ANALYSIS OF CHEST X-RAY REQUESTS AND FINDINGS IN THE UNIVERSITY OF BENIN TEACHING HOSPITAL, EDO STATE, NIGERIA: A RETROSPECTIVE STUDY

A PROJECT

BY

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DEPARTMENT OF RADIOGRAPHY,
SCHOL OF BASIC MEDICAL SCIENCES,
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UNIVERSITY OF BENIN,
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MARCH, 2025

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SUBMITTED TO

DEPARTMENT OF RADIOGRAPHY,

SCHOOL OF BASIC MEDICAL SCIENCES,

UNIVERSITY OF BENIN,

BENIN CITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF RADIOGRAPHY (B.RAD)

MARCH, 2025

CERTIFICATION

This is to certify that this project work was satisfactorily carried out by Miss **USUANLELE OGHOGHO JOY** with Matriculation Number **BMS1902599** under our guidance..

Dr G.E. OKUNGBOWA _____

(Project Supervisor) Signature and date

Mrs. F.O IGBENEDION _____

(Ag. Head of Department) Signature and date

Dr. Tom ADEJOH _____

(External Examiner) Signature and date

DEDICATION

To God Almighty for He has been my source and strength through my academic journey. I am also dedicating this to my late father, Mr. Victor Usuanlele, who always believed in my academic success, and to my mother who has been my rock and everything I could ever need in a mother, for raising me and sacrificing her all for me.

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LIST OF ABBREVIATIONS

UBTH: University of Benin Teaching Hospital

CXR: Chest X-ray

ICU: Intensive Care Unit

A&E: Accident and Emergency

MER: Medical Emergency Response

MRI: Magnetic Resonance Imaging

CT: Computed Tomography

ARDS: Acute Respiratory Distress Syndrome

PICU: Pediatric Intensive Care Unit

PACU: Post-anesthesia Care Unit

MPP: Mycoplasma Pneumoniae Pneumonia

COPD: Chronic Obstructive Pulmonary Disease

GPC: General Practice Clinics

NHIS: National Health Insurance Scheme

PEPFAR: President's Emergency Plan for AIDS Relief Unit

SOP: Standard Operating Procedures

ABSTRACT

Chest x-ray remains a major tool for the diagnosis and management of many diseases ravaging mankind. The aim of this study is to assess the chest x-ray requests and findings in the University of Benin Teaching Hospital, Edo. A retrospective study of 1,624 patients who underwent chest x-ray examination at the University of Benin Teaching Hospital, Edo. The results showed that more females, (58%, n = 943) were referred for chest x-ray than the males, (42%, n = 681). The highest indication for chest x-rays in the University of Benin Teaching Hospital is Other, (47%, n = 762). Patients between the age bracket of (36– 50) have the highest referral for chest x-ray. Most of the chest x-ray referrals are from GPC (33% n = 542). More than half of the chest x-ray referrals (65.1%, n =) appear radiologically normal while the remainder (34.9%, n = 174) were abnormal. The chest radiographs of 100% of those for medical exam/Routine check appeared radiologically normal. In conclusion, conventional chest x-ray remains the primary diagnostic tool for most diseases of the chest region. However appropriate clinical diagnosis should always be conducted to reduce the number of normal chest-x-rays diagnosed. Routine chest X-rays should be discouraged as they almost amount to unnecessary irradiation of patients with low diagnostic yield.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

A chest x-ray (CXR) is a type of projection radiograph used to diagnose conditions affecting the chest, its contents, and nearby structures. The chest radiograph remains the most common radiographic examination undertaken with 8,789,840 carried out in 2017/18 in the United Kingdom (Small, 2021). In the United States, over 70 million chest X-rays (CXRs) are performed each year (National Institute of Standards and Technology, 2005). Chest X-rays may be conducted for various clinical reasons such as pneumonia, enlarged heart, congestive heart failure, lung mass, rib fractures, fluid around the lung (pleural effusion), and air around the lung (Nabili, 2021). At some other times, they are done for screening, pre-admission, and medical examination purposes.

Over time, chest X-rays have proven to be an essential tool for diagnosing numerous pathological conditions. Patients are often referred for chest X-rays from different medical and surgical departments, including the Intensive Care Unit (ICU), Accident and Emergency (A&E), Medical Emergency Response (MER), Oncology, Pediatric Emergency and Neurology, etc.

Routine admission CXRs rarely yield clinical value (<4%), such as changing management or finding previously unidentified diseases (Malnick *et al.,* 2010). Adverse consequences of unwarranted CXRs include unnecessary radiation exposure, cost, time, and the possibility of generating false positives, which can trigger a diagnostic cascade (Hubbell *et al.,* 1985).

Diagnostic radiation has been implicated as a contributor to malignancy; a study suggests that some 1861 cases or 0.6% of all cancers, were caused by diagnostic radiation (Parkin *et al.,* 2011).

However, the extent of how frequently these departments use radiology services is not well documented. Therefore, it is important to assess the frequency and extent of referrals and usage of chest radiography across these various departments.

Most of the time, chest X-rays don't show any major abnormalities. This could be because some referrals are made without a thorough clinical diagnosis. Looking at how many chest X-rays actually detect an issue could help assess this. It's also important to check how often these scans are done, why they're requested, and what the results usually show. How many turn out normal, negative, or abnormal? Is there a link between the reason for the scan and what the X-ray finds? And are chest X-rays always necessary in every case?

While other imaging modalities like MRI and CT scans can provide detailed diagnostic information, routine conventional chest X-rays continue to be a primary source of information for a wide range of conditions.

1.2 Statement of the Problem

Chest x-ray appears to be the most common x-ray done (Small, 2021). This is not different from the Accident & Emergency (A&E) unit of the University of Benin Teaching Hospital (UBTH) which also appears to be the highest source of referrals for chest x-rays. The commonest clinical indications and radiological diagnosis, to the researcher's best of knowledge, have not been noted and documented in the locality. Studies have shown that the clinical indications and findings of chest x-rays vary across age, gender and localities (Xue *et al.,* 2018). There is need to find out what is obtainable in our own locality. Therefore, it is essential to determine the patterns specific to our locality to guide clinical practice. In the course of the researcher's clinical postings, it had been observed that the Accident & Emergency (A&E) unit seems to have the highest referrals for chest x-rays, whether the departmental records agree with this is yet to be ascertained. This study aims to confirm

whether this trend is reflected in the departmental records and to provide a comprehensive analysis of the clinical indications and findings in our locality.

1.3 Research Questions

i. What is the frequency of chest x-ray referrals from the different medical/surgical units in the University of Benin Teaching Hospital, UBTH?

ii. What are the common indications of chest X-rays?

iii. What are the common radiological findings of chest X-rays?

iv. Is there a pattern between the requests and findings of chest X-rays in the University of Benin Teaching Hospital?

1.4 Null Hypotheses (H0)

i. There is no significant difference in referral sources and frequency of chest X-ray referrals from the different medical/surgical units in UBTH.

ii. There is no pattern between the requests and findings of chest X-rays in UBTH

iii. There is no significant correlation between the clinical indications and radiological findings of chest X-ray requests.

Alternative Hypotheses (H1)

i. There is a significant difference in referral sources and the frequency of chest X-ray referrals from different medical/surgical units in UBTH.

ii. There is a pattern between the requests and findings of chest X-rays in UBTH.

iii. There is a significant correlation between clinical indications and radiological findings of chest X-ray requests.

1.5 Aim Of The Study

This study aims to access and evaluate the patterns of requests and findings of chest x-ray referrals in the University of Benin Teaching Hospital, Edo state.

1.6 Objectives of the Study

The following are the specific objectives of this research work:

i. To determine the frequency of chest x-rays between the period of January - December 2024 in the University of Benin Teaching Hospital.

ii. To identify the common clinical indications of chest x-rays from different medical wards/units in the University of Benin Teaching Hospital.

iii. To examine the common radiological findings of chest x-rays from different medical wards/units in the University of Benin Teaching Hospital.

iv. To determine if there is a pattern between the requests and findings of chest x-rays in the University of Benin Teaching Hospital.

1.7 Significance of the Study

The outcome of this research will help to reveal the extent of chest examinations in the hospital which will help the hospital management to budget and plan for the radiology department calculatedly. The result of this work will help the radiology department to make adequate plans on how to obtain chest radiographs that will accurately diagnose a particular pathological condition. The findings will as well help to validate the findings of previous related researches done by others. The research will also help to give a clear picture of how the different referring units utilize the radiology department. This will help the radiology department to improve on their work plan and patient care. The research will provide an updated, authentic added literature on the most common indications for chest x-ray.

1.8 Scope of the Study

The study was focused on the conventional chest X-ray requests from January – December 2024 at the University of Benin Teaching Hospital, Edo State, Nigeria. Specifically, the University of Benin Teaching Hospital was selected due to its high patient volume and the

variety of conditions it addresses, with patients referred from neighboring rural communities and states. Specialists, and private, and state-owned hospitals were excluded from this research due to potential limitations in available data.

1.9 Operational Definition of Terms

Chest x-ray referral: A chest x-ray referral is a formal request by a healthcare provider for a patient to undergo a chest x-ray examination. This referral is typically made when a healthcare provider suspects a condition related to the chest or its structures that need further investigation.

Chest X-ray request: A chest X-ray request is a formal document or electronic order issued by a healthcare provider to initiate a chest X-ray examination.

Chest x-ray finding: A chest x-ray finding refers to any observation or result identified in the images produced by a chest x-ray examination. These findings are interpreted by a radiologist and can provide valuable information about the condition of the chest, including the lungs, heart, and surrounding structures.

Clinical indication: A clinical indication refers to a valid reason or justification for using a specific test, medication or procedure. It can also be defined as a sign, symptom, or medical condition that leads to the recommendation of a treatment, test, or procedure.

Pattern: A clinical pattern is a standardized medical procedure or routine for treating specific medical conditions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Concept of Chest Radiography

Chest radiography otherwise known as the chest x-ray is the commonest radiological examination (Small, 2021). A chest X-ray is a type of imaging test used to examine the chest, including the organs and structures inside it. It helps doctors assess the lungs and even the heart, either directly by looking at the heart itself or indirectly by checking for any related changes. Some heart conditions can affect the lungs or their blood vessels, and any unusual changes in the heart, lungs, or lung vessels could be a sign of disease or other health issues.

Chest x-ray involves using ionizing radiation called x-radiation (x-ray) to obtain diagnostic (pathologic) information about the chest and its structures (Holmes, 2019). A chest X-ray can give useful details about the size, shape, and position of the heart, lungs, and other structures in the chest. It can also show the bronchi, major blood vessels like the aorta and pulmonary arteries, as well as the mediastinum—the space in the middle of the chest that separates the lungs. In addition, it helps examine the bones, including the spine, clavicles, shoulder girdle, and ribs.

X-rays are invisible electromagnetic radiations which are used to produce images of internal tissues, bones and organs on film. X-rays pass through body tissues onto specially treated plates (similar to camera film) and a negative type picture is made (the more solid a structure is the whiter it appears on the film)

2.1.2 Radiographic Anatomy of the Chest

The human chest is made up of both bones and soft tissues, which are arranged to form the chest cavity that houses important organs. The bony structure, known as the thorax, consists of 12 pairs of ribs, 12 thoracic vertebrae, a pair of clavicles, and the sternum. The chest extends from the lower edge of the diaphragm up to the top of the first thoracic vertebra.

The soft tissues in the chest include muscles, fascia, the trachea and bronchi, the lungs, heart, major blood vessels, and the diaphragm. In children, the thymus is also present. Other key structures include the esophagus, breast tissue, and the lymphatic system. Since the chest contains the heart and lungs, it plays a central role in two major body systems—the circulatory and respiratory systems. (Figure 2.1)

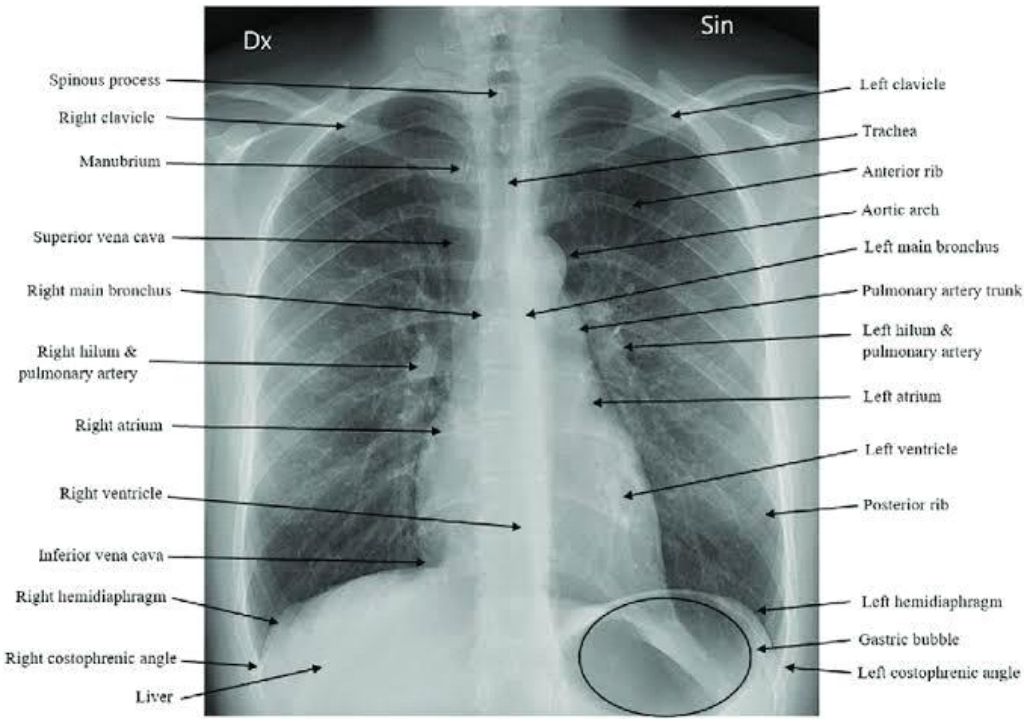

Figure 2.1 Radiographic anatomy of the chest

2.1.3 Equipments and Accessories Used For Chest X-Ray

For a proper conventional chest X-ray, several pieces of equipment are required. These include the X-ray machine, which consists of the X-ray couch, chest stand (for an erect Bucky), X-ray tube, control console, and generator. Additionally, X-ray films in their cassettes, grids, sandbags, foam pads, lead aprons, and other accessories like cassette holders and patient gowns are also used.

The X-Ray Machine

An X-ray machine consists of the X-ray tube, a support system (ceiling-mounted with rails or floor-mounted with a vertical column), a high-tension generator, and a control console.

X-rays are produced when high-energy electrons from the cathode hit a metallic target (anode) inside the X-ray tube. The exposure settings (kVp and mAs) are adjusted on the control console.

Ceiling-mounted machines have the X-ray tube on a rail system for flexibility, while floor-mounted machines use a vertical column on a floor rail. The high-tension generator supplies the power needed to generate X-rays.

X-Ray Couch

The X-ray couch, also called the X-ray table, is where the patient lies for supine chest X-rays. Its radiolucent tabletop allows X-rays to pass through to the cassette below. The table is strong, durable, and resistant to chemicals.

Chest Stand/Erect Bucky

For a standard erect chest X-ray, the patient stands either facing or backing a stand, which holds the X-ray cassette. This stand is called the chest stand. In cases where the patient has a body thickness greater than 10 cm, an erect Bucky with a built-in grid is used to achieve clearer images.

The Grid

The grid is used to absorb unnecessary scatter radiations.

X-Ray Films & Cassette

X-ray films serve as image receptors, capturing diagnostic information from the attenuated X-ray beam. They come in various sizes to fit their corresponding cassettes.

Sandbags/Foam Pads

These are primarily used to keep the patient still and prevent unnecessary movement during the examination. In pediatric chest X-rays, they are also helpful for positioning in supine or prone views.

Other Accessories

A lead apron is worn by parents or caregivers accompanying a patient during a radiological exam to protect against radiation. Patients wear a gown during the procedure. Cassette holders are used to keep the cassette in place, especially for decubitus exams.

2.1.4 Patient Preparations For Chest X-Ray

Chest X-rays don’t require special preparation. Before the exam, the patient goes into a changing cubicle to remove any clothing or accessories with metal objects that could affect the image, such as pins, buttons, or jewelry. They then put on a patient gown and wait to be called for the examination.

2.1.5 The Chest X-Ray Examination

Several factors must be considered when performing a chest X-ray, including the patient's size, condition (ambulatory or immobilized), and age (adult or pediatric). These factors help determine the appropriate cassette size and exposure settings. Typically, adult chest X-rays use cassette sizes of 35 × 43 cm or 35 × 35 cm, while pediatric chest X-rays use a 24 × 30 cm cassette.

2.1.6 Pathologic Indications For Chest X-Ray

The commonest pathologic indications for chest x-ray include;

i. Trauma

ii. Masses

iii. Pericardial disease

iv. Lung diseases such as Tuberculosis, pneumonia, pleural effusion

v. Heart conditions such as hypertensive heart diseases, pulmonary embolism, aortic aneurysm

2.2 Empirical Review

A research was conducted by Al Shahrani e*t al.,* (2018) to identify and assess the clinician's perspective in abandoning the current practice of daily routine chest radiographs and replacing them with on-demand radiographs in Saudi hospitals. Findings revealed that routine daily chest X-rays were performed on approximately 96.8% of ICU patients. However, 73% of clinical staff believed that this protocol should be replaced with an on-demand CXR policy. The top five reasons for performing daily chest X-rays in Saudi Arabian ICUs included

endotracheal intubation, central venous line insertion, chest tube placement, tracheostomy, and ventricular deterioration. Among clinicians surveyed, 64% reported that daily CXRs were conducted for all ICU patients, while 19.4% stated they were done only for specific patient groups. Additionally, 33.3% of clinicians indicated that CXRs were primarily performed for intubated and mechanically ventilated patients. Regarding the impact of routine CXRs on patient care, 35.9% of respondents believed they had a significant influence, while a similar proportion (35.2%) held the same view for on-demand CXRs. The remaining participants in both groups felt that CXRs influenced ICU patient care management by less than 60%.

Interestingly, 93.3% of clinicians agreed that chest radiographs are essential for the early detection and management of Acute Respiratory Distress Syndrome (ARDS), which is crucial for optimizing treatment outcomes. This is especially important as ARDS patients are at high risk for complications such as pneumonia (92.3%) and pneumothorax (93.5%).

A prospective observational study done by Gupta *et al.,* (2021) on prescription practice and clinical utility of chest radiographs in a pediatric intensive care unit revealed that of 303 children admitted during the study period, 159 underwent a total of 524 CXRs in PICU. The majority of chest X-rays (CXRs) (n = 449, 85.7%) were performed on mechanically ventilated patients, with a median of three (range: 2–5) radiographs per patient. The number of CXRs increased proportionally with the duration of ventilation, especially within the first two weeks. Among non-ventilated children, about 68% had only one CXR. Most CXRs were prescribed on demand, with the most common reasons being peri-procedure prescriptions (37%) and assessments for respiratory disease status (24%). Approximately 40% of CXRs led to medical interventions, with ventilator setting adjustments (13.5%) being the most frequent.

Another study by Gaget *et al.,* (2022) to determine the trends in the utilization of plain X-rays by older Australians showed that during the study period, the Australian population over 65

years old increased by 39% while the crude plain X-ray utilization by this population increased by 63%. Most X-rays were performed on the extremities or chest, with men undergoing chest radiography more frequently than women, particularly for lung-related examinations. The incidence of chest X-rays increased the most among individuals aged 85 and older. Between 2009–2010 and 2013–2014, there was also a rise in X-rays of the extremities and hip joint in this age group. The study concluded that the use of plain X-rays for the chest, gastrointestinal tract, and extremities was high and increased among older Australians between 2009–2010 and 2018–2019. Despite advancements in medical imaging, plain X-rays remain a widely used diagnostic tool for aging populations.

A study by Porter *et al.,* (2020) to investigate chest x-ray ordering practices and their impact on clinical care showed that a total of 241 patients met inclusion. All patients received a routine post-anesthesia care unit (PACU), 48% (117) of patients had abnormal chest X-ray (CXR) findings, such as pneumothorax, consolidation, or effusion. However, only one patient (0.4%) required a change in care, which was a repeat CXR. All patients also underwent a routine final CXR after chest tube (CT) removal, with 58% (140) showing abnormalities. Following this, 33 patients (14%) required a change in care—32 had a repeat CXR, and one was placed under clinical observation. No patients required a procedural intervention. The study concluded that routine post-thoracic surgery CXRs in the PACU and after CT removal have minimal clinical impact. It recommended reducing unnecessary CXRs and reserving them for specific clinical indications.

A study by Saraya *et al.,* (2017) to compare the radiological and laboratory data of children and adults with Mycoplasma pneumoniae pneumonia (MPP) and to evaluate the correlation between the total affected lung area and the clinical findings showed that 171 children and 54 adults identified with MPP. Consolidation was the most common chest X-ray finding in both

groups, with a similar incidence in children (n = 62, 87.3%) and adults (n = 45, 83.3%). However, air bronchogram, bronchial thickening, and atelectasis were significantly more frequent in children than in adults. A chest X-ray scoring system in both groups indicated that lung abnormalities were most prevalent in the middle-to-lower lung fields. This study provided the first evidence of a correlation between the extent of lung abnormalities on chest X-rays and clinical findings, including hypoxemia, in children and adults with Mycoplasma pneumoniae pneumonia (MPP).

A study by Speets *et al.,* (2022) at the University Medical Center Utrecht Netherlands to assess the diagnostic yield of chest radiography in primary care patients suspected of pneumonia shows that a total of 192 patients with a clinical suspicion of pneumonia (aged > 18 years) were radiographed. Pneumonia was diagnosed in 25 (18%) patients. Chest X-rays (CXR) influenced pneumonia diagnosis in 53% of cases, ruling it out in 47% and significantly increasing its probability in 6% of patients. Patient management changed in 69% of cases after CXR, primarily due to a reduction in medication prescriptions (from 43% to 17%) and increased patient reassurance (from 8% to 35%). The study concluded that general practitioners frequently overdiagnose pneumonia, and chest radiography is a valuable tool for reducing misdiagnoses and ruling out pneumonia when necessary. The average age of patients with suspected pneumonia was 56.8 years, with 55% being male, and 15% having a prior pneumonia diagnosis. Cough was the most commonly reported symptom (66%). Radiology reports confirmed pneumonia in 14% (27 patients), identified other clinically relevant abnormalities in 17% (32 patients), detected previously known abnormalities in 19% (35 patients), and found no abnormalities in 52% (98 patients).

A study by Njeze *et al.,* (2021) at the University of Nigeria Teaching Hospital to establish if there was a correlation between the clinical referrals and chest radiograph diagnosis of

pneumonia in Nigerian children shows that a total of 100 chest radiographs were in agreement with the clinical diagnosis of pneumonia while 63 radiographs had no evidence of infections. 57 were male and 43 were female. They concluded that chest radiographs are efficacious in the management of children suspected to have pneumonia.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter explains the research methods used in this study, including the approach, design, and data collection techniques. It also outlines how the data was analyzed and ensures that the findings are reliable and valid.

3.0 Study Design

This was a cross-sectional study which uses a descriptive observational approach to examine the Radiology request forms submitted at the Radiology Department of the University of Benin Teaching Hospital (UBTH). The work was carried out from October 2024 to January 2025.

3.1 Research Setting

The study was conducted in the Radiology Department of the University of Benin Teaching Hospital, Edo state Nigeria. The University of Benin Teaching Hospital (UBTH), located in Ugbowo, Benin City, was established on May 12, 1973, as the sixth of Nigeria's first-generation teaching hospitals. It was founded to complement the University of Benin and serves as a training center for high- and mid-level healthcare professionals. UBTH offers internship programs for medical professionals across various fields, including medicine, pharmacy, physiotherapy, ophthalmology, medical laboratory science, nursing, radiography, dentistry, and nutrition and dietetics. With over 900 beds, the hospital provides both secondary and tertiary healthcare services to the public. Key services provided in the radiology department include routine x-ray, contrast studies, hysterosalpingography, CT scans etc.

3.2 Target Population

The study only focused on the routine conventional chest x-ray requests of January December 2024 in the University of Benin Teaching Hospital(UBTH). The total population included 1,624 participants.

3.3 Sampling Technique/Sample Size

Census sampling technique which is an all-inclusive sampling technique was used for this study.

3.4 Instrument For Data Collection

The data for this study was a proforma which is purely a secondary source of data collection. A checklist was used to obtain the information to be entered into it which was obtained from the referral forms (request cards) and results (radiologist's reports) of the conventional chest x-ray examinations performed, filed and kept in the filing room of the Radiology Department of the University of Benin Teaching Hospital, Edo, Nigeria. (See Appendix I)

3.5 Validity of the Instrument

The instrument for data collection was subject to content validity by my supervisor.

3.6 Reliability of Instrument

To ensure the reliability of this instrument, only official records were used in this study. Referral cards and reports with incomplete information were excluded.

3.7 Method of Data Collection

Data was collected through the departmental record book to establish the total number of various x-ray requests in the year of study (2024). The chest x-ray forms and radiologist's reports were retrieved from the filing room. The patients' information on the request cards and the radiologist's chest x-ray reports were copied out and recorded on the proforma. Chest

x-ray folders that contained the request card, radiograph and the radiologist's reports were randomly selected. The requests were matched with the reports. Any case with incomplete information was excluded.

3.8 Method of Data Analysis

The collected data was categorized using frequency table according to the age and sex distribution of patients that underwent chest x-ray examinations, the referrals according to the referring units, the clinical indications and the radiological findings. The data collected was analyzed using the descriptive and inferential statistical technique using IBM Statistical Package for the Social Sciences (SPSS) version 28.0 statistic software.

Descriptive statistical tools of frequencies and percentages were applied, in addition to the inferential statistical tool of Chi-square for test of association.

3.9 Ethical Consideration

Before the study was conducted, ethical approval was obtained from the health research and ethics committee of the University of Benin Teaching Hospital, UBTH. (See Appendix II). In this study the confidentiality of hospital and patient information was ensured by anonymizing data and ensure secured storage of all records.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the findings of the study based on the data collected and analyzed. It provides a detailed summary of the key results, highlighting trends, patterns, and significant observations.

4.1 Results

Table 4.1: Demographic Characteristics Of Participants

Characteristic	**Frequency (n** = 1,624)	**Percentage**
Gender		
Female	943	58%
Male	681	42%
Age Group (years)		
0-18	141	8.70%
19-35	432	27%
36-50	495	31%
51-65	316	20%
65+	234	14%

Demographic Characteristics Of Participants (Table 4.1)

The study included 1,624 participants, of whom 58% were female and 42% were male. The majority of participants fell within the 36-50 age group (31%), followed by those aged 19-35 years (27%). The least represented age group was 0-18 years (8.7%), while older adults (65+ years) accounted for 14% of the population. The distribution suggests a predominance of middle-aged individuals undergoing chest X-ray (CXR) examinations.

Table 4.2: Clinical Indications And Referral Ward/Unit For CXR

Characteristic	Frequency (n = 1,624)	Percentage
Indications		
Cardiovascular	254	16%
Medical Fitness/Screening	197	12%
Other	762	47%
Pre-operative	117	7.20%
Respiratory Symptoms	294	18%
Referral Ward/Unit		
COPD	114	7.00%
GPC	542	33%
Gynaecology	87	5.40%
NHIS	254	16%
Others	408	25%
PEPFAR	30	1.80%
SOP	189	12%

Clinical Indications And Referral Ward/Unit For CXR (Table 4.2)

The most common clinical indication for CXR was categorized as “Other” (47%), which may encompass non-specific or multiple reasons. Respiratory symptoms accounted for 18% of cases, followed by cardiovascular conditions (16%). Pre-operative screening made up 7.2%, while medical fitness/screening contributed 12%. Referral sources were dominated by General Practice Clinics (GPC) at 33%, followed by “Others” (25%), and the National Health Insurance Scheme (NHIS) at 16%. This suggests a significant reliance on CXRs for various indications beyond standard respiratory or cardiovascular evaluations.

Table 4.3: Clinical Findings From Chest X-Rays

	Total
Normal	1058(65.1)
Cardiovascular Changes	416(25.6)
Pneumonia	51(3.1)
Otherwise Normal Findings	99(6.1)
Total	1624(100.0)

Clinical Findings From Chest X-Rays (Table 4.3)

A majority of CXR results (65.1%) were normal, indicating that CXRs were frequently ordered even in cases without apparent pathology. Cardiovascular changes were the most common abnormal finding (25.6%), followed by "Otherwise normal findings" (6.1%) and pneumonia (3.1%). This implies that while CXRs are widely used, their clinical yield in detecting significant pathology remains limited.

Table 4.4: Association Between Demographic Characteristics And Clinical Findings

	Finding Category			
Characteristic	**Cardiovascular Changes, N = 416[1]**	**Normal, N = 1,058[1]**	**Other Findings, N = 99[1]**	**Pneumonia, N = 51[1]**
Gender				
Female	317 (76%)	572 (54%)	39 (39%)	15 (29%)
Male	99 (24%)	486 (46%)	60 (61%)	36 (71%)
Age Group(Years)				
0-18	6 (1.5%)	93 (8.8%)	15 (15%)	27 (53%)
19-35	39 (9.4%)	360 (34%)	21 (21%)	12 (24%)
36-50	147 (36%)	330 (31%)	15 (15%)	3 (5.9%)
51-65	113 (27%)	170 (16%)	27 (27%)	6 (12%)
65+	108 (26%)	102 (9.7%)	21 (21%)	3 (5.9%)

Association Between Demographic Characteristics And Clinical Findings (Table 4.4)

A gender-based analysis revealed that females had a higher prevalence of cardiovascular changes (76%) compared to males (24%). Conversely, pneumonia was more common in males (71%) than in females (29%). Age-wise, pneumonia was predominantly observed in children (53% of cases in the 0-18 age group), whereas cardiovascular changes were most frequent in the 36-50 age bracket (36%). This pattern aligns with known epidemiological trends where cardiovascular disease prevalence increases with age, while pneumonia is more common among children and the elderly.

Table 4.5: Association Between Clinical Indications And Clinical Findings

Characteristic	Findings			
	Cardiovascular Changes, N = 416	**Normal**, N = 1,058	**Other Findings**, N = 99	**Pneumonia**, N = 51
Indications				
Cardiovascular	102 (25%)	146 (14%)	6 (6.1%)	0 (0%)
Medical Fitness/Screening	0 (0%)	197 (19%)	0 (0%)	0 (0%)
Other	203 (49%)	445 (42%)	72 (73%)	42 (82%)
Pre-operative	42 (10%)	72 (6.8%)	3 (3.0%)	0 (0%)
Respiratory Symptoms	69 (17%)	198 (19%)	18 (18%)	9 (18%)

$\chi 2=187.655 \cdot df=12 \cdot$ Fisher's p=0.000

Association Between Clinical Indications And Clinical Findings (Table 4.5)

Among participants with cardiovascular indications, 25% exhibited cardiovascular changes on CXR, but no pneumonia cases were detected in this group. Those undergoing medical fitness screening were primarily found to have normal CXRs (100%). The “Other” category had the highest proportion of pneumonia cases (82%) and other findings (73%), suggesting that non-specific indications often correlate with more significant findings. A statistically significant association was observed (p = 0.000), confirming that clinical indications influence the likelihood of detecting pathology.

Table 4.6: Association Between Demographic Characteristics And Clinical Findings

Characteristic	Findings			
	Cardiovascular Changes, N = 416	**Normal**, N = 1,058	**Other Findings**, N = 99	**Pneumonia**, N = 51
Referral_Ward_Unit				
copd	45 (11%)	48 (4.5%)	18 (18%)	3 (5.9%)
gpc	144 (35%)	368 (35%)	21 (21%)	9 (18%)
gynae	30 (7.2%)	57 (5.4%)	0 (0%)	0 (0%)
nhis	21 (5.0%)	227 (21%)	6 (6.1%)	0 (0%)
others	128 (31%)	217 (21%)	27 (27%)	36 (71%)
pepfar	6 (1.4%)	21 (2.0%)	3 (3.0%)	0 (0%)
sop	42 (10%)	120 (11%)	24 (24%)	3 (5.9%)

Association Between Referral Ward/Unit And Clinical Findings (Table 4.6)

Cardiovascular changes were most commonly observed in referrals from GPC (35%) and "Others" (31%). Pneumonia cases were mostly found in patients referred from "Others"(71%), suggesting that less conventional referral sources contributed to the highest disease burden. Patients referred from NHIS and Gynaecology had the lowest proportion of abnormal findings.

4.2 Discussion of Findings

Al Shahrani *et al.,* (2018) found that 96.8% of ICU patients underwent daily routine CXRs, although 73% of clinicians preferred an on-demand approach. In the present study, a significant proportion of CXRs were performed for non-specific indications (47%) as shown in Table 4.2, similar to the high frequency of routine CXRs observed by Al Shahrani *et al.,* However, while their study emphasized the shift toward an on-demand approach, the present findings indicate that routine CXRs still dominate clinical practice, likely due to institutional policies.

Gupta *et al.,* (2021) reported that 85.7% of CXRs in a pediatric ICU were performed on mechanically ventilated patients, with peri-procedure needs being the primary indication. In contrast, the present study found a wider distribution of indications, with only 18% related to respiratory symptoms as shown in Table 4.2. This suggests that in general clinical practice, CXRs are used more broadly compared to ICU settings, where ventilation-related needs drive utilization.

Gaget *et al.,* (2022) observed an increased utilization of plain radiographs, particularly for extremities and chest, among older Australians. Similarly, the present study found that 31% of CXR recipients were aged 36-50 years as shown in Table 4.1, reflecting the frequent use of CXRs in middle-aged and elderly populations. The findings support the notion that CXRs remain a key diagnostic tool, despite ongoing debates about their necessity in certain scenarios.

Porter *et al.,* (2020) reported that routine post-operative CXRs in the PACU had limited clinical impact, with only 0.4% of cases leading to a change in care. As shown in Table 4.3, the present study aligns with this conclusion, as 65.1% of CXRs were normal, raising

concerns about overuse and limited diagnostic yield. The need for more targeted CXR utilization strategies is evident.

Saraya *et al.,* (2017) found that consolidation was the most common finding in Mycoplasma pneumoniae pneumonia cases, with children showing more air bronchograms and atelectasis. The current study showed that pneumonia was most prevalent among children (53%) as shown in Table 4.4, which aligns with Saraya *et al.,'s* findings. However, the lower overall prevalence (3.1%) compared to their study suggests that pneumonia may not be a primary indication for CXR in this population.

Chest X-rays have served as a veritable tool for the diagnosis and management of many diseases. Referrals to the radiology department come from many medical units and this has made the Radiology department a center point of any hospital as many units benefit from their services. Results of chest x-rays are influenced by the quality of the image acquired and then, the accuracy of radiological interpretation.

CHAPTER FIVE

This chapter wraps up the study by drawing conclusions based on the results. It also provides practical recommendations for future research or real-world applications. Overall, this chapter provides a clear reflection on the study's impact and areas for improvement.

5.1 Conclusion

The study revealed that CXRs are frequently ordered for diverse indications, with a significant proportion yielding normal results. Cardiovascular changes were the most common abnormal findings, particularly in older adults.

Conventional Chest x-ray remains the primary diagnostic tool for many diseases ravaging mankind. Good clinical and radiological diagnoses are the first steps toward winning the war against diseases. Since the radiology unit serves as a center point of any hospital, the radiographers should strive to make diagnoses that can be appreciated by the referring units.

5.2 Recommendations

From the findings of this study, the following recommendations are made:

1. There is a need to implement evidence-based guidelines/protocols to ensure CXRs are ordered only when clinically necessary to reduce unnecessary radiation exposure.

2. Strengthen clinician training programs on appropriate CXR utilization and interpretation to enhance diagnostic accuracy.

3. Adequate clinical examinations should be done by referring clinicians to avoid unnecessary patient irradiation, especially in cases with higher numbers of normal radiographic reports. Eg Routine medical examinations.

4. Chest Units or sophisticated X-ray machines should be provided by the government to withstand the high number of daily chest X-ray referrals to the radiology department.

5.3 Suggestions For Further Studies

1. Investigate the long-term clinical outcomes of patients who undergo routine versus on-demand CXRs.

2. Assess the cost-effectiveness of reducing unnecessary CXRs in healthcare facilities.

3. Conduct comparative studies between different hospital settings to evaluate variations in CXR utilization patterns.

4. This research can be repeated in private hospitals to make comparisons

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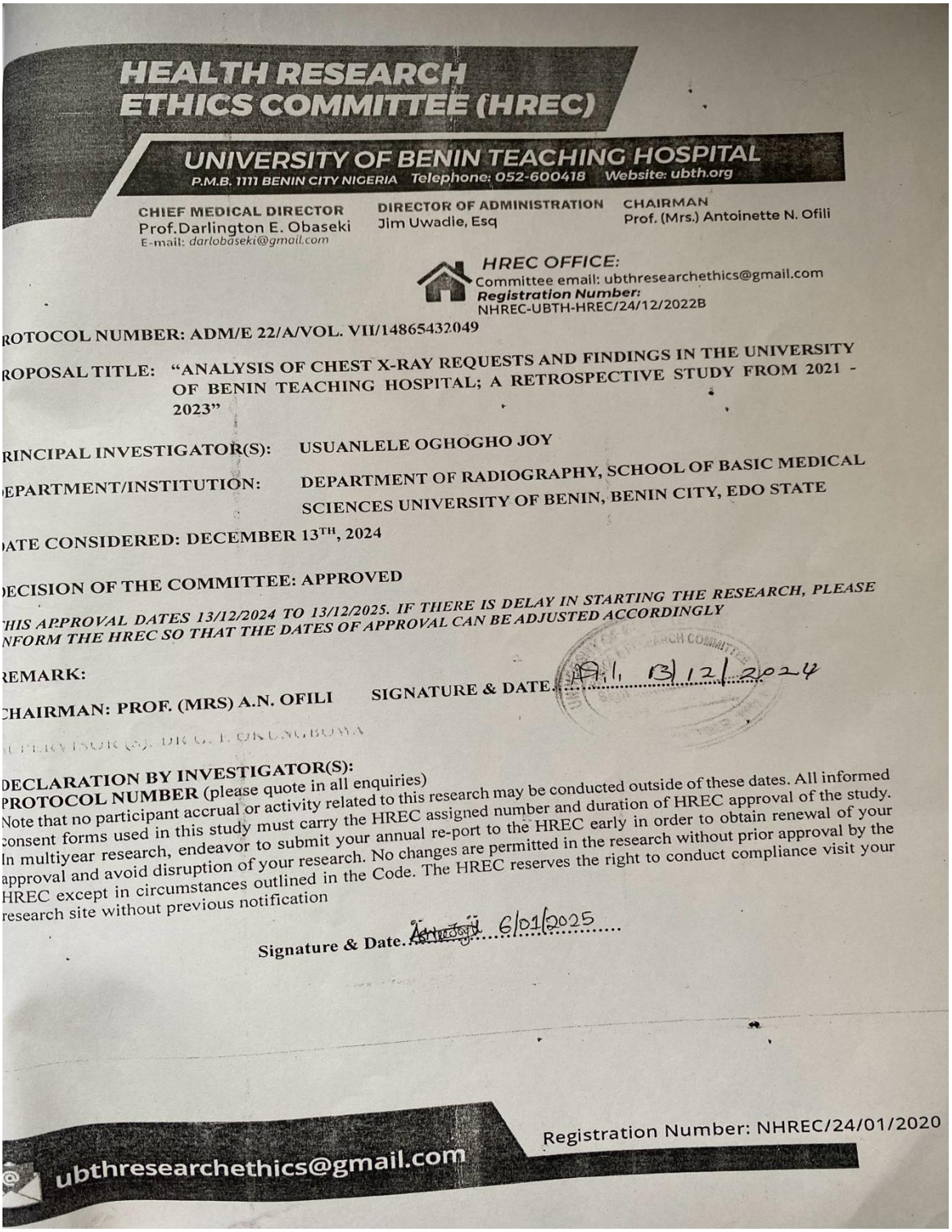
APPENDIX I



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ROPOSAL TITLE: "ANALYSIS OF CHEST X-RAY REQUESTS AND FINDINGS IN THE UNIVERSITY OF BENIN TEACHING HOSPITAL; A RETROSPECTIVE STUDY FROM 2021 - 2023"

RINCIPAL INVESTIGATOR(S): USUANLELE OGHOGHO JOY

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

ATE CONSIDERED: DECEMBER 13TH, 2024

ECISION OF THE COMMITTEE: APPROVED

HIS APPROVAL DATES 13/12/2024 TO 13/12/2025. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE NFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI SIGNATURE & DATE 13/12/2024

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. 6/01/2025

ubthresearchethics@gmail.com

Registration Number: NHREC/24/01/2020

APPENDIX II

DATE	GENDER	AGE	WARD/UNIT	CLINICAL INDICATION	FINDING