L. N., Sanamandra, S. K., & Shah, V. A. (2017). Reducing radiation hazard opportunities in neonatal unit: Quality improvement in radiation safety practices. *BMJ Open Quality*, *6*(2), e000128. https://doi.org/10.1136/bmjoq-2017-000128

El-Kholy, M. R., & Gaballah, T. R. G. (2025). *The Value of Repeated Chest X-Ray in Intensive Care Units*. *98*, 441–446.

Foster, L., & Miller, T. (2021). Multidisciplinary teamwork in the ICU: Improving patient outcomes. Critical Care Medicine, 49(6), e589-e596.

Godoy, M. C. B., Leitman, B. S., De Groot, P. M., Vlahos, I., & Naidich, D. P. (2012). Chest Radiography in the ICU: Part 2, Evaluation of Cardiovascular Lines and

Other Devices. *American Journal of Roentgenology*, *198*(3), 572–581. https://doi.org/10.2214/AJR.11.8124

Gupta, R., Nallasamy, K., Williams, V., Saxena, A. K., & Jayashree, M. (2021). Prescription practice and clinical utility of chest radiographs in a pediatric intensive care unit: A prospective observational study. *BMC Medical Imaging*, *21*(1), 44. https://doi.org/10.1186/s12880-021-00576-6

Herring, W. (2021). Learning Radiology: Recognizing the Basics (4th ed.). Elsevier.

Ibrahim, H. (2021). *Role of multidetector CT in predicting patient outcome in cases of pulmonary embolism: Correlation between imaging findings, ICU admissions and mortality rate*.

International Atomic Energy Agency (IAEA). (2014). Radiation protection in diagnostic radiology. IAEA Safety Standards Series No. RS-G-1.5.

Islam, O., Lin, A. W., & Bharatha, A. (2023). Potential application of ultra-low field portable MRI in the ICU to improve CT and MRI access in Canadian hospitals: A multi-center retrospective analysis. *Frontiers in Neurology*, *14*, 1220091. https://doi.org/10.3389/fneur.2023.1220091

Jain, S. N., Modi, T., Aswani, Y., & Varma, R. U. (2019). Chest radiography in adult critical care unit: A pictorial review. *Indian Journal of Radiology and Imaging*, *29*(04), 418–425. https://doi.org/10.4103/ijri.IJRI_329_19

Johnson, A., Smith, P., & Lewis, K. (2020). Enhancing ICU teamwork for improved patient safety. Journal of Intensive Care, 8(1), 45.

Khan, M., Ahmed, S., & Patel, R. (2022). Wireless ultrasound devices: Revolutionizing bedside imaging. Ultrasound in Medicine & Biology, 48(5), 921-929.

Kalyanpur, A., Rao, P., & Mathur, N. (2023). Utilization of Teleradiology by Intensive Care Units: A Cohort Study. *Indian Journal of Critical Care Medicine*, *28*(1), 20–25. https://doi.org/10.5005/jp-journals-10071-24593

Kamel, R. K., Mahdy, E. W., & Elsayed, M. M. (2021). Updates on Role of Ultrasound in Intensive Care Unit. *Benha Journal of Applied Sciences*, *6*(4), 133–140. https://doi.org/10.21608/bjas.2021.189596

Karami, V., Zabihzadeh, M., Isavand-Faraji, A., & Karampour, H. (2019). Radiological protection in the Neonatal Intensive Care Units (NICUs): A retrospective and observational audit at two teaching hospitals. *Journal of Pediatric and Neonatal Individualized Medicine*, *8*(1), e080126. https://doi.org/10.7363/080126

Miller, J., Thompson, R., & Wilson, L. (2017). Challenges of imaging critically ill patients. Radiography, 23(2), e15-e21.

Moore, C. L., & Copel, J. A. (2011). Point-of-care ultrasonography. New England Journal of Medicine, 364(8), 749–757. https://doi.org/10.1056/NEJMra0909487

Nguyen, T., & Patel, S. (2019). Communication strategies for radiographers in the ICU. Journal of Medical Imaging and Radiation Sciences, 50(1), 100-107.

Ogunbiyi, O., Sanusi, A., Osinaike, B., Yakubu, S., Rotimi, M., & Fatungase, O. (2021). An overview of intensive care unit services in Nigeria. *Journal of Critical Care*, *66*, 160–165. https://doi.org/10.1016/j.jcrc.2021.07.007

O'Hara, L., Williams, D., & Taylor, P. (2021). Infection control in portable radiography: A review. Radiography, 27(2), 174-180.

Rizk, A. M., Zidan, M. A., Emara, D. M., Abd El-Hady, M. A., & Wahbi, M. O. (2017). Chest ultrasound in the assessment of patients in ICU: How can it help? *The Egyptian Journal of Radiology and Nuclear Medicine*, *48*(1), 313–322. https://doi.org/10.1016/j.ejrnm.2016.10.009

Shbeer, A. (2024). Radiation in the intensive care units: A review of staff knowledge, practices, and radiation exposure. *Journal of Radiation Research and Applied Sciences*, *17*(2), 100849. https://doi.org/10.1016/j.jrras.2024.100849

Sharma, V., & Gupta, A. (2018). Radiation safety in portable X-ray imaging. Journal of Clinical Imaging Science, 8, 12.

Smith, L., & Lee, J. (2020). Radiographer roles in intensive care: Positioning and patient care. Radiography, 26(3), 234-240.

Smith, P., et al. (2023). Artificial intelligence in ICU imaging: Current status and future directions. Journal of Medical Imaging, 10(2), 020501.

Su, Y.-T., Chen, Y.-S., Yeh, L.-R., Chen, S.-W., Tsai, Y.-C., Wu, C.-Y., Yang, Y.-N., Tey, S.-L., & Lin, C.-H. (2022). Unnecessary radiation exposure during diagnostic radiography in infants in a neonatal intensive care unit: A retrospective cohort study. *European Journal of Pediatrics*, *182*(1), 343–352. https://doi.org/10.1007/s00431-022-04695-2

Tewari, K., Pelluru, S., Mishra, D., Pahuja, N., Mohapatra, A. R., Sharma, J., Thapa, O. B., & Multani, M. (2024). Comparison of efficacy of lung ultrasound and chest X-ray in diagnosing pulmonary edema and pleural effusion in ICU patients: A single centre, prospective, observational study. *Open Journal of Anesthesiology*, *14*(03), 41–50. https://doi.org/10.4236/ojanes.2024.143004

Tiwari, D. V., & Gedam, D. D. S. (2019). *Role of X ray chest in Paediatric intensive care unit (PICU): Is it a good predictor of outcome ? 1*(1).

Vetrugno, L., Biasucci, D. G., Deana, C., Spadaro, S., Lombardi, F. A., Longhini, F., Pisani, L., Boero, E., Cereser, L., Cammarota, G., & Maggiore, S. M. (2024). Lung ultrasound and supine chest X-ray use in modern adult intensive care: Mapping 30 years of advancement (1993–2023). *The Ultrasound Journal*, *16*(1), 7. https://doi.org/10.1186/s13089-023-00351-4

World Health Organization (WHO). (2022). Infection prevention and control in health care settings. WHO Guidelines.

World Health Organization. (2016). Manual of diagnostic ultrasound (Vol. 1, 2nd ed.). https://www.who.int/publications/i/item/9789241548516

Appendix I: Questionnaire form

My name Okhomina Eseosasere Hope a student in the Department of Radiography, School of Basic Medical Science, University of Benin with matriculation number BMS2010669 conducting a research study on "Role of radiography in intensive care unit'', under the supervision of my lecturer Mrs Olasuyi Kemisola. Kindly help complete this questionnaire.

Section A: Demographic Information

Please select appropriate options

Age: ☐ 18-23 yrs ☐ 24-29 yrs ☐ 30 yrs and above

Gender: ☐ Male ☐ Female

Experience/level:☐ Intern ☐ Radiographer (1-5 yrs) ☐ Chief Radiographer (above 5 yrs)

Section B: Knowledge of ICU radiography

1. Are you aware of the radiographer's role in the ICU? ☐ Yes ☐ No
2. Have you ever worked or trained in an ICU setting? ☐ Yes ☐ No
3. What imaging modality is most commonly used in ICU?

   ☐ X-ray ☐ Ultrasound ☐ CT ☐ MRI
4. Portable X-rays are commonly used in the ICU due to:

   Accessibility ☐ Patient immobility ☐ Cost ☐ Other: _____
5. Chest radiography in the ICU is primarily used to assess:

   ☐ Lung pathology ☐ NG tube position ☐ Line placement ☐ All of the above
6. Radiographers assist in infection control while working in ICU ☐ Yes ☐ No
7. Is radiation protection challenging in the ICU setting? ☐ Yes ☐ No
8. What protective equipment do you usually use in the ICU?

   ☐ Lead apron ☐ Lead shield ☐ Dosimeter ☐ None
9. Timely radiographic imaging contributes significantly to improved patient outcomes in the ICU.

   ☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree
10. Radiographic imaging reduces the risk of delayed diagnosis of complications (e.g., pneumothorax, misplaced lines/tubes).

    ☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree
11. Frequent use of portable radiography in the ICU improves patient monitoring and recovery.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

12. Radiography plays a critical role in guiding treatment modifications in critically ill patients.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

Section C: Attitude and perception of ICU radiography

13. Do you think radiographers are members of the ICU team? ☐ Yes ☐ No
14. ICU imaging requires more skill and attention than routine imaging.

☐ Yes ☐ No

15. Radiographers should receive ICUspecific training.☐ Yes ☐ No
16. In your experience, ICU staff (e.g., nurses, doctors) value the radiographer's role. ☐ Yes ☐ No
17. **Which radiographic examinations are most commonly performed in the ICU? (Tick all that apply)**

☐ Chest X-ray
☐ Abdominal X-ray
☐ Extremity imaging
☐ Other (please specify): ……

18. What are the common clinical indications for radiography in ICU patients? (**Tick all that apply)**

☐ Tube/line placement verification
☐ Respiratory complications (e.g., pneumothorax, pleural effusion)
☐ Abdominal obstruction
☐ Orthopedic/trauma cases
☐ Other (please specify): ……

Section D: Practices and challenges in the ICU radiography

19. Do you experience any difficulty positioning ICU patients for imaging? ☐ Yes ☐ No
20. Which challenge is most common when performing ICU imaging?

☐ Limited space ☐ Infection risk ☐ Patient condition ☐ Equipment issues

21. Do you receive assistance from ICU staff during imaging? ☐ Yes ☐ No
22. Have you ever had to improvise due to poor positioning conditions? ☐ Yes ☐ No
23. Is there a need for better collaboration between ICU staff and radiographers? ☐ Yes ☐ No
24. Have you received any training specific to ICU imaging? ☐ Yes ☐ No
25. What do you recommend for improving radiographic services in the ICU?

_____

Section E: The role of technology (AI) in improving ICU radiography

26. AI can enhance the accuracy of ICU radiograph interpretation.

    ☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

27. AI tools can help reduce reporting delays in the ICU.
    ☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree
28. AI can improve the diagnostic value of suboptimal ICU radiographs.
    ☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree
29. The integration of AI into ICU radiography is acceptable and beneficial to radiographers/radiologists.
    ☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

APPENDIX II: Ethical approval request

Department of Medical Radiography,

School of Basic Medical Sciences,

University of Benin,

Edo State.

June 2025.

The Chairman,

Health Research and Ethics Committee

University of Benin Teaching Hospital,

Edo State.

Dear Sir/ma,

APPLICATION FOR ETHICAL APPROVAL TO CONDUCT A RESEARCH STUDY

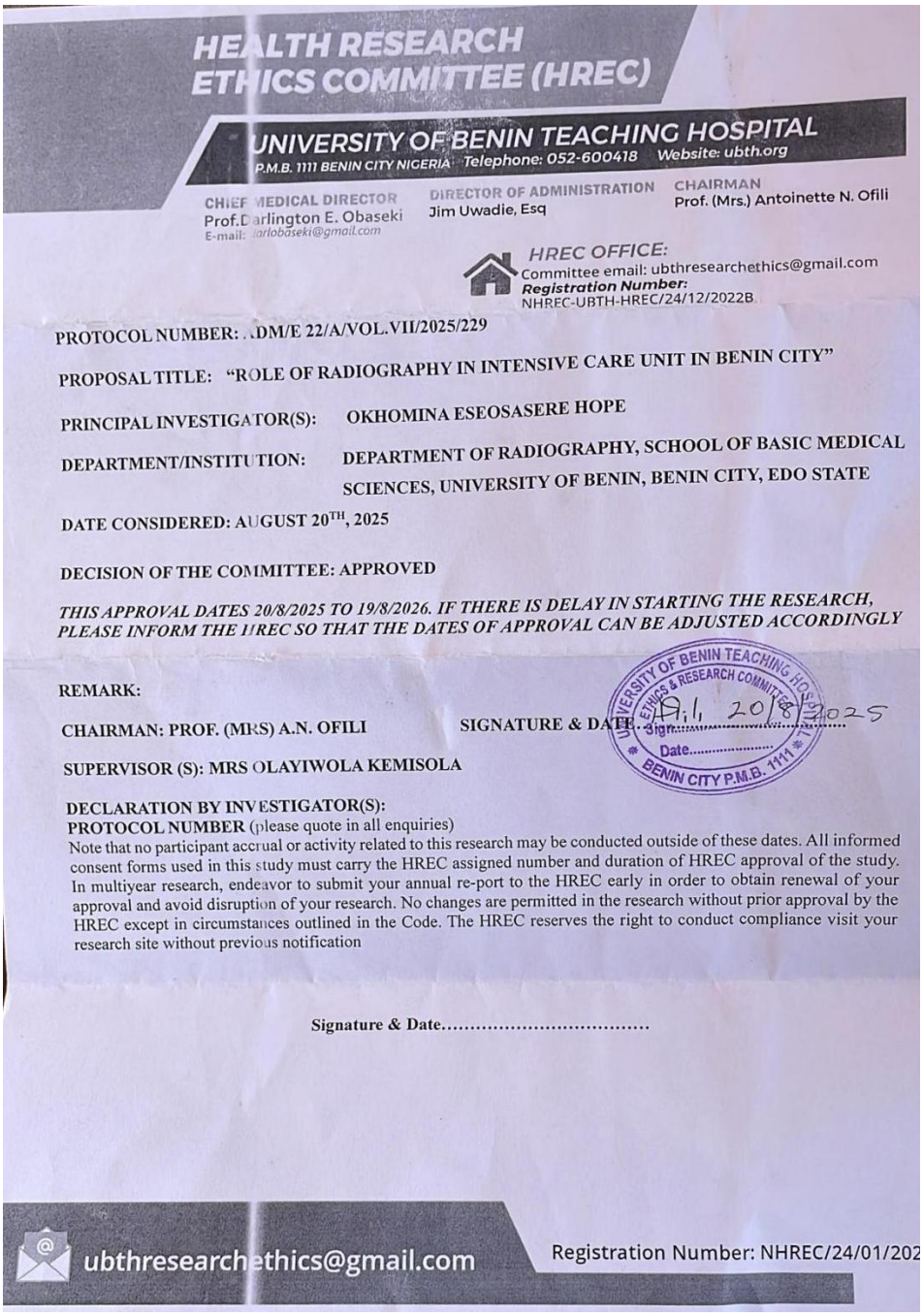
I Okhomina Eseosasere Hope with matriculation number BMS2010669, hereby apply for the above subject. I am an undergraduate student from the Department of Radiography, School of Basic Medical Science, University of Benin. I kindly request for ethics approval to conduct a research project on the topic titled "Role of radiography in intensive care unit" in partial fulfillment of the requirements for the award of a Bachelor of Science degree in Radiography. Attached is a copy of my research project proposal. I hope my request will be considered.

Yours Faithfully,

Okhomina Eseosasere Hope

Phone number: 08144683565

APPENDIX III: Ethical approval letter



HEALTH RESEARCH ETHICS COMMITTEE (HREC)

UNIVERSITY OF BENIN TEACHING HOSPITAL

P.M.B. 1111 BENIN CITY NIGERIA Telephone: 052-600418 Website: ubth.org

CHIEF MEDICAL DIRECTOR
Prof. Darlington E. Obaseki
E-mail: darlobaseki@gmail.com

DIRECTOR OF ADMINISTRATION
Jim Uwadie, Esq

CHAIRMAN
Prof. (Mrs.) Antoinette N. Ofili

HREC OFFICE:
Committee email: ubthresearchethics@gmail.com
Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL.VII/2025/229

PROPOSAL TITLE: "ROLE OF RADIOGRAPHY IN INTENSIVE CARE UNIT IN BENIN CITY"

PRINCIPAL INVESTIGATOR(S): OKHOMINA ESEOSASERE HOPE

DEPARTMENT/INSTITUTION: DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

DATE CONSIDERED: AUGUST 20TH, 2025

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 20/8/2025 TO 19/8/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

UNIVERSITY OF BENIN TEACHING HOSPITAL ETHICS & RESEARCH COMMITTEE Sign. Date. BENIN CITY P.M.B. 1111

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI **SIGNATURE & DATE** 20/8/2025

SUPERVISOR (S): MRS OLAYIWOLA KEMISOLA

DECLARATION BY INVESTIGATOR(S):
PROTOCOL NUMBER (please quote in all enquiries)
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date.....

ubthresearchethics@gmail.com Registration Number: NHREC/24/01/202