RETROSPECTIVE REVIEW OF THE INVESTIGATIVE ROLE OF CHEST X-RAYS IN THE DIAGNOSIS OF CHEST PATHOLOGIES

BY

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OCTOBER, 2025

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A PROJECT WORK IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF B.SC.(RAD) DEGREE SUBMITTED TO THE DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES,

UNIVERSITY OF BENIN, BENIN CITY

SUPERVISOR: MRS F.O. IGBINEDION

DATE: OCTOBER, 2025

CERTIFICATION

This is to certify that the research project titled "**RETROSPECTIVE REVIEW OF THE INVESTIGATIVE ROLE OF CHEST X-RAYS IN THE DIAGNOSIS OF CHEST PATHOLOGIES**" was undertaken and completed by **ELIJAH CHIAGOZIEM MARSHAL**, with matriculation number **BMS2001296**, of the Department of Radiography, School of Basic Medical Sciences, University of Benin.

This project is an original piece of work carried out by the student under my supervision and is submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Radiography (B.RAD) in the Department of Radiography, School of Basic Medical Sciences, University of Benin, Benin City, Edo State, Nigeria.

_____ _____

MRS F.O. IGBINEDION **DATE**

Project Supervisor

_____ _____

MRS F.O. IGBINEDION **DATE**

(HEAD OF DEPARTMENT)

_____ _____

EXTERNAL EXAMINER **DATE**

PLAGIARISM DECLARATION

I, ELIJAH CHIAGOZIEM MARSHAL declare that this research project is my own original work. All sources used or quoted have been indicated and acknowledged by means of using the APA 7th edition system of in-text and end-of-text referencing i.e I HAVE NOT PRACTICED ANY FORM OF PLAGIARISM.

DEDICATION

This work is lovingly dedicated to God Almighty for His unfailing grace, strength, and guidance throughout my academic journey. I also dedicate this project to my dear parents, whose love, prayers, and sacrifices have been my greatest source of inspiration and support. To my well-wishers and siblings, I thank you for always believing in me every step of the way.

ACKNOWLEDGEMENT

First and foremost, I thank Almighty God for His grace, strength, and wisdom during this research work and my academic journey. My heartfelt appreciation goes to my wonderful parents, Mom and Dad, for their endless love, prayers, encouragement, and sacrifices. I also deeply appreciate everyone who has significantly contributed to my success through their belief in me.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The chest X-ray (CXR) remains a widely requested and essential imaging method for assessing chest pathologies. This study aimed to evaluate the role of chest radiography in diagnosing chest diseases by investigating the relationships among clinical indications, radiographic findings, and final diagnoses. The objectives were to categorize and analyze thoracic pathologies identified through chest X-rays, identify patterns and relationships between radiographic results and pathology, and evaluate the relationship between clinical indications and diagnostic results.

Chest X-ray reports collected over a specified period were documented and used to conduct a retrospective review. The data were sorted into categories based on age group, clinical indication, radiographic findings, and final diagnosis. Each instance was assigned to one of several pathology categories—specifically cardiac, respiratory, neoplastic, traumatic, and miscellaneous. To identify patterns, relationships, and the diagnostic appropriateness of the dataset, statistical and descriptive analyses were conducted.

The results showed that heart diseases were the most common, with respiratory and neoplastic conditions following. Hypertension as a clinical indication and cardiac disease as the diagnostic category showed the highest correlation (86.76%), signifying that hypertension has a high predictive value for detecting cardiac abnormalities on chest X-ray. In the same way, the specificity of dyspnea for respiratory disease was high (88.00%), while trauma served as a perfect predictor for thoracic injury (100%). On the other hand, non-specific symptoms like cough and chest pain were linked to various types of pathology, highlighting their low diagnostic specificity. The research further demonstrated that radiographic examination was appropriately indicated for 65.69% of cardiac disease cases and 58.90% of respiratory cases, while neoplastic pathologies were frequently identified incidentally during imaging for unrelated symptoms.

The findings confirm that chest X-rays are essential for both targeted and incidental detection of thoracic diseases. When used appropriately, chest X-rays demonstrate diagnostic accuracy due to the strong correlation between clinical indications and radiographic findings; incidental detections further underscore their value as a screening tool.

To sum up, this research validates that chest X-ray imaging is still a crucial diagnostic technique for assessing chest pathologies. It bolsters diagnostic assurance, aids in clinical decision-making, and plays a role in the early identification and treatment of cardiopulmonary diseases, especially in healthcare environments with limited resources.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Chest x-ray imaging is a very crucial and important diagnostic tool in clinical practice, providing invaluable insights and view into cardiovascular and respiratory health. Chest X-ray is a well-established imaging modality for detecting lung, pleural and mediastinal abnormalities (Gambato et al., 2023).

Chest x-ray are accessible in low-resource settings making them a valuable tool for global initiatives (WHO, 2016). Chest x-rays are also accessible in emergency departments and hospitals, supporting their use as a diagnostic tool (British thoracic society (BTS), 2019). General practitioners frequently request chest x-rays, demonstrating their accessibility in primary care settings (Speets et al., 2006).

Chest x-ray is very crucial first line imaging modality for evaluating chest symptoms and diagnosing various chest pathologies (American college of Radiology (ACR, 2020). The importance of chest x-rays cannot be over-emphasized in the diagnosis of lung disease including pneumonia, heart failure and lung cancer using an approach known as the four pattern approach which are: **consolidation, interstitial disease, nodules and atelectasis. (**Smithuis, 2014).

Chest x-rays are very important in the detection of pulmonary nodules and monitoring treatment response in patients with lung cancer (McMahon et al., 2017).

Lung cancer and Chronic obstructive pulmonary disease (COPD) pose a significant burden as respiratory diseases and are leading causes of mobidity and mortality worldwide (Global burden of disease study (GBD), 2020). Chronic Obstructive pulmonary disease pose a substantial burden which include reduced quality of life, increased healthcare utilization, and mortality (Mannino

and Buist, 2007). There is a growing burden of lung cancer, particularly in developing countries, where late-stage diagnosis and an access to treatment which is limited and will contribute to poor outcomes. Pneumonia is a very burdensome disease in vulnerable populations, such as older adults who are at the risk of severe diseases and death rate (Jain et al., 2015).

Chest x-ray has a huge role to play in the detection of lung cancer especially in high risk individuals like smokers (Quekel et al., 1999). This modality also has a high diagnostic accuracy in detecting lung abnormalities such as Pneumonia and lung cancer (Albaum et al., 1996).

It is a very important modality in the diagnosis and of cardiovascular and chest pathologies in clinical practice.

1.2 STATEMENT OF THE PROBLEM

Chest pathologies contribute a whole lot to the increasing death rate worldwide (GPD Diseases and injuries Collaborators, 2020). Diagnosis of chest pathologies at their early stages are crucial for effective and outcome (Aberle et al., 2011).

Chest x-ray despite the advances in medical imaging remains a diagnostic tool widely used for chest pathologies due to its accessibility, cheapness and on-invasive nature (Speets et al., 2006). However, the diagnostic accuracy of chest x-ray are limited by various factors such as degree of exposure, motion artifacts, anatomy of interest, its 2D nature of imaging. Furthermore, Chest x-ray imaging has some limitations in diagnosis and of certain chest pathologies (Hayden et al., 2018). There is a relationship between chest x-ray results and treatment recommendations which is not well understood and makes its challenging to develop effective and efficient strategies (Pinto et al., 2019).

This is a study which aims to investigate the role of chest x-ray imaging in diagnosis and of chest pathologies through a retrospective analysis.

1.3 RESEARCH QUESTIONS

This study or proposal seeks to answer the following questions:

1. What are the common clinical indications that prompt patients with suspected chest pathologies to undergo chest x-ray examination?
2. What are the most common radiographic findings and categories of chest pathologies among the population across each age group?
3. What is the relationship between the indications and the corresponding radiographic findings, and how does correlation contribute to the accuracy of chest x-rays in diagnosis of chest pathologies?

1.4 RESEARCH HYPOTHESES

The following are the hypothesis for this research topic:-

Null Hypothesis (H0): No significant correlation exists among patients' clinical indications, radiographic findings, and the final diagnoses of chest pathologies detected via chest X-ray imaging.

Alternative Hypothesis (H_1): A notable correlation exists among patients' clinical indications, radiographic findings, and the ultimate diagnoses of chest pathologies determined via chest X-ray imaging.

1.5 AIM OF STUDY

To investigate the role of chest x-ray in the diagnosis of chest pathology

1.6 OBJECTIVES OF STUDY

- To categorize and produce an analysis of chest pathologies diagnosed with chest x-ray imaging.

- To provide an evaluation of the relationship between patient indications, radiographic findings and the final diagnosis in order to determine the accuracy of chest x-ray imaging.
- Identifications of patterns and the relationship between chest x-ray findings and pathology,

1.7 SIGNIFICANCE OF STUDY

This study is one which holds significant importance in the field of radiography. The findings of this study will contribute to the better understanding of how chest x-ray imaging can be efficiently useful in the diagnosis and of chest pathologies. This study utilizes the identification of patterns in diagnostic findings and strategies which will produce a meaningful difference in the diagnosis, treatment and of chest pathologies.

This study will also add to the existing body of knowledge on the role of chest x-ray imaging and potentially aid research.

1.8 SCOPE OF STUDY

University of Benin Teaching hospital, Benin City, Edo State.

1.9 OPERATIONAL DEFINITION OF TERMS

- **CHEST X-RAY REPORTS:** It is a document outlining the chest x-ray result, patient information, symptoms, radiological findings, conclusion, recommendation.
- **OBSERVATION SECTION:** Part of the report which details the radiological findings.
- **CONCLUSION SECTION:** Summary of the diagnosis.

CHAPTER TWO

LITERATURE REVIEW

2.1 CONCEPTUAL REVIEW

Medical imaging as a practice has evolved very fast since Wilhelm Conrad Rontgen discovered x-rays in 1895. This field has been further developed by the emergence of Computed tomography (CT) machines, Magnetic Resonance imaging (MRI) machines, Positron emission tomography (PET) machines e.t.c.

Chest radiography is a very important modality for the research of several applications further emphasizing the foundational role of CXR in medical imaging.

X-rays, which have wavelengths far shorter than visible light, are used in chest X-ray imaging, which is based on the principles of electromagnetic radiation. Electrons are quickly accelerated inside an X-ray tube before being directed onto a dense metal target, usually tungsten, to produce these X-rays. These electrons abruptly slow down upon impact, generating X-ray photons via two main processes. Bremsstrahlung radiation, which translates as "braking radiation" in German, is the first mechanism. This occurs when the atomic nuclei of the target material deflect electrons that are moving at high speed. When the electrons lose energy due to this change in velocity, a continuous spectrum of X-rays is emitted. The second process, where an incoming electron ejects an inner-shell electron from a tungsten atom, is known as typical radiation. As a result, an outer-shell electron fills the vacancy, causing energy to be released as tungsten-specific X-rays. Once generated, the X-rays penetrate the patient’s chest. They are either absorbed or dispersed throughout the body, depending on the density and composition of the various tissues they come into contact with. This mechanism is managed by two primary

interactions. The photoelectric effect is dominant in dense materials such as bone, where tightly bound inner-shell electrons fully absorb X-ray photons. Due to this considerable absorption, the X-ray image displays white or bright spots. When X-rays encounter weakly bound outer-shell electrons, they scatter in various directions; this is referred to as Compton scattering. This scattering can reduce visual contrast and contribute to background noise.

2.1.1 CHEST X-RAY POSITIONING TECHNIQUES

1. Posteroanterior (PA) View: The typical X-ray of the chest. While the patient is standing, the X-ray beam moves from the rear (posterior) to the front (anterior).
   Special-applications:
   Ideal for mediastinal shape, heart size, and overall lung examination.
   It is favored in standard inpatient or outpatient settings.
2. Anteroposterior (AP) View: The patient is usually seated or laying in bed as the X-ray beam moves from front to back.
   Special-Applications:
   It is used in intensive care units (ICUs) when patients are too sick to stand.
   It may overestimate heart size (not good for cardiac examination).
   It is helpful in evaluating patients who are immobile for urgent conditions like pleural effusion or pneumothorax.
3. Description of the Lateral View: A side view of the chest, typically showing the patient's left side up against the detector.
   Special Applications:
   It aids in locating lesions visible in PA view.
   It is helpful in locating retrocardiac or retrosternal masses.

It makes hidden diseases (such lower lobe pneumonia) and overlapping structures more understandable.

4. Lateral Decubitus View Description: The X-ray beam travels horizontally while the patient is on their side.

   Special Applications:

   It detects little pleural effusions (depending on the layering of the fluid).

   It evaluates the mobile air and air-fluid levels in pneumothorax.

   It is helpful in situations where upright imaging is not feasible.

5. Lordotic View: The clavicles protrude above the apices as the patient leans back.

   Special Applications:

   It draws attention to the upper lobes of the lungs.

   It is used to check for Pancoast tumors or other apical lesions like TB.

   It reduces clavicle and rib overlap.

In recent years, chest x-ray datasets have been released and made publicly available encouraging research interest and boosting the number of applications. All studies have been reviewed using deep learning on chest radiographs and categorizing works by tasks: image-level prediction (classification and regression), segmentation, localization, image generation and domain adaptation (Sogancioglu, E., et al., 2021)

Using pulsed image exposure, a larger field of view than fluoroscopy, and a low radiation dose, dynamic chest radiography (DCR) is a real-time sequential high-resolution digital X-ray imaging system of the thorax in motion over the respiratory cycle. A computer algorithm automatically characterizes the motion of thoracic structures after image acquisition (Fyle et al., 2023)

In the medical sciences, a chest radiograph, often known as a chest X-ray (CXR), is a frequent, quick, non-invasive, and reasonably priced radiographic assessment technique. Numerous lung conditions, including pneumonia, tuberculosis, pneumoconiosis, COVID-19, and lung cancer, can be diagnosed with the help of CXRs. In addition to other radiological tests, 2 billion CXRs are carried out year worldwide. It is difficult to find enough workers to manage this volume of work in hospitals, especially in low-income and developing countries

Solving difficult medical picture analysis problems has gained attention due to recent developments in AI, especially in computer vision. One sector in which AI/ML-based assistive screening and diagnostic aid can be extremely important for societal welfare is healthcare. Nevertheless, it has several problems, including a short sample size, data privacy, low-quality samples, hostile attacks, and—above all—the interpretability of the model for machine intelligence dependability. (Frontiers Editorial, 2023)

The chest X-ray is still the most widely used first-line imaging method for chest evaluation worldwide, despite its straightforward acquisition method. Recent data suggests that image processing with contemporary machine learning techniques may increase the effectiveness and precision of chest X-ray interpretation. Despite their promise, these machine learning algorithms have not yet offered a thorough evaluation of an image's findings and do not take clinical history or other pertinent clinical data into consideration. But given how quickly technology is developing and the data supporting its use, it appears that the next generation of thorough, tried-and-true machine learning algorithms will undergo a revolution similar to the early developments in X-ray technology. Chest X-ray machine learning systems' current applications, use cases, advantages, and disadvantages are examined (Jones, C. M., et al., 2022).

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The accessibility of ultraportable A projection radiograph of the chest used to diagnose problems affecting the chest, its contents, and surrounding structures is called a chest radiograph, chest X-ray (CXR), or chest film. The most often taken film in medicine is a chest radiograph. Chest radiography, like all radiography techniques, creates images of the chest using ionizing radiation in the form of X-rays.

2.1.2 Chest x-ray review is a key competency for medical students, junior doctors and other allied health professionals. Using A, B, C, D, E, F is a helpful and systematic method for chest x-ray review:

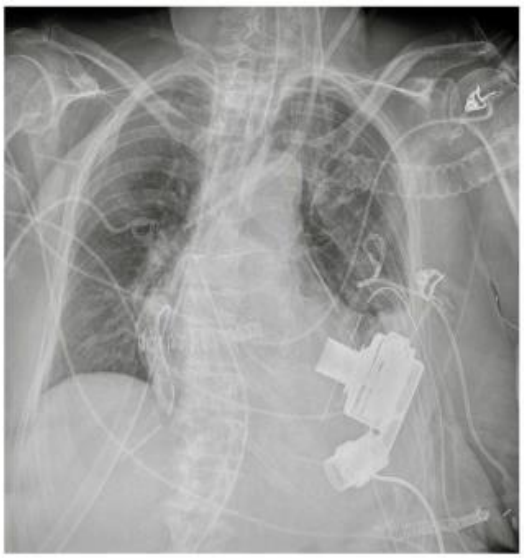
- A: airways (intraluminal mass, narrowing, splayed carina)
- B: breathing (lungs, pulmonary vessels, pleural spaces)
- C: circulation (cardiomediastinal contour, great vessels)

- D: diaphragm and below (diaphragmatic paresis, pneumoperitoneum, gaseous distension, splenomegaly, calculi)
- E: external e.g. chest wall (ribs, shoulder girdles, fractures), soft tissues
- F: foreign material (devices, foreign bodies, gossypibomas)

(Radiopaedia, 2024).

(a)

(**a**) Anteroposterior CXR of a right-sided rotated patient



(b)

b) Anteroposterior CXR of a patient with multiple devices and external EKG leads

2.1.3	**Device Classification**
Intravascular devices	Central vein catheter
	Peripherally inserted central catheter
	Port
	Swan-Ganz catheter
Airway devices	Endotracheal tubes
	Tracheostomy tubes
Cardiac devices	Loop recorder

2.1.3	Device Classification
	Pacemaker and automatic implantable cardioverter-defibrillator Ventricular assistance devices
	Impella
	Intra-aortic balloon pump Other cardiac devices
Gastro-intestinal devices	Nasogastric tubes
	Nasoenteric tubes

Conditions commonly identified by chest radiography

1. Pneumonia
2. Pneumothorax
3. Interstitial lung disease
4. Heart failure
5. Bone fracture
6. Hiatal hernia
7. Pulmonary tuberculosis. etcetera.

Early detection of abnormalities on CXR, such as lung nodules or pneumonia symptoms, greatly speeds up the diagnostic process and allows for the early start of targeted treatments. For instance, early CXR results in suspected lung cancer patients frequently lead to more sophisticated imaging, such as CT scans, and enable quick oncologic referral, both of which improve patient outcomes. Moreover, chest radiographs facilitate the start of empirical treatment for infectious disorders such as tuberculosis (TB) even before confirmation microbiological data are available. This indicates that CXRs not only validate diagnoses but

also assist physicians in determining the priority and course of treatment, particularly in settings with limited resources and diagnostic equipment. (Kim et al., 2022)

The incorporation of chest X-ray imaging, particularly in conjunction with artificial intelligence (AI), had a major impact on treatment strategies within tuberculosis screening programs throughout Nigeria. Their research showed that patients screened with the help of AI-augmented CXR had greater incidences of precise early detection, which facilitated a quicker start to anti-TB treatment. Additionally, the radiological grading system used helped clinicians differentiate between latent, subclinical, and active TB cases, which in turn shaped whether patients were referred for immediate treatment, monitored conservatively, or sent confirmatory laboratory tests. CXR aided in the optimization of limited healthcare resources and the reduction of unnecessary overtreatment or delays by directing these stratified responses. They arrived at the conclusion that, particularly in low-resource contexts, chest radiography is an indispensable resource for clinical decision-making and public health surveillance. (Garg et al., 2025).

A chest X-ray taken within four hours of admission improves outcomes for persons with community-acquired pneumonia (CAP) who are hospitalized. Early imaging was linked to a shorter hospital stay (median 5.75 vs. 7.13 days; $p < 0.01$) and more appropriate antibiotic ordering after radiographic confirmation ($OR = 12.8$, $p < 0.001$). Their results highlight how crucial timely CXR is for efficient and timely antibiotic distribution as well as lower healthcare utilization (Bewick et al., 2010).

2.2 EMPIRICAL REVIEW

With a primary focus on empirical data, an empirical review comprises a comprehensive examination and evaluation of previously published research publications is to compile, assess,

and compare the findings of multiple investigations on a certain topic. By summarizing and critiquing multiple studies, empirical reviews help researchers: identify gaps in current knowledge; validate or challenge existing theories; discover inconsistencies or contradictions in findings (Project Spring, 2023).

An empirical literature review collects, creates, arranges, and analyzes numeric data reflecting the frequency of themes, topics, authors and/or methods found in existing literature. Empirical literature reviews present their summaries in quantifiable terms using descriptive and inferential statistics. Empirical research is a 'systematic approach for answering certain types of questions through the collection of evidence under carefully defined and replicable conditions. Emprircal review is needed in Supporting structured problem analysis and data interpretation. (Calfee et al., 2005)

ROLE OF CHEST RADIOGRAPH IN PREDICTING THE NEED FOR VENTILATOR SUPPORT IN COVID-19 PATIENTS

Background: Major morbidity and mortality associated with pulmonary involvement are associated with COVID-19 disease, which has been a pandemic for more than two years. The primary imaging modality for patients in critical condition is chest radiography. We organized the current study because Level I and II healthcare centers, which are important partners in providing healthcare in times of budget constraints, have restricted access to arterial blood gas analysis.

Goals: To evaluate how well chest radiography predicts whether severely ill COVID-19 patients will require oxygen or ventilator support.

Methods: 135 patients with optimal-quality chest radiographs at admission who required oxygen/ventilator support were included in this retrospective analysis conducted in a hospital.

After evaluating each chest X-ray, a severity score was determined using a pre-made pro forma. The collected data was statistically evaluated using the proper instruments and techniques.

Findings: With a mean age of 54.35 ± 14.49 years, there were more men than women. While the remaining patients in our study required oxygen assistance, over 72% of them required ventilator support. In our investigation, the severity score of the chest radiograph and the SPO2/PaO2 values showed a significant statistical association.

When predicting whether a Covid-19 patient would require ventilator support, the sensitivity, specificity, and accuracy were 85.7%, 92.5%, and 89.5%, respectively, using a cut-off value >8 for the chest radiograph severity score.

In conclusion, when critically ill COVID-19 patients are on various life-support systems, chest radiography continues to be the primary imaging modality. The severity score from the initial chest radiograph at the time of admission may also be utilized as a screening tool, even though arterial blood gas measurement is the gold standard for determining if these patients require oxygen/ventilator assistance. By predicting the requirement for oxygen or ventilator support, chest radiography can reduce morbidity and death by giving patients enough time to be transferred to a suitable healthcare facility (Rastogi et al., 2022).

CHEST COMPUTED TOMOGRAPHY AND CHEST X-RAY IN THE DIAGNOSIS OF COMMUNITY-ACQUIRED PNEUMONIA: A RETROSPECTIVE OBSERVATIONAL STUDY

Objectives: To evaluate the effect of chest computed tomography (CT) on the initial diagnosis and compare the yield of early combined use of CXR and CT in patients with community-acquired pneumonia (CAP) who arrive to the emergency department (ED).

Techniques: After reviewing the medical records of 900 patients who visited the emergency department and were diagnosed with CAP over a one-year period, 130 patients who had chest CT and CXR performed within 48 hours were chosen. For CAP, CXR results were categorized as either positive, negative, or inconclusive. In addition to the CXR results, the chest CT results were classified as positive, negative, inconclusive, or positive. CT was classified as having no benefit, large benefit, or moderate benefit based on the chest CT and CXR findings.

Results: 90.7% of patients had positive chest CT results; 41.5% of these patients received a new diagnosis following a negative or ambiguous CXR, and 21.5% received a diagnosis in addition to the CXR results. For the diagnosis or exclusion of CAP, CT was large, moderate, and of no benefit over CXR in 45.3%, 21.5%, and 33.1% of patients, respectively. In conclusion, early chest CT can be utilized in conjunction with CXR to help identify CAP in ED patients early. (Ibrahim et al., 2021)

OUTCOME OF RECOMMENDATIONS FOR RADIOGRAPHIC FOLLOW-UP OF PNEUMONIA ON OUTPATIENT CHEST RADIOGRAPHY

Goal: To record the resolution of radiographically suspected pneumonia, radiologists often advise follow-up chest radiographs. Nevertheless, nothing is known about the clinical value of follow-up radiography. Examining the prevalence of significant pulmonary pathology identified during follow-up imaging of suspected pneumonia on outpatient chest radiography was the aim of this investigation.

Methods: To find cases where the radiologist suggested follow-up chest radiography for suspected community-acquired pneumonia, reports of 29,138 outpatient chest radiography examinations conducted at an academic medical center in 2008 were searched (n = 618). Abnormalities on the index radiograph were described. To evaluate the outcome of the index

abnormality, reports of follow-up imaging (CT and MRI) conducted between January 2008 and January 2010 were examined. Reports on pathology, microbiology, clinical history, and demographics were examined and documented.

Results: 76.7% of patients followed the advice for follow-up imaging. Nine out of 618 cases (1.5%) had a newly discovered cancer that matched the chest radiography anomaly that was first thought to be pneumonia. Of the 618 individuals, 23 (3.7%) had an alternative nonmalignant condition that matched the chest radiography anomaly that was first thought to be pneumonia. Thus, during follow-up imaging of suspected pneumonia, important new pulmonary diagnoses were discovered in 32 out of 618 patients (5.2%).

Conclusion: A modest proportion of new diagnoses of malignancy and significant nonmalignant disorders are obtained with follow-up imaging of radiographically suspected pneumonia, which may change patient care. (Little et al., 2014)

2.3 THEORETICAL REVIEW

Chest radiography remains a key tool in the diagnostic evaluation of thoracic pathology, due to its accessibility, speed, and relative cost-effectiveness (Akhter et al., 2023). A chest X-ray (CXR) produces an image based on the different absorption rates of X-rays by various types of tissue—air-filled areas like the lungs appear dark, while denser substances such as fluid, bone, or consolidation are shown in white—thus enabling the identification and categorization of pathologies (Satia et al., 2013). The technique's diagnostic precision—its ability to accurately reflect the final diagnosis based on patient indications and radiographic findings—is crucial for guiding clinical decisions, given its widespread use. (Ghodrati et al., 2022).

Studies examining the link between clinical imaging indications, radiographic outcomes, and final diagnoses have shown that although CXR often exhibits high specificity, its sensitivity can

differ. As an example, regarding the screening of interstitial lung disease, chest radiographs demonstrated a high specificity but a modest sensitivity (Ghodrati et al., 2022). This variant underscores the importance of correlating imaging results with clinical data and diagnosis in order to determine the true diagnostic value of CXR in practice. In addition, retrospective analyses of large datasets have demonstrated that observational classification of radiographic abnormalities—when subjected to systematic analysis—can reveal patterns of pathology and diagnostic workflows (Jones et al., 2021).

Pathologies detected through CXR can be classified, and the relationships among patient indication, radiographic finding, and final diagnosis can be examined. This facilitates a clearer comprehension of the part radiography plays in diagnostic pathways. The modality's value is shown when the results of a chest radiograph closely match clinical indications and confirmed diagnoses; discrepancies highlight the need for further imaging or additional clinical data. This theoretical framework supports the study's objectives: to classify and analyze pathologies diagnosed via CXR, evaluate the relationship between patient indication and final diagnosis, and identify patterns linking radiographic findings with pathology outcomes. The retrospective cross-sectional design of the study facilitates the review of existing radiograph reports and outcomes, offering insight into the real-world diagnostic effectiveness of chest X-rays.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 RESEARCH SETTING

This study was conducted at the University of Benin teaching hospital located in Benin City, Edo State, Nigeria.

3.2 STUDY DESIGN

A retrospective cross-sectional study was the most suitable study design for my research. The design entailed gathering and assessing existing CXR reports from a specified timeframe within my study, where observations and diagnostic conclusions were already documented. In resource-constrained settings, retrospective designs were ideal when prospective data collection was impractical or time-consuming. This design enabled me to investigate how common and what kinds of chest pathologies are detected through imaging, along with the frequency and characteristics of diagnostic findings and treatment decisions associated with those findings.

3.3 TARGET POPULATION

The target population for this study was patients who underwent chest x-ray imaging with suspected chest pathologies at the facility acting as my scope of study.

3.4 SAMPLING TECHNIQUES/ SAMPLING SIZE

The Stratified Random Sampling Technique was employed for sampling in this study. This method was chosen because chest pathologies are diverse and encompass many diagnostic categories. Stratification ensures that each pathology category is adequately represented in the study population, thereby minimizing sampling bias and enhancing the validity of the findings.

The study included only chest X-ray reports documented between July 2025 and September 2025. A total of 304 chest X-ray reports were selected and analyzed after applying this inclusion criterion. The sample size was deemed adequate for meaningful categorization, pattern analysis,

and assessment of relationships among clinical indications, radiographic findings, and final diagnoses.

3.5 INSTRUMENT FOR DATA COLLECTION

The ideal instrument for data collection is a form or spreadsheet where I can insert and capture relevant information for each x-ray report which include the clinical indication, patient age-group, observations and diagnosis.

This instrument helped me ensure to maintain consistency, aid my analysis and research and explore patterns and relationships between indications, findings and diagnosis .

3.6 VALIDITY OF THE INSTRUMENT

The data collection tool (a standardized spreadsheet or form) was created using important variables listed in the literature and radiology report standards in order to guarantee validity. These consist of radiological observations, age groups, categories of pathology, clinical indications, radiographic findings. The tool was examined by knowledgeable radiographers and physicians to make sure it appropriately records pertinent information and conforms to accepted reporting guidelines for chest X-rays.

3.7 RELIABILITY OF THE INSTRUMENT

A pilot test on a subset of chest X-ray reports was used to assess the instrument's reliability. Repeated entries were compared to determine consistency. To make sure that many users can read and fill out the data form consistently, inter-rater reliability was computed. To increase clarity and decrease variability, any disparities discovered during pilot testing was fixed.

3.8 METHODS OF DATA COLLECTION

Following ethical permission, data was gathered retroactively from the archives of the University of Benin Teaching hospital. After reviewing traditional chest X-ray reports, pertinent data was added to the spreadsheet that has been generated. Patient identifiers were kept private.

3.9 METHODS OF DATA ANALYSIS

I utilized SPSS, a powerful statistical software capable of efficiently handling and analyzing large datasets commonly found in retrospective medical studies. It allows for the entry and organization of data derived from chest X-ray records and patient histories. The program offers a range of statistical tests that can help identify trends and correlations between X-ray data and chest disorders. Demographic data and the prevalence of various chest conditions can be summarized using descriptive statistics in SPSS. To evaluate the diagnostic accuracy and predictive value of chest X-rays, one can employ inferential techniques such as chi-square.

3.10 ETHICAL CONSIDERATION

Ethical approval was obtained from the University of Benin Teaching Hospital Ethics Committee. One thing that I was cautious of is confidentiality and data protection by excluding all personal information. I also complied with guidelines on data handling and patient privacy and use the data only for my research.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the findings from the retrospective analysis of 304 chest X-ray reports collected from the University of Benin Teaching Hospital (UBTH), Benin City. The data were analyzed using descriptive and inferential statistics to address the three research objectives: (1) identifying common clinical indications for chest X-ray examinations, (2) determining the most common radiographic findings and pathology categories across age groups, and (3) examining the relationship between clinical indications and radiographic findings to assess diagnostic accuracy.

4.1 Demographic Characteristics of the Study Population

The study population comprised 304 patients who underwent chest X-ray examination during the study period. Table 9 presents the age group distribution of the study participants.

Table 4.1.1: Age Group Distribution of Study Population

Age Group	Frequency (n)	Percentage (%)
Adolescent	14	4.61
Adult	149	49.01
Child	8	2.63
Geriatric	118	38.82
Infant	12	3.95
Other	3	0.99
Total	**304**	**100.00**

The results show that adults (18-64 years) constituted the largest proportion of the study population (49.01%, n=149), followed by geriatric patients aged 65 years and above (38.82%, n=118). Pediatric populations including adolescents, children, and infants collectively represented 11.19% (n=34) of the sample. This age distribution reflects the typical pattern of

chest pathology presentation in clinical practice, where adult and elderly populations bear the greatest burden of cardiopulmonary diseases.

4.2 Clinical Indications for Chest X-ray Examination

4.2.1 Overall Clinical Indications

The first research objective sought to identify the common clinical indications that prompt patients with suspected chest pathologies to undergo chest X-ray examination. After standardization to eliminate duplicates and variations, 17 distinct clinical indication categories were identified.

Table 4.2.1: Top 15 Clinical Indications for Chest X-ray Examination

Rank	Clinical Indication	Frequency (n)	Percentage (%)
1	Hypertension	68	22.37
2	Other Indications	58	19.08
3	Cough	27	8.88
4	Dyspnea	25	8.22
5	Heart Failure	15	4.93
6	Pulmonary Tuberculosis	15	4.93
7	Trauma	15	4.93
8	Chest Pain	14	4.61
9	Hemoptysis	10	3.29
10	Swelling/Edema	9	2.96
11	Palpitations	8	2.63
12	RVD with Symptoms	8	2.63
13	Pre-operative	7	2.30
14	Chest Pain with Dyspnea/Edema	5	1.64
15	Community Acquired Pneumonia	4	1.32

The data reveals that hypertension was the most common clinical indication for chest X-ray examination, accounting for 22.37% (n=68) of all requests. This was followed by miscellaneous indications grouped as “Other Indications” (19.08%, n=58), which included less frequent presentations. Respiratory symptoms including cough (8.88%, n=27) and dyspnea (8.22%, n=25) were also prominent indications. Notably, cardiovascular-related indications (hypertension, heart

failure, chest pain, palpitations) collectively represented approximately 35% of all chest X-ray requests, highlighting the modality's crucial role in cardiovascular assessment.

4.2.2 Clinical Indications by Age Group

The distribution of clinical indications varied significantly across different age groups, reflecting age-specific disease patterns.

Table 4.2.3: Top 3 Clinical Indications by Age Group

Age Group	Rank	Clinical Indication	Frequency (n)	Percentage (%)
Adolescent	1	Other Indications	6	42.86
	2	Weight Loss/Fatigue	4	28.57
	3	Cough	2	14.29
Adult	1	Other Indications	34	22.82
	2	Hypertension	25	16.78
	3	Dyspnea	12	8.05
Child	1	Cough	5	62.50
	2-4	Multiple (equal frequency)	3	37.50
Geriatric	1	Hypertension	42	35.59
	2	Other Indications	15	12.71
	3	Cough	12	10.17
Infant	1	Dyspnea	9	75.00
	2	Other Indications	2	16.67
	3	Chest Pain with Dyspnea/Edema	1	8.33

In the geriatric population, hypertension dominated as the primary indication (35.59%, n=42), reflecting the high prevalence of hypertensive heart disease in elderly patients. Among adults, the indication pattern was more diverse, with hypertension (16.78%) and dyspnea (8.05%) being prominent. In contrast, pediatric populations (children and infants) predominantly presented with acute respiratory symptoms, with cough accounting for 62.50% of indications in children and dyspnea representing 75.00% of indications in infants. Adolescents showed a unique pattern with weight loss/fatigue (28.57%) as a significant indication, likely associated with neoplastic diseases prevalent in this age group.

4.3 Radiographic Findings and Pathology Categories

4.3.1 Distribution of Pathology Categories

The second objective examined the most common radiographic findings and categories of chest pathologies among the study population across each age group.

Table 4.3.1: Distribution of Chest Pathology Categories

Rank	Pathology Category	Frequency (n)	Percentage (%)
1	Cardiac Disease	137	45.07
2	Respiratory Disease	73	24.01
3	Neoplastic Disease	28	9.21
4	Pleural Disease	17	5.59
5	Lung Disease	13	4.28
6	Thoracic Trauma	7	2.30
7	Cardiac Disease with Respiratory Infection	6	1.97
8	Lung Disease with Infection	6	1.97
9	Cardiac Disease with Pleural Involvement	4	1.32
10	Cardiac and Respiratory Disease	4	1.32
11	Lung Disease with Neoplasm	4	1.32
12	Neoplastic Disease with Pleural Involvement	4	1.32
13	Pleural Disease with Respiratory Involvement	1	0.33

Cardiac disease emerged as the predominant pathology category, accounting for 45.07% (n=137) of all diagnosed conditions. Respiratory diseases constituted the second largest category at 24.01% (n=73). Together, cardiac and respiratory pathologies represented approximately 69% of all chest X-ray findings, underscoring the importance of chest radiography in cardiopulmonary assessment. Neoplastic diseases accounted for 9.21% (n=28) of cases, while pleural diseases represented 5.59% (n=17). Complex, multi-system pathologies (categories 7-13) collectively represented 8.56% of cases, demonstrating the overlapping nature of thoracic pathologies.

4.3.2 Pathology Categories by Age Group

Table 4.3.2: Pathology Categories by Age Group (Selected Data)

Age Group	Pathology Category	Frequency (n)	Percentage (%)
Adolescent	Neoplastic Disease	11	78.57
	Pleural Disease	2	14.29
	Respiratory Disease	1	7.14
Adult	Cardiac Disease	66	44.30

	Respiratory Disease	44	29.53
	Pleural Disease	7	4.70
Geriatric	Cardiac Disease	66	55.93
	Neoplastic Disease	12	10.17
	Respiratory Disease	11	9.32
Infant	Respiratory Disease	12	100.00

The distribution of pathology categories varied markedly across age groups. Geriatric patients showed the highest proportion of cardiac disease (55.93%, n=66), consistent with the age-related increase in cardiovascular pathology. Adults demonstrated a balanced distribution between cardiac (44.30%) and respiratory (29.53%) diseases. Strikingly, adolescents showed a predominance of neoplastic diseases (78.57%, n=11), suggesting that chest X-rays in this age group are frequently performed for suspected malignancies, particularly lymphomas. Infants exclusively presented with respiratory diseases (100%, n=12), reflecting the vulnerability of this age group to respiratory infections.

4.3.3 Specific Radiographic Diagnoses

Table 4.3.3: Top 15 Specific Radiographic Diagnoses

Rank	Specific Diagnosis	Frequency (n)	Percentage (%)
1	Cardiomegaly	79	25.99
2	Hypertensive Heart Disease	44	14.47
3	Pneumonia	28	9.21
4	Pleural Effusion	26	8.55
5	Bronchopneumonia	25	8.22
6	Heart Failure	18	5.92
7	Hilar Lymphadenopathy	12	3.95
8	Barrel Chest Morphology	10	3.29
9	Pulmonary Tuberculosis	10	3.29
10	Atypical Pneumonia	9	2.96
11	Lung Collapse/Atelectasis	7	2.30
12	Mediastinal Mass	6	1.97
13	COPD/COAD	5	1.64
14	Hodgkin’s Lymphoma	5	1.64
15	Pulmonary Nodule/Granuloma	5	1.64

Cardiomegaly was the most frequently diagnosed specific finding (25.99%, n=79), followed by hypertensive heart disease (14.47%, n=44). These findings align with the high prevalence of cardiovascular indications noted earlier. Among respiratory diagnoses, pneumonia (9.21%, n=28) and bronchopneumonia (8.22%, n=25) were most common, collectively representing 17.43% of all diagnoses. Pleural effusion, detected in 8.55% (n=26) of cases, was the third most common specific finding. Tuberculosis (3.29%, n=10) and other chronic lung diseases (COPD/COAD, 1.64%, n=5) were also notable diagnoses, reflecting the persistent burden of these conditions in the study population.

4.4 Correlation Between Indications and Radiographic Findings

The third objective examined the relationship between clinical indications and corresponding radiographic findings to assess how this correlation contributes to diagnostic accuracy.

4.4.1 Indication-Pathology Correlations

Table 4.4.1: Top 20 Indication-Pathology Correlations

Rank	Clinical Indication	Pathology Category	Frequency (n)
1	Hypertension	Cardiac Disease	59
2	Other Indications	Cardiac Disease	23
3	Dyspnea	Respiratory Disease	22
4	Other Indications	Neoplastic Disease	15
5	Heart Failure	Cardiac Disease	14
6	Other Indications	Respiratory Disease	14
7	Cough	Respiratory Disease	9
8	Chest Pain	Cardiac Disease	7
9	Cough	Cardiac Disease	7
10	Swelling/Edema	Pleural Disease	7
11	Trauma	Thoracic Trauma	7
12	Hemoptysis	Lung Disease with Infection	6
13	Palpitations	Cardiac Disease	6
14	Pulmonary Tuberculosis	Respiratory Disease	6
15	RVD with Symptoms	Respiratory Disease	6

The strongest correlation was observed between hypertension as a clinical indication and cardiac disease as the pathology category (n=59, representing 86.76% of all hypertension cases). This strong correlation demonstrates the high predictive value of hypertension as an indication for

detecting cardiac pathology on chest X-ray. Similarly, dyspnea showed a strong association with respiratory disease (n=22, 88.00% of dyspnea cases), and trauma invariably led to the diagnosis of thoracic trauma (n=7, 100% specificity). These findings suggest that certain clinical indications are highly specific for particular pathology categories.

Interestingly, some indications showed less specific correlations. For instance, cough was associated with both respiratory disease (n=9) and cardiac disease (n=7), reflecting its non-specific nature as a symptom that can arise from multiple cardiopulmonary pathologies.

4.4.2 Diagnostic Specificity of Clinical Indications

Table 4.4.2: Diagnostic Specificity of Clinical Indications (Top 15)

Rank	Clinical Indication	Predominant Pathology	Total Cases (n)	Specificity (%)
1-4	COPD/COAD	Lung Disease	3	100.00
	General Checkup	Cardiac Disease	4	100.00
	Stroke	Cardiac Disease	3	100.00
	Weight Loss/Fatigue	Neoplastic Disease	4	100.00
5	Heart Failure	Cardiac Disease	15	93.33
6	Dyspnea	Respiratory Disease	25	88.00
7	Hypertension	Cardiac Disease	68	86.76
8	Chest Pain with Dyspnea/Edema	Cardiac Disease	5	80.00
9	Swelling/Edema	Pleural Disease	9	77.78
10	Palpitations	Cardiac Disease	8	75.00
11	RVD with Symptoms	Respiratory Disease	8	75.00
12	Hemoptysis	Lung Disease with Infection	10	60.00
13	Pre-operative	Respiratory Disease	7	57.14
14	Chest Pain	Cardiac Disease	14	50.00
15	Community Acquired Pneumonia	Respiratory Disease	4	50.00

Several clinical indications demonstrated perfect specificity (100%) for their corresponding pathology categories, including COPD/COAD for lung disease, stroke for cardiac disease, and weight loss/fatigue for neoplastic disease. However, these were based on relatively small sample

sizes (n=3-4). Among indications with larger sample sizes, heart failure showed excellent specificity for cardiac disease (93.33%, n=15), as did dyspnea for respiratory disease (88.00%, n=25) and hypertension for cardiac disease (86.76%, n=68).

Lower specificity was observed for more ambiguous presentations such as chest pain (50.00%) and pre-operative screening (57.14%), suggesting that these indications are associated with a broader range of pathologies and require more comprehensive clinical evaluation beyond chest radiography alone.

4.4.3 Appropriateness of Clinical Indications

Table 4.4.3: Appropriateness of Clinical Indications by Pathology Category

Pathology Category	Appropriate Indications (n)	Other Indications (n)	Appropriate (%)
Cardiac Disease	90	47	65.69
Respiratory Disease	43	30	58.90
Lung Disease	7	6	53.85
Pleural Disease	7	10	41.18
Neoplastic Disease	5	23	17.86
Thoracic Trauma	7	0	100.00
Cardiac Disease with Respiratory Infection	0	6	0.00
Lung Disease with Infection	0	6	0.00
Cardiac Disease with Pleural Involvement	0	4	0.00
Cardiac and Respiratory Disease	0	4	0.00

The analysis of appropriateness reveals that 65.69% of cardiac disease cases (n=90/137) were requested with appropriate cardiovascular-related indications (hypertension, heart failure, chest pain, palpitations). Similarly, 58.90% of respiratory disease cases (n=43/73) had appropriate respiratory indications (cough, dyspnea, fever, hemoptysis). Thoracic trauma showed perfect appropriateness (100%, n=7/7), as all trauma cases were correctly indicated. Notably, neoplastic diseases showed low appropriateness (17.86%, n=5/28), suggesting that many malignancies were

incidentally discovered during chest X-rays performed for other indications. Complex multi-system pathologies (categories with 0.00% appropriateness) were predominantly diagnosed serendipitously or through non-specific presenting symptoms, highlighting the value of chest radiography in detecting unexpected pathology.

4.5 DISCUSSION OF FINDINGS

The finding that hypertension was the most common clinical indication (22.37%) for chest X-ray examination aligns with global epidemiological trends showing the rising burden of cardiovascular disease in developing countries (GBD 2020 Collaborators). This is particularly relevant in Nigeria, where hypertension prevalence among adults ranges from 28-38% (Adeloye et al., 2015). The high frequency of hypertension-related chest X-ray requests reflects the standard clinical practice of cardiac assessment in hypertensive patients to detect complications such as left ventricular hypertrophy, cardiomegaly, and early signs of heart failure.

The prominence of respiratory symptoms—cough (8.88%) and dyspnea (8.22%)—as common indications is consistent with the findings of Speets et al. (2006), who reported that respiratory complaints constitute the majority of chest X-ray requests in primary care settings. The 4.93% prevalence of pulmonary tuberculosis as an indication reflects Nigeria's status as a high-burden TB country (WHO, 2021), where chest radiography remains a crucial first-line diagnostic tool despite its limitations in differentiating active from healed lesions.

Age-specific variation in clinical indications was particularly striking. The 75% prevalence of dyspnea among infants reflects the vulnerability of this age group to acute respiratory infections, which are leading causes of infant mortality globally (Jain et al., 2015). Conversely, the 35.59% prevalence of hypertension among geriatric patients underscores the age-related increase in cardiovascular disease burden. The unique pattern observed in adolescents, where weight loss/fatigue accounted for 28.57% of indications, likely reflects the increased index of suspicion

for malignancies (particularly lymphomas) in this age group when presenting with constitutional symptoms.

The 19.08% categorization as “Other Indications” suggests the diverse range of presentations prompting chest radiography. This heterogeneity underscores the utility of chest X-ray as a versatile screening tool capable of detecting unexpected pathology beyond the primary clinical suspicion, as noted by Little et al. (2014).

The predominance of cardiac disease (45.07%) among diagnosed pathologies is consistent with the high burden of cardiovascular disease in sub-Saharan Africa, where epidemiological transition is increasing the prevalence of non-communicable diseases (Mensah et al., 2017). The specific finding that cardiomegaly (25.99%) and hypertensive heart disease (14.47%) were the most common diagnoses aligns with studies demonstrating the high sensitivity of chest radiography for detecting cardiac enlargement, particularly when the cardiothoracic ratio exceeds 50% (American College of Radiology, 2020).

The 24.01% prevalence of respiratory diseases, with pneumonia and bronchopneumonia collectively accounting for 17.43%, reflects the persistent burden of lower respiratory tract infections in developing countries. This finding is supported by the Global Burden of Disease Study (2020), which identified pneumonia as a leading cause of morbidity and mortality in resource-limited settings. The detection of tuberculosis in 3.29% of cases, while seemingly modest, is clinically significant given the disease’s public health implications and the importance of chest radiography in TB screening programs (Garg et al., 2025).

The 9.21% prevalence of neoplastic diseases, with Hodgkin’s lymphoma representing 1.64% of all diagnoses, highlights the role of chest radiography in detecting mediastinal and hilar masses. However, this also underscores a limitation: chest X-rays can only detect relatively advanced

masses, and early-stage malignancies may be missed (McMahon et al., 2017). The detection of pulmonary nodules/granulomas in 1.64% of cases further emphasizes the need for follow-up imaging with computed tomography for characterization, as recommended by the Fleischner Society guidelines.

Age-specific pathology patterns revealed important insights. The 100% prevalence of respiratory disease in infants corroborates pediatric epidemiology showing that respiratory infections dominate morbidity in early childhood (Jain et al., 2015). The 55.93% prevalence of cardiac disease in geriatric patients reflects age-related cardiovascular remodeling and the cumulative effects of risk factors such as hypertension, diabetes, and atherosclerosis. Most strikingly, the 78.57% prevalence of neoplastic diseases in adolescents suggests that when chest radiography is performed in this age group, there is often a high pre-test probability for malignancy, particularly lymphomas which characteristically present with mediastinal masses.

The presence of complex, multi-system pathologies (8.56% collectively) illustrates the interconnected nature of thoracic diseases. Conditions such as “Cardiac Disease with Respiratory Infection” reflect the reality that heart failure patients are predisposed to pulmonary infections due to pulmonary congestion, while “Lung Disease with Neoplasm” may represent obstructive pneumonia distal to an endobronchial tumor—scenarios that chest radiography can identify but which require multimodal assessment for comprehensive diagnosis.

The strong correlation between hypertension as an indication and cardiac disease as a finding (86.76% specificity) validates the clinical utility of chest radiography in hypertensive patients. This high specificity is consistent with the American College of Radiology Appropriateness Criteria (2020), which recommends chest radiography for initial cardiac assessment in hypertensive patients. Similarly, the 88% specificity of dyspnea for respiratory disease confirms

chest X-ray's value as a first-line investigation for breathlessness, as recommended by the British Thoracic Society (2019).

However, the moderate specificity of some indications reveals important clinical nuances. Chest pain showed only 50% specificity for cardiac disease, with the remaining cases associated with respiratory or other pathologies. This finding aligns with emergency medicine literature showing that chest pain has diverse etiologies, including musculoskeletal, gastrointestinal, and pulmonary causes, not all of which are radiographically apparent (Hayden et al., 2018). This underscores the importance of integrating chest X-ray findings with clinical assessment and other investigations such as ECG and cardiac enzymes.

The perfect specificity (100%) observed for certain indication-pathology pairs (COPD/COAD→Lung Disease, Trauma→Thoracic Trauma, Weight Loss/Fatigue→Neoplastic Disease) should be interpreted cautiously due to small sample sizes (n=3-4). However, the 100% specificity of trauma for thoracic trauma is expected and validates the appropriateness of chest radiography as the initial imaging modality in blunt chest trauma (American College of Surgeons, 2018).

The appropriateness analysis revealed that 65.69% of cardiac disease cases had appropriate cardiovascular indications, leaving 34.31% diagnosed with other or non-specific indications. This finding has two important implications. First, it demonstrates the screening capacity of chest radiography to detect unsuspected cardiac pathology in patients presenting with non-specific symptoms. Second, it highlights potential areas for improving clinical assessment and indication selection to optimize resource utilization. The 58.90% appropriateness for respiratory diseases similarly suggests that while chest X-rays are generally well-indicated for respiratory

symptoms, nearly 41% of cases were diagnosed despite non-respiratory indications, further supporting the modality's broad screening value.

The extremely low appropriateness (17.86%) for neoplastic diseases is particularly noteworthy. This suggests that most malignancies detected on chest X-ray were incidental findings rather than targeted diagnoses. While this demonstrates the serendipitous value of chest radiography, it also raises concerns about late-stage diagnosis. Many of these cases likely represent advanced malignancies with radiographically apparent masses, emphasizing the need for earlier detection strategies such as low-dose CT screening in high-risk populations (Aberle et al., 2011).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

This retrospective study evaluated the diagnostic contribution of chest X-ray imaging in identifying thoracic pathologies by examining the correlations among clinical indications, radiographic findings, and ultimate diagnoses. The data were sorted into categories based on age group, type of chest pathology, clinical indication, and diagnostic findings. The study aimed to (1) classify and analyze chest pathologies identified via chest X-ray imaging, (2) uncover patterns and connections between radiographic findings and pathology, and (3) assess the relationship among patients' clinical indications, radiographic findings, and final diagnoses to ascertain the diagnostic value of chest radiography.

The analysis uncovered several significant trends. Hypertensive patients exhibited evidence of cardiac alterations on chest X-rays in 86.76% of cases, indicating that hypertension, as a clinical indication, is strongly linked to cardiac diseases as the related pathology category. In the same vein, dyspnea showed a robust link to respiratory pathologies (88.00%), while trauma was consistently related to thoracic trauma findings (100% specificity). The findings underscore that certain clinical indications, especially those with clearly established pathophysiological connections, possess a high predictive value for specific radiographic outcomes.

Nevertheless, not all indications showed this level of specificity. For example, cough was linked to respiratory and cardiac diseases alike, demonstrating its non-specific nature as a presenting symptom. In the same way, pre-operative screening and chest pain demonstrated reduced diagnostic specificity, correlating with various pathology categories. This indicates that these factors often necessitate further investigations beyond chest X-rays to ensure accurate diagnosis.

The examination of diagnostic appropriateness showed that 65.69% of cardiac diseases were requested with valid cardiovascular-related indications like hypertension, heart failure, and palpitations. In comparison, 58.90% of respiratory diseases were appropriately indicated by respiratory symptoms such as cough, dyspnea, and fever. While the appropriateness of thoracic trauma cases was 100%, neoplastic diseases had a low rate of 17.86%. This suggests that many malignancies were found incidentally on X-rays performed for other reasons.

These results show that chest radiography continues to be a highly valuable tool in medical diagnostics. Chest X-rays often uncover incidental or unexpected pathologies, even when indications are non-specific, highlighting their ongoing importance in initial screening and diagnostic assessment.

The study accomplished the goals it had outlined.

Objective 1: To classify and analyze chest pathologies identified through chest X-ray imaging. By systematically categorizing diagnoses into pathology groups — such as cardiac, respiratory, neoplastic, traumatic, and miscellaneous — and examining their frequency and distribution, this was accomplished. The data showed that cardiac pathologies were the most common, followed by respiratory and neoplastic conditions, mirroring the common disease burdens in the studied population.

Objective 2: To recognize patterns and correlations between pathology and chest X-ray findings. Radiological patterns that were distinct from one another were identified across the different pathology categories. For instance, cardiomegaly and vascular prominence were frequently linked to hypertensive heart disease and cardiac failure, whereas opacities, effusions, and lobar consolidations had a strong correlation with respiratory infections like pneumonia and

tuberculosis. The consistent nature of these associations affirms that typical X-ray patterns can be relied upon for the differentiation of major chest diseases.

Objective 3: To assess how patients' clinical indications correlate with radiographic findings and final diagnoses.

This goal was accomplished via correlation analysis, which illustrated that certain clinical symptoms (like hypertension, dyspnea, and trauma) were reliable predictors of corresponding radiographic findings and pathologies. The findings emphasize the diagnostic precision of chest X-rays when applied to cases with proper indications and demonstrate that radiography serves a significant ancillary function in clinical assessment, even for non-specific symptoms.

The results of this research are relevant to clinical practice and medical training. To begin with, they underscore the importance of chest X-ray imaging as a primary diagnostic resource for evaluating patients with cardiovascular, respiratory, and thoracic disorders. Given the robust link between clinical indications and X-ray findings, it is validated to continue depending on chest radiography for initial diagnostic evaluation, particularly in healthcare settings with limited resources where advanced imaging options may not be accessible. Secondly, the results underscore the significance of documenting suitable clinical indications prior to radiological assessment. Well-defined clinical indications enhance diagnostic yield and minimize unnecessary radiation exposure. It is recommended that clinicians customize their requests according to evident patient symptoms and presumed conditions; this improves both the precision and efficiency of diagnostics in radiology departments.

Thirdly, the study's observation of incidental findings, especially in neoplastic and complex multi-system pathologies, highlights the importance of chest X-rays for early detection. A

number of cancers were found accidentally, showing how useful radiography can be in revealing concealed or asymptomatic disease processes.

to conclude, this research has shown that the chest X-ray continues to be fundamental in assessing potential chest pathologies. The robust correlations between particular clinical indications and radiographic findings validate its diagnostic reliability and clinical significance. The most common categories were cardiac and respiratory diseases, with hypertension and dyspnea acting as strong predictors for cardiac and pulmonary conditions, respectively. Although some symptoms like cough and chest pain were not very specific, chest radiography's overall appropriateness and diagnostic yield remain high, confirming its ongoing significance in patient care. Moreover, the discovery of incidental findings strengthens the wider diagnostic capability of X-rays in detecting unanticipated pathologies.

Valuable insights into diagnostic patterns, appropriateness, and predictive relationships between clinical presentation and radiological outcomes are provided by this study. It underscores the significance of combining clinical and radiographic data to improve diagnostic precision, refine patient management, and direct more efficient use of radiological services in clinical settings.

5.2 Recommendations

Taking into account the results of this retrospective study examining the investigative role of chest X-rays in diagnosing chest pathologies, the following recommendations are suggested to enhance the diagnostic value and clinical use of chest radiography in managing patients: Improve the Precision of Clinical Indications: It is essential for clinicians to provide accurate and pertinent clinical indications, like cough, dyspnea, hypertension, or chest pain, when requesting chest X-rays. Radiologists can interpret findings with greater precision and relate them to possible underlying conditions when indications are documented appropriately. The research

showed that when indications were clearly specified, like hypertension or dyspnea, a strong correlation existed with cardiac and respiratory diseases respectively, underscoring the diagnostic importance of proper indication use.

Enhance Effective Collaboration between Clinicians and Radiologists: Clinicians and radiologists should increase the frequency of their communication and feedback. Clinicians should rely on radiographic findings for diagnosis and treatment, while radiologists should receive sufficient patient history. Joint case reviews and multidisciplinary meetings can aid in minimizing misinterpretation and enhancing diagnostic accuracy.

Implement Standardized Imaging and Reporting Protocols: Radiology departments are encouraged to create standardized protocols for chest X-ray imaging and reporting. Structured reporting formats with designated sections for indications, findings, and impressions will enhance consistency and facilitate retrospective analyses. This will assist in spotting trends, refining audit processes, and boosting overall diagnostic efficiency.

Promote Ongoing Education and Training: Clinicians and radiology staff should participate in regular workshops and seminars to enhance their knowledge of chest imaging indications, interpretation, and limitations. Ongoing professional development guarantees that practitioners are informed about current diagnostic guidelines and radiologic best practices.

When Needed, Include Additional Diagnostic Methods: Although chest X-rays are a useful first-line tool, cases that present ambiguous or inconclusive findings should be further examined using more advanced imaging methods like CT or MRI. By combining different diagnostic methods, this approach increases accuracy and guarantees that intricate or subtle pathologies are not missed.

Establish Routine Audit and Research Initiatives: Health institutions ought to carry out periodic audits of chest X-ray requests and reports to assess the suitability of imaging and the accuracy of diagnoses. It is advisable to promote additional studies that will compare chest X-ray findings with those obtained from other imaging methods. This will help to better define the function of chest radiography in disease detection and management.

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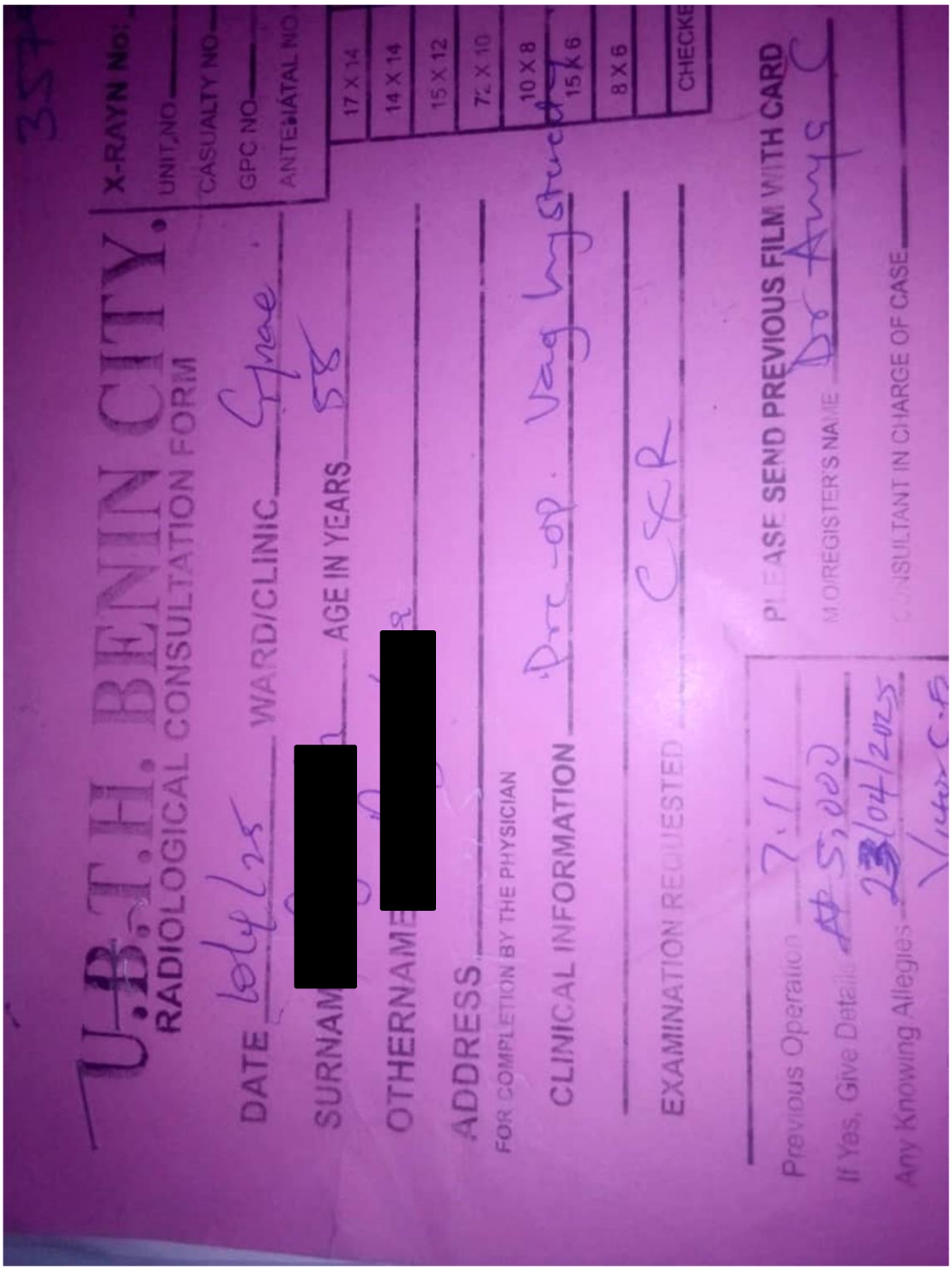
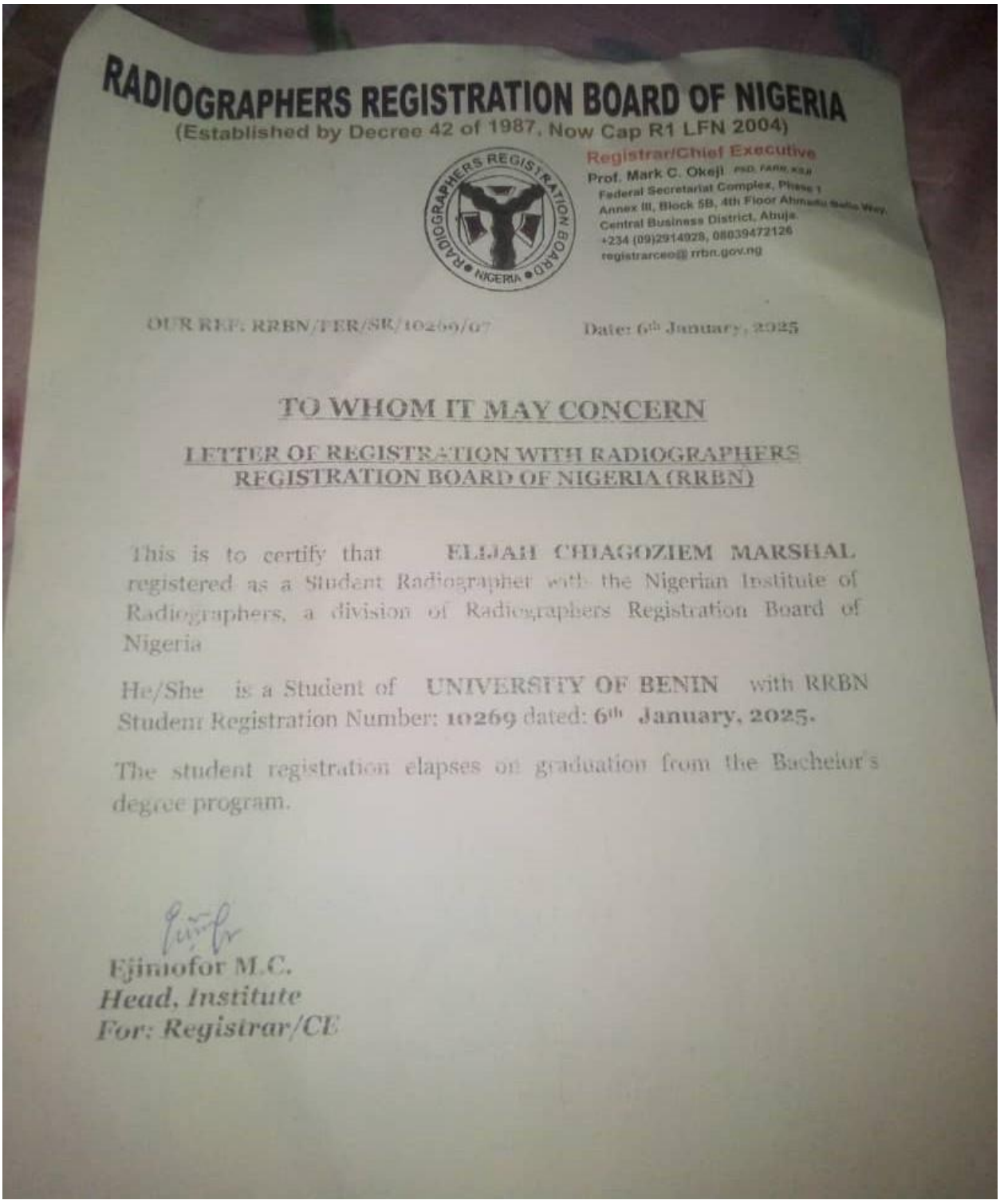
APPENDICES

APPENDIX ONE



APPENDIX TWO



RADIOGRAPHERS REGISTRATION BOARD OF NIGERIA
(Established by Decree 42 of 1987, Now Cap R1 LFN 2004)

Registrar/Chief Executive
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OUR REF: RRBN/TER/SR/10269/07 Date: 6th January, 2025

TO WHOM IT MAY CONCERN

LETTER OF REGISTRATION WITH RADIOGRAPHERS REGISTRATION BOARD OF NIGERIA (RRBN)

This is to certify that **ELIJAH CHIAGOZIEM MARSHAL** registered as a Student Radiographer with the Nigerian Institute of Radiographers, a division of Radiographers Registration Board of Nigeria

He/She is a Student of **UNIVERSITY OF BENIN** with RRBN Student Registration Number: **10269** dated: **6th January, 2025.**

The student registration elapses on graduation from the Bachelor's degree program.

Ejimofor M.C.
Head, Institute
For: Registrar/CE