EVALUATION OF X-RAY REPORTING ACCURACY IN DETECTING LUNG ABNORMALITIES IN PEDIATRIC PATIENTS IN UNIVERSITY OF BENIN TEACHING HOSPITAL, EDO STATE.

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DECEMBER 2025.

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF RADIOGRAPHY, SCHOOL OF BASIC MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE, NIGERIA.

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (B.Rad) DEGREE

SUPERVISOR
Mrs. E.O. OKEH

DECEMBER 2025

CERTIFICATION

This is to certify that this research project by ODOH HENRY CHINONSO with a Matriculation Number of BMS2005200 has been examined and approved for the award of Bachelor of Science Degree in Radiography in the Department of Radiography, School of Basic Medical Sciences, University of Benin, Benin City.

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MRS IGBINEDION F.O. Date
(Head of Department)

______________________ ______________________

Date

EXTERNAL EXAMINER.

DEDICATION

This project is dedicated to God Almighty for His endless grace and guidance, and to my beloved family for their constant love, support, and belief in me.

ACKNOWLEDGMENT

I am deeply grateful to God Almighty, the giver of life, for granting me the strength, health, and clarity of mind to complete this project.

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ABSTRACT

This study determined the precision of X-ray reporting in detecting lung abnormalities in children at the University of Benin Teaching Hospital (UBTH), Edo State. Lung diseases such as pneumonia remain major causes of morbidity and mortality among children in developing countries, making accurate and prompt diagnosis essential. A retrospective quantitative study design was used to analyze chest X-ray findings of children aged 0–18 years examined between May and December 2024. Data were collected using a structured checklist including age, gender, clinical indication, radiological findings, and confirmed diagnosis, and analyzed using descriptive statistics with SPSS software. The results showed that pneumonia was the most common lung abnormality, followed by bronchitis, bronchiolitis, and tuberculosis. Most X-ray reports were accurately interpreted, though some errors were linked to poor image quality and varying levels of radiologist experience. Overall, X-ray reporting at UBTH was effective in detecting pediatric lung abnormalities. The study concludes that regular training, standardized reporting formats, and continuous quality assurance would further improve diagnostic accuracy and pediatric patient care.

Keywords: Pediatric Patients, Lung Abnormalities, Chest X-ray, Radiographic Reporting, Diagnostic Accuracy, UBTH.

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Although radiological pneumonia is used as an outcome measure in epidemiological studies, there is considerable variability in the interpretation of chest radiographs. A standardized method for identifying radiological pneumonia and other lung abnormalities would facilitate diagnosis and radiological report (Chang, 2009).

The increased rate of hospitalization for acute lower respiratory tract infections has been highlighted among children (Hassan et al.,2019). Pneumonia and other acute respiratory infections continue to be the leading causes of death in children under 5 years globally (McAllister et al., 2019). Bronchitis and pneumonia are the leading cause of respiratory disorder death in children. They are expected to be among the major causes of death among children before or in 2030(Chang 2009). Chest radiographs may be requested in recurrence of bronchiolitis or pneumonia among children. A chest x-ray can help differentiate between bronchitis and pneumonia.

Hospital based questionnaires for severe respiratory infections have been addressed globally (WHO,2011). However, grading the clinical severity has been difficult in making differences or comparisons easy to carry out. For instance, chest radiographs are a component of the contemporary epidemiological analysis of lung abnormalities globally, for example the Pneumonia etiology study for child health project, being conducted in Bangladesh, Gambia, Kenya, Mali, South Africa, Thailand and Zambia (Levine, 2011). The lungs are the primary organs affected in the lower respiratory tract infections, and chest radiography remains a tool for evaluating both abnormal findings and disease severity (Bashir et al., 2017).

Despite the global progress in tuberculosis (TB) case control and prevention, it remains a leading cause of death. Accurate diagnosis is a major challenge with chest X-ray (CXR), many diagnoses rely on CXR, in most diagnostic centers CXR is used as one of the major screening tools to identify TB patients. The complex interpretation of CXR is dependent on the expertise of the radiologist and the quality of the radiograph produced by the radiographer. Interestingly Digital radiography (DR) has improved the diagnostic quality of CXR by providing better quality radiographs and lower running cost compared to analog technology (Lipman, 2012). An example is the CXR reading and recording system form developed by the lung institute at the university of cape town (Bateman, 2012).

Chest radiography continues to serve as the primary imaging modality for diagnosing pediatric respiratory infections, although their utility in distinguishing viral from bacterial illness is limited by clinical overlap (O'Grady et al., 2016).

1.2. Statement of problems

Acute respiratory infections are still among the leading causes of hospitalization and mortality in children under five in low- and middle-income countries, despite notable decreases over the past decades (McAllister et al., 2019). In 2010, an estimated 120 million episodes of pneumonia in children under five resulted in roughly 1.3 million deaths, with the majority occurring in resource-limited settings (Troeger et al., 2018).

Effective clinical care, quick treatment, and enhanced health results depend on timely and accurate diagnosis and detection. Pediatric emergency department studies have reported a large range of discrepancies in the rates of chest radiograph use, which is often determined by local practice, availability of resources and also clinician choice (Ramgopal et al., 2022).

The accuracy, consistency, and diagnostic value of x-ray reporting may however be different and there may be missed or delayed diagnosis particularly in situations where the workload is high such as in a busy clinical setting or in situations with limited resources such as in a public health organization. (Cherian et al., 2005; Mahomed et al., 2012).

The quality and efficacy of x-ray reporting in detecting pediatric lung abnormalities at the University of Benin Teaching Hospital (UBTH) have not been thoroughly investigated. Gaps in diagnosis may persist without thorough assessment, maybe causing misdiagnosis or late treatment.

Improving diagnostic accuracy, guiding clinical decision-making, and finally enhancing pediatric patient care depend on an awareness of the advantages and disadvantages of the present reporting methods. The goal of this project is to assess how efficiently x-ray findings are identifying lung problems in pediatric patients at the University of Benin Teaching Hospital (UBTH), Edo State, and also to find areas for improving radiological reporting and clinical management.

1.3. Research Questions

1. What is the accuracy of x-ray reporting in pediatric cases?
2. What are the most common lung abnormalities reported?

1.4. Hypotheses;

Null hypothesis (HO); Accuracy of X-ray reporting does not have impact on pediatric lung abnormalities detection for clinical findings.

Alternative hypothesis (HI); Accuracy of X-ray reporting has impact on pediatric lung abnormalities detection for clinical findings.

1.5. Aim of the study

The aim of this study is to evaluate the accuracy of x-ray reporting in detecting lung abnormalities in UBTH, Edo State.

Objectives of the study

1. To evaluate common abnormalities of the lungs in pediatric patients.

2. Assessing the accuracy of x-ray reports in the diagnosis of lung abnormality.

1.6. Significance of the study

This project was noteworthy as it helped in the assessment of lung abnormalities among pediatric patients in UBTH. It was of great benefit in easy evaluation of chest radiographs and eliminated misinterpreted abnormalities, this study also improved diagnostic ability, patient outcome and contributed to pediatric health research.

1.7. Scope of the study

This study was limited to a specific location. The research was conducted within the University of Benin Teaching Hospital (UBTH) in Benin City, Nigeria. The study's findings were retrospective within the period of May, 2024 to Dec, 2024 of all chest x-ray of pediatric patients at UBTH, a major tertiary healthcare facility. The choice of UBTH was due to its major role in the healthcare system and its diverse radiographic services, making it a significant location for the researcher. The study was carried out at the radiology department at UBTH, Edo State.

1.8. Operational definition of terms

ALARA: As low as is reasonably attainable.

ICRP: International commission of radiological protection.

Lung: The organ of breathing in and out gases.

Lung abnormalities: Any abnormal lung anatomy or lung function that is seen in the X-rays of the chest, including infiltrates, consolidation, masses, atelectasis, pneumothorax or other pathological processes (WHO, 2011)

Pediatric Patients: The patients in this group are children and adolescents aged between one and eighteen years who visit the health facilities at UBTH to seek medical attention on respiratory symptoms.

Radiography: Abnormalities are diagnosed by the use of ionizing radiation.

X-ray Reporting: It is the procedure of radiologists to interpret the images of the lungs of the children by reading the results of the findings.

Detection: Radiological interpretation of the lung's abnormalities in the chest x-rays.

Radiologist: A medical physician who has specialized in the interpretation of medical radiographs such as X-rays so as to identify an illness or medical anomaly.

Sensitivity of X-ray Reporting: The sensitivity of the X-ray report to identify correctly patients with pediatric lung abnormalities (true positives).

Specificity of X-ray Reporting: The X-ray report has the capability of identifying correctly pediatric patients who lack lung abnormalities (true negatives).

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Pediatric Patients

The term pediatric patient normally refers to any patient under medical treatment in the context of childhood and adolescence, but is more complex than a mere age group. The term pediatrics is a combination of the words child and healer, and traditional usage dates back to the use of the term in relation to the individuals between birth and adolescence, that is, to the age before 18 years (Strouse et al., 2023). But in practice, even in adult patients with congenital or childhood-onset disorders, patients are still treated in pediatric environments after adulthood due to their medical demands, disease extensions and recurrence, and continuum of care being more consistent with pediatric knowledge. To this end, a pediatric patient not only has a numerically constrained age but also a medical condition and clinical context against which care is provided (Strouse et al., 2023).

As Strouse et al., 2023, state, the American Academy of Pediatrics, among others, has recommended 21 years of upper age limit, but also states that such a limit might not be applicable to all clinical scenarios. In the meantime, the United States Food and Drug Administration uses the range of birth to 21 as a pediatric category, whereas international agencies, like the United Nations and UNICEF give a definition of a child as any individual under the age of 18.

Strouse et al. (2023) also articulate that the division between the adult and pediatric care is usually complicated by institutional policies and clinical practice. Congenital or childhood-onset conditions like heart disease in childhood, some orthopedic or urologic diseases, often find their way into a pediatric setting later in the lives of patients because of their medical requirements. Equally, adult patients who seek medical attention with malignancies that started when they were young are usually treated in pediatric centers. This fact in radiology is manifested in patient worklists which may contain subjects far outside the standard pediatric age limits and age-based definitions are therefore not practical.

2.1.2 Anatomy of the Lungs

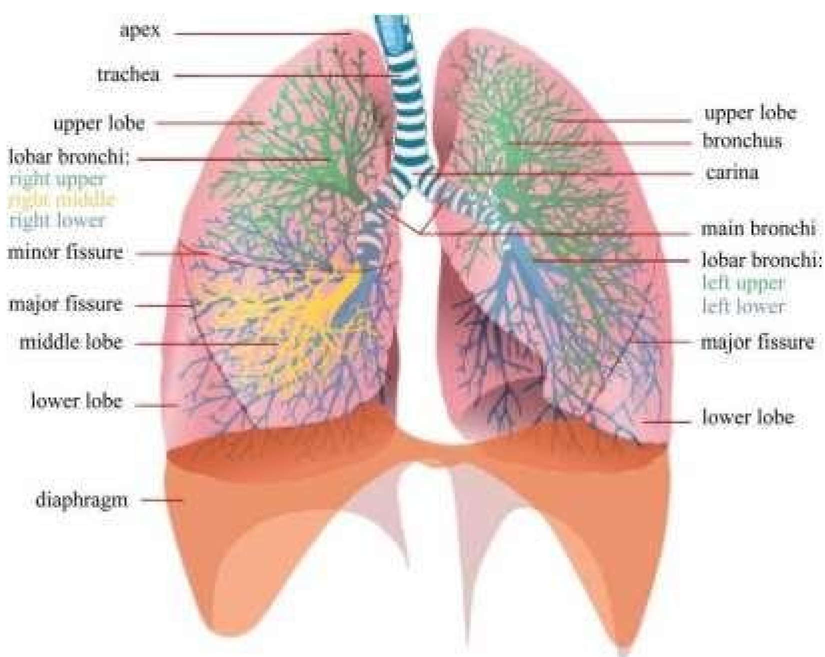

Fig 2. 1. A schematic drawing of the lungs and airway tree

The diagram shows us the important anatomical structures of the lungs, which includes the apex, lobes, fissures, trachea, bronchi, and diaphragm. All these structures collectively form the airway tree, enabling respiration and gas exchange. Understanding how they are arranged spatially aids in identifying possible locations of lung abnormalities on chest X-rays, particularly in pediatric patients (Van Rikxoort & Ginneken, 2013; Marieb & Hoehn, 2019).

The lungs are soft, pinkish-gray organs that have a top that goes above the first rib and a bottom that curves down and rests on the diaphragm (the right lung is higher because of the liver). The lungs have three surfaces: costal, mediastinal, and diaphragmatic. They also have three edges: anterior, posterior, and inferior. The right lung has three lobes (RUL, RML, and RLL) that are separated by oblique and horizontal fissures, and ten segments. The left lung has two lobes (LUL and LLL) that are separated by an oblique fissure. It also has eight or nine segments. The hilum, which is on the mediastinal surface, has the bronchi, pulmonary vessels, lymphatics, and nerves. The vein, artery, and bronchus are arranged from front to back. The pleural space is between the visceral and parietal layers, which lets the lungs move with little friction.

According to histology, type I pneumocytes, which aid in gas exchange, type II pneumocytes, which produce surfactant and act as progenitors, and alveolar macrophages, which aid in immunity and clearance, make up the alveolar epithelium. The alveolar epithelium, capillary endothelium, and their basement membranes make up the blood–air barrier, and collateral ventilation is made possible by the Kohn pores. The embryonic foregut is where the respiratory system begins. The splanchnic mesoderm produces supporting structures like muscles, connective tissue, and cartilages, while the endoderm creates the epithelium. Gas exchange is possible because respiratory bronchioles have formed by around the 24th week of pregnancy.

The bronchial arteries and veins supply and drain the supporting lung tissue, while the pulmonary circulation uses the pulmonary arteries and veins to exchange gases. After draining from the superficial and deep plexuses, lymph travels to the thoracic duct via intraparenchymal, peribronchial, and tracheobronchial nodes. The phrenic nerve and the pulmonary plexus (sympathetic and parasympathetic branches) mediate innervation, which controls glandular activity, vascular tone, and airway calibre (Chaudry et al., 2024).

2.1.3 Physiology of the Lungs

The main function of the lungs is gas exchange, which permits carbon dioxide, a waste product of metabolism, to be expelled from the body and oxygen to pass from the alveoli into the bloodstream. This process is effectively supported by the structure of the pulmonary blood vessels (Chaudry et al., 2024). Air is drawn into the respiratory tract and travels through a very well-organised network of airways before reaching the alveoli, which are tiny, fragile sacs with a thin layer of epithelium lining them. Here, carbon dioxide travels from the bloodstream into the alveoli for exhalation at the same time that oxygen diffuses from the alveolar space into the pulmonary capillaries and binds with haemoglobin within red blood cells. Alveolar epithelium, capillary endothelium, and the intervening basement membrane make up the remarkably thin interface across which this mechanism functions. The ventilation–perfusion ratio, which describes the ideal balance between the air entering the alveoli and the blood circulating in the surrounding capillaries, is crucial to the effectiveness of gas exchange (Powers & Dhamoon, 2023). Respiratory mechanics are essential in order to maintain this fine equilibrium. During inhalation, the diaphragm and external intercostal muscles contract and this expands the thoracic cavity and lowers the intrathoracic pressure allowing air to get into the lungs.

Conversely, expiration is typically a passive mechanism, which depends on the interactions of surface tension of the alveoli and passive recoil of lung tissue. Surfactant is a phospholipid-rich substance that is secreted by alveolar type II pneumocytes and is necessary to reduce the surface tension across alveolar walls to maintain their patency and reduce the amount of energy needed to breathe. The so-called atelectasis, or alveolar collapse, may occur in case of the lack of surfactant that may severely impair gas exchange and reduce lung compliance (Powers and Dhamoon, 2023).

Other physiological processes also control the exchange of gases in the lungs. The ventilatory drive is regulated by a complex feedback mechanism, which relies on the rate of changes in the levels of carbon dioxide, oxygen, and pH of the arteries in central and peripheral locations, with the help of central and peripheral chemoreceptors. The respiratory rate and depth rise according to a drop in pH (acidosis) or an upsurge in arterial CO2 (hypercapnia), which aids in the removal of CO2 and the restoration of the acid base balance. Nevertheless, a reduction in arterial O2 (hypoxia) also initiates compensatory shifts in the breathing patterns. The ability of the pulmonary system to adapt to the shifts in physiological requirements is important to maintaining cellular metabolism and systemic homeostasis (Powers and Dhamoon, 2023).

It is this smooth combination of mechanical, cellular and chemical processes that allow the respiratory system to provide the blood with life-sustaining oxygen and eliminate waste gases at an environmentally friendly rate. By so doing, it acts as a key to maintaining the internal physiological balance and reacting to the needs of the body that continuously change (Powers and Dhamoon, 2023).

2.1.4 Chest X-rays

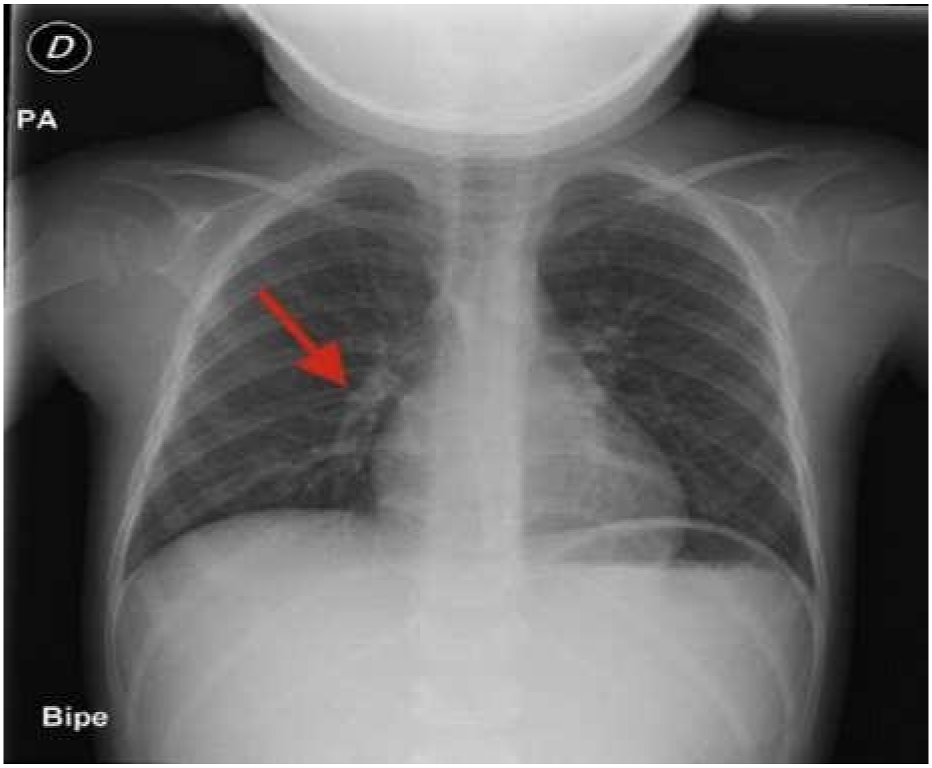

Fig 2.2. COVID-19 Pediatric patient: PA chest radiograph (Lopez de Munain et al., 2021).

Chest x-rays make it possible to not only subjectively estimate the size of the heart but also to measure cardiac silhouette that in turn can be correlated with the size of the thorax. Chest x-rays are considered a baseline of diagnostic tools, particularly in an emergency. The accessibility and speed of obtaining radiographic images allow for prompt evaluation of cardiovascular conditions. However, it is essential to consider the cardiothoracic ratio in conjunction with clinical findings and other imaging modalities, such as echocardiography, to enhance diagnostic accuracy.

An erect posterior anterior chest x-ray is common and depending on the child's age and mobility we perform either a posterior anterior chest x-ray or an anterior posterior chest x-ray. The centering point for each of the view varies. A PA chest x-ray is centered at the level of the 8th thoracic vertebrae (i.e. spinous process of the 7th thoracic vertebrae [T7]), while for an AP it is centered below the mammary folds for children. PA chest x-rays are usually preferred to AP because of radiation protection and magnification of the heart. Exposure is made in full normal arrested inspiration.

2.1.5 Common Pediatric Lung Abnormalities

Globally, paediatric lung diseases cause a significant burden of morbidity and mortality, especially in low and middle-income nations where access to healthcare and preventative measures may be restricted. About 800,000 deaths worldwide are attributed to pneumonia each year, making it the leading cause of death for children under five (World Health Organisation [WHO], 2023). The aetiology is complex and includes bacterial agents like Streptococcus pneumoniae and Haemophilus influenzae type b, as well as viral pathogens like influenza, adenovirus, and respiratory syncytial virus (RSV). Due to their immature immune systems and smaller airway calibres, which make them more susceptible to more severe disease, the incidence is highest in infants and toddlers. Malnutrition, not breastfeeding, indoor air pollution, and HIV infection are risk factors. Clinical signs of pneumonia include a high fever, cough, tachypnea, chest pain, and in extreme situations, hypoxaemia, which calls for immediate medical attention (Kliegman et al., 2015). Infants under two years old are primarily affected by bronchiolitis, which is most common in those under six months. Up to 70% of cases are linked to RSV, which results in extensive inflammation and small airway oedema. Globally, hospital admissions spike during the winter due to seasonal epidemics (WHO, 2022). Apnoea, respiratory failure, and the requirement for mechanical ventilation are among the severe illnesses that infants born prematurely or with underlying cardiopulmonary disease are more likely to experience. Usually, an upper respiratory tract infection is the first sign, which then progresses rapidly to wheezing, coughing, and difficulty breathing (Kliegman et al., 2015).

Asthma is the most prevalent chronic respiratory illness in children, and it affects almost 10 percent of the children around the world, and its prevalence is growing particularly in urbanized and industrialized regions (WHO, 2021). Symptoms are worsened by environmental causes, including air pollution, tobacco smoke, and allergens. There is a strong contribution of genetic predisposition with a family history increasing the risk. The manifestations of asthma are periodical, such as wheezing, coughing (at night or in the early morning), chest tightness, and dyspnea. Repeated episodes may affect the quality of life and result in absence at school (Kliegman et al., 2015).

Tuberculosis (TB) still remains a serious global health concern in children, particularly in areas where adult TB prevalence is high. An estimated 1.1 million children contracted tuberculosis in 2022, with young children and those living with HIV being especially at risk (WHO, 2023). Paediatric tuberculosis can be difficult to diagnose because of its nonspecific and subtle symptoms, which include lethargy, weight loss, low-grade fever, and a persistent cough that lasts longer than two weeks (Kliegman et al., 2015).

Toddlers between the ages of one and three, who are known for their oral exploration and propensity to put small objects in their mouths, are at risk for sudden-onset respiratory distress and morbidity due to foreign body aspiration. The clinical presentation varies from choking episodes and persistent cough to localised wheezing and cyanosis in severe cases, depending on the size and location of the obstruction of the airway. It is essential to timely diagnose and remove atelectasis, bronchiectasis, pneumonia, and other complications (Kliegman et al., 2015).

Cystic fibrosis (CF) is the most prevalent fatal inherited disease amongst Caucasians with an incidence of approximately 1 in 2,500 live births in Europe and North America (WHO, 2022). The respiratory system is the main victim and chronic cough, frequent infections and gradual lung damage begin in infancy or early childhood. Despite the improved outcomes by the means of early diagnosis, in the form of newborn screening, CF still is a long-term chronic progressive disease that needs to be managed throughout the lifetime (Kliegman et al., 2015).

Bordetella pertussis is the bacteria that causes Whooping cough or pertussis which is very contagious and happens mostly in young children and unvaccinated babies. Even with vaccination, outbreaks are still going on across the world. WHO (2023) estimates that the cases reported globally were 151,000 in the year 2022. The symptoms of the disease include prolonged and paroxysmal coughing, inspiratory whoop, and vomiting after coughing. The most dangerous are infants under the age of six months because they may develop serious complications including pneumonia, seizures, and death (Kliegman et al., 2015).

Neonatal respiratory distress syndrome (RDS) is mainly a prematurity disease caused by the lack of the surfactant, which causes the collapse of the alveoli, the loss of gas exchange, and hypoxia. It occurs in about 10 per cent of preterm babies and is negatively correlated with gestational age. Clinical symptoms emerge soon after birth and they comprise tachypnea, flaring of the nose, grunting, and cyanosis. The use of antenatal steroids and surfactant replacement therapy improved mortality rates to a large extent (Kliegman et al., 2015).

The major victims of bronchopulmonary dysplasia (BPD) which is a chronic lung disease are pre-term babies who have required the administration of continuous oxygen therapy and mechanical ventilation. It presents as persistent requirement of oxygen following 28 days of life and as damage to the lungs and stunted development of alveoli. Some of the long-term respiratory morbidities that BPD increases the risk of are childhood lung impairment and frequent hospitalisations (Kliegman et al., 2015). These childhood pulmonary diseases show the diversity and intricacy of childhood respiratory pathology. Their epidemiology depends on genetic, environmental, and socioeconomic factors and the severity of the disease and age determines the clinical manifestations. In order to facilitate the appropriate treatment, diagnosing early and preventing the problem in paediatric care, it is essential to be aware of these trends.

2.1.6 Clinical Presentation and Radiographic Findings of Common Pediatric Lung Pathologies on Chest Radiograph

Pediatric lung disease presents a unique and heterogeneous spectrum of clinical manifestation because of the influences of the developmental immunology, anatomy of airways, environmental and exposures to infectious agents. Clinical presentation knowledge and radiographic evidence are the most important in appropriate diagnosis and early intervention.

Pneumonia is a widespread respiratory illness of children, whose clinical manifestation is determined by mild cough and discomfort up to severe respiratory failure and hypoxia. The only early signs in babies could be irritability, feeding difficulty and tachypnea. Children of older age are more characteristic of fever, chills, a productive cough, and localized chest pain (Caffey and Weisman, 2023). Bacterial pneumonias with bacteria such as Streptococcus pneumoniae usually appear radiographically as dense and uniform lobar consolidation with air bronchograms as a result of alveolar exudation. Pneumonias that are viral, such as Mycoplasma pneumoniae or RSV, or atypical and caused by organisms, as well as bilateral or patchy interstitial infiltrates, are typical of airways and peribronchiolar types, respectively, and associated with their ability to induce hyperinflation, peri bronchial thickening, and bilateral or patchy interstitial infiltrates (Frush and Donnelly, 2019).

Bronchiolitis is a disease that affects the infant under the age of two years; it happens most often due to RSV. Its clinical manifestations are cough, tachypnea, wheezing, and difficulty feeding with severe cases of respiratory distress. Clinical progression may be acute, and dehydration and hypoxia need to be addressed in the shortest possible time. The chest radiographs show hyperinflation of the air traps, flattening of the diaphragms, and segmental or lobar atelectasis as a result of obstructed minor airways. The resulting peri bronchial thickening is a direct outcome of the mucosal edema and cell infiltration of the bronchioles (Caffey &Weisman, 2023).

In asthma, the range of clinical presentations is between mild and intermittent coughing and wheezing with exercise or allergenic triggers, to status asthmaticus with severe respiratory distress and cyanosis. Clinical manifestation is based on the extent of airway hyperreactiveness and obstruction. Asthma radiographically can be characterized by hyperinflation, flattened diaphragms, and expansion of retrosternal air station because of air trapping. In more extreme circumstances, segmental atelectasis and peri bronchial thickening may be seen, particularly when viscid secretions lead to obstruction (Frush & Donnelly, 2019). Long-term hyperinflation and bronchovascular markings may be brought about by chronic asthma.

Tuberculosis (TB) among children is often insidious with the clinical manifestation of cough, low grade of fevers, malaise, weight loss and night sweats. Children at an early age can exhibit irritability, loss of activity, and adenopathy. Radiographic changes change as the disease progresses: a Ghon focus or a parenchymal lesion can be linked to the increase in size of the hilar or mediastinal lymph nodes, forming the classic primary complex. In miliary disease, both lung fields are filled with diffuse, small and nodular densities, which indicate hematogenous dissemination. The disease can result in upper lobe cavities, as well as fibrotic alteration, either chronic or reactivated (Caffey & Weisman, 2023).

Foreign body aspiration is of an acute nature and it usually occurs after choking or coughing, mostly in the one-to-three years old age group. The symptoms include localized wheezing and persistent coughing; respiratory distress and cyanosis. Clinical appearance is based on the character and location of the aspirated body. Radiographically, the initial changes can be so insensitive, whereas air-trapping caused by an obstruction of a ball-valve, segmental collapse, or hyperinflation of the involved lung are frequent. Post-obstructive pneumonia or bronchiectasis may develop when it is a long-term case (Frush & amp; Donnelly, 2019). Cystic fibrosis (CF) is a disease that manifests itself early in life with clinical manifestations in the form of persistent cough, frequent respiratory diseases and weight gain. The progressive respiratory deficit is a result of chronic airway obstruction by thick, viscous secretions. The radiographic image is characterized by early hyperinflation and peri bronchial thickening that progresses to a more progressive disease in the course of time characterized by upper-lobe dominant cystic and saccular bronchiectasis, scarring, and regions of atelectasis. Pneumothorax or enlargement of the pulmonary arteries can also be a manifestation of chronic CF caused by pulmonary hypertension (Caffey & Weisman, 2023). Whooping cough is known as Pertussis and is mostly seen in cases of unvaccinated infants and includes paroxysmal coughing episodes that develop into the classic whooping cough, post-tussive vomiting, and apnea. In extremely young babies the clinical picture can be dreadful as they may show a life-threatening apnea. Radiographic changes seen include hyperinflation and perihilar infiltrates, which are a result of airway barrier and mucosal edema. The clinical picture may be complicated by the segmental or lobar collapse under the influence of thick secretions (Frush & Donnelly, 2019). Neonatal respiratory distress syndrome is an acute condition of premature infants that is caused by the lack of surfactant, manifested in the first hours of life, and has the form of tachypnea, nasal flaring, grunting, and cyanosis. Clinically, it is reversely associated with gestational age, and infants born extremely premature suffer the most. The radiographic appearances change rapidly to low-volume of the lungs with fine and diffuse ground-glass opacities and air bronchograms, and in severe cases, there is widespread alveolar collapse. Surfactant therapy and respiratory support can help to improve the clinical and radiographic picture (Caffey & amp; Weisman, 2023). BPD is a disease that occurs in preterm babies who have had respiratory distress syndrome and chronic mechanical ventilation. Affected newborns have clinical manifestations of chronic respiratory insufficiency (tachypnea, nursing difficulties and supplemental oxygen requirement after 28 days of life). Radiographically, early BPD is an air bronchogram, fine and ground-glass, with an advancement to a course, heterogeneous, pattern with areas of hyperinflation and cysts caused by fibrotic scarring and alveolar disruption (Frush and Donnelly, 2019).

2.1.7 Role of Radiographers and Radiologist in the Handling and Reporting of Pediatric Chest Radiographs

Radiographers and radiologists are the key players in the multidisciplinary team in the clinical assessment of lung disease, as they assist each other in ensuring the correct diagnosis, patient safety, and post-discharge patient care. The task of the radiographer is much more than getting a satisfactory chest x-ray.

Radiographers, as frontline employees, should strike a balance between engaging with patients and safety n infection control measures. Radiographers play a pivotal role in the correct use of personal protective equipment, hand hygiene practices, and decontamination of equipment after every patient examination in settings that have high airborne and droplet-portable infections like tuberculosis or coronavirus disease (COVID-19) (Nyirenda et al., 2018; Qu et al., 2020). The research carried out in Malawi has underscored that despite the general satisfactory levels of knowledge about the measures to counteract the infection, the real performance was often below par, and it is crucial to continue the process of specific training and organizational reinforcement (Nyirenda et al., 2018). The same results were observed in the situation with COVID-19 pandemic, during which radiographers were forced to implement increased measures such as wearing N95 respirators, protective gowns, and deep disinfection of equipment between patients, which highlights the crucial role that they play in the process of infection containment (Qu et al., 2020).

Clinical pathways also allow radiographers to use their developed observational skills. Re d Dot System is the system where radiographers notify referring clinical teams about the possible important radiographic findings and it is an early warning mechanism that may be critical in terms of patient outcomes. Identifying an area of concern, a pneumothorax, a newly developed consolidation, or a suspicious pulmonary mass, whether it is a radiographer or a clinician who performs this task, they have a crucial safety net as it guarantees that the issue can be immediately reviewed and addressed. This is of particular importance in the busy departments where a formal radiology report is not always readily available, and the Red Dot System plays a critical role in the patient triage and efficiency of work-flow.

As radiographers will ensure that they achieve the best possible quality of an image and that their environment does not pose a risk, the ultimate responsibility lies with the radiologists to interpret the images and give appropriate actionable reports. Accuracy and promptness of radiology reporting directly affect patient outcome particularly when it comes to lung disease. Research has found out that the recommendation of follow-up by radiologists on the pulmonary nodules and other lung pathologies varies significantly (Kapoor et al., 2021; Sugimoto et al., 2024). As an example, a multi-institutional review showed that follow-up recommendations were different across radiologists, which implies the significance of the clinical scenario, patient factors, and training of specific radiologists to make a practice (Kapoor et al., 2021). Another study that confirmed the need to standardize recommendations to follow-up pulmonary nodules was the fact that the recommendations followed are not habitual, which also argues in favor of the necessity to standardize the reporting behaviors in order to reduce the differences in the future care provision to a patient (Sugimoto et al., 2024).

The radiologists also have been at the forefront in development of systematic reporting of range pulmonary diseases such as lung disease fibrosis. Through the collaboration between the pulmonologists, very structured templates have been developed that result in accuracy and consistency in the intervention, which allows the referring teams to develop a more meaningful clinical decision. These systematic processes reduce uncertainty, improve radiology terms to clinical needs and contribute to better patient care (Sverzellati et al., 2018). Meanwhile, timely and actionable recommendations clinical effect is evidenced by a study that focused on outpatient follow-ups of pneumonia. It was discovered that patient outcomes were highly interconnected with the adherence and performance of these recommendations that underscored the significance of radiologists in monitoring and care continuity in patients (Little et al., 2014).

Radiographers and radiologists should work as a coordinated group in both the routine and complex clinical situations to ensure that the care given to the patients is safe and effective. The contribution of the radiographer to the achievement of high-quality images, the application of the Red Dot System, and safe clinical environment is supplemented by the contribution of the radiologist to the provision of accurate, structured and actionable diagnostic reports. These professionals, collectively, constitute the foundation of lung disease evaluation and follow-up, and they represent a collaborative idea that becomes more crucial in a challenging and resource-limited healthcare setting.

2.2 Empirical Review

2.2.1 Clinical Indication of Patients Undergoing Emergency Abdominal X-rays

Sharan and Rahimi -Ardabili, 2023 used a systematic review to examine how machine learning methods can be used to identify cough sounds in children with acute respiratory illnesses. As of 25 January 2023, the authors selected six related articles in the Scopus, Medline, and Embase databases and assessed the quality of the studies with the checklist of medical artificial intelligence. Their results indicated that there was a high degree of variability in the input data and the techniques of classification that were employed in the studies. The types of inputs were such as cough sound features only, cough acoustics with clinical characteristics, and the algorithms used were such as traditional algorithms, such as logistic regression and support vectors machines, or the deep learning-based algorithms like convolutional neural networks. The findings proved that there were classification accuracies of between 82 and 96 per cent of bronchiolitis, croup, pertussis and pneumonia in five researches. Nonetheless, one of the articles documented a large decrease in the detection performance of bronchiolitis and pneumonia.

Mitchell et al., 2022 conducted a meta-analysis and systematic review to determine the prevalence of 22 most common respiratory viruses in children with community-acquired pneumonia. They used MEDLINE, PubMed, Embase, Web of Science, and Scopus databases to find articles published between 1 January 1995 and 31 December 2019 but only limited to the pre-COVID-19 period. There were 186 studies that included 152,209 children aged below 18 years of age. DerSimonian by Laird random-effects models were used to estimate the pooled prevalence and Newcastle-Ottawa Scale was used as an assessment of bias. The review concluded that 55.0% of the paediatric patients had at least one or more respiratory viruses, followed by respiratory syncytial virus (22.7) and rhinovirus (22.1). Other viruses had between 1-9% infection. The authors have not identified any significant differences in prevalence by different levels of national income, under- five mortality rates, or by WHO regions.

In Manti et al., 2024, a systematic review and meta-analysis were conducted with regard to severe asthma in children in Europe. The study covered publications that were published since 2003 and followed a registered protocol (PROSPERO CRD42023472845). The literature was filtered by the authors through PubMed, Scopus, and Web of science and included both cross-sectional and cohort studies. The quality of the studies that were selected was assessed according to the STROBE guidelines. The meta-analysis included 9 studies and the publication bias was not significant. The prevalence of severe asthma was 3% (95% CI 1-6; I 2 =99.9; p=.001) without significant sex difference in children overall. The prevalence of the estimated value differed according to diagnostic criteria, whereby, prevailing at the European Respiratory Society/American Thoracic Society identification, it was 1 to 6 percent, with the Global Initiative for Asthma, and about 3 percent with alternative definitions. The authors must have highlighted that prospective studies were not conducted thus complicating the estimation of the incidence rate of severe asthma in this population.

2.2.2 Common Radiographic Findings in Emergency Abdominal X-rays

Kebede et al., 2021 assessed the ability of paediatric residents to interpret common emergency radiographs in a cross-sectional study conducted at Tikur Anbessa Specialized Hospital (TASH). The authors presented ten radiographic images (seven chest, two abdominal, and one extremity) to 79 paediatric residents, asking them to complete a questionnaire. A consultant radiologist interpreted the same images, and results were analysed using SPSS version 25. The results established that classification accuracies ranged between 82 and 96 per cent of bronchiolitis, croup, pertussis and pneumonia were found in five studies. However, in one of the articles, the performance of detecting bronchiolitis and pneumonia reduced significantly.

The results showed that the percentage of residents with satisfactory skills of radiograph interpretation was only 32 (40.5) with an overall accuracy of 73. There was also a high level of discrepancy rate, 49.6. The sensitivity rate of detecting abnormal radiographs was 91.1, and the specificity was quite low, 43. Another important finding was that there is significant correlation between performance of the residents and their training year.

The study by Taves et al., 2018 is based on a retrospective analysis of discrepancies between emergency physicians and radiologists working with paediatric patients in the context of plain radiograph interpretation. The review included information between the months of October 2012 and December 2014, comprising of 25,304 radiographic studies performed at one paediatric emergency department. This was discrepancy where the interpretation of the radiologists and emergency physicians were different and this was termed as false positives, false negatives or otherwise. These findings showed that 252 (1%) of the studies had discrepant reports, most of which were false negatives (82.1%), and false positives (17.9%). Most of the discrepancies were in the chest radiograph and upper- or lower-extremity radiographs, usually because of the missed pneumonia or the missed fractures. Notably, the number of clinically significant instances (105) was only 0.41 percent, which is an indication that there was relatively low error rate in paediatric emergency environment and this was rather acceptable in clinical practice.

In Marais et al., 2023 the authors investigated the impact of patient rotation on the interpretation of chest radiographs of neonates and the impact that this had on clinical outcomes. The authors pointed out that patient rotation was very prevalent in intensive care units because nurses were afraid to turn neonates around because of the risk of line and tube dislocation. Mahbub et al., 2022 introduced a deep neural network (DNN) approach of assisted screening and detection of typical pulmonary infections in a chest X-ray image, including COVID-19, pneumonia, and tuberculosis. How these perceptions affect their efficiency and accuracy can be used to uncover areas that can be improved especially in relation to the process of determining the abnormalities in the lungs of the pediatric patients.

The review identified six primary effects of rotation, including apparent hyperlucency of the side towards which the patient was turned, apparent enlargement of the ‘up’ side, distortion of the cardiac silhouette, apparent shift of the mediastinum, false evidence of cardiomegaly, and reversal of the position of umbilical artery and vein catheter tips. These effects often led to misinterpretation, mistaking rotation for air-trapping, atelectasis, or pleural effusion, and sometimes masking actual pathology. The authors demonstrated these errors using examples and a three-dimensional thoracic model and concluded that recognising the effects of patient rotation was vital for making accurate clinical decisions, especially in the intensive care setting.

2.2.3 Age and Sex Distribution of Patients Undergoing Emergency Abdominal X-rays

Nam et al., 2021 created a deep learning model named DLAD-10 which is meant to identify ten prevalent abnormalities on chest radiographs. It was trained on 146,717 radiographs of 108,053 patients and used a ResNet34 based network with lesion specific channels, which include pneumothorax, mediastinal widening, pneumoperitoneum, pulmonary nodules or masses, consolidation, pleural effusion, linear atelectasis, fibrosis, calcification, and cardiomegaly. DLAD-10 was tested on external CT-validated data and an open-source dataset (PadChest), with the area under the receiver operating characteristic curve (AUC) scores of 0.895 to 1.00, and 0.913 to 0.997, respectively. DLAD-10 was more accurate in clinical scenarios simulated as genuine emergency department disease prevalence than radiologists were in unassisted scenarios. The DL AD-10 usage by far contributed to the higher level of detection of critical (95.0) and urgent (82.7) abnormalities and minimal decreased time to interpret and report such cases.

Geric et al., 2023 have carried out a literature review of computer-aided detection (CAD) software in interpreting chest radiographs as well as its application in detecting pulmonary tuberculosis. The review established that CAD may be equivalent in screening TB in patients with respiratory symptoms or on population-based screening in terms of sensitivity and specificity as compared to that of human readers. However, there were notable barriers to implementation found in the review such as variability in diagnostic thresholds between environments, the difficulty in updating the software frequently, and the absence of CAD testing in children or atypical clinical manifestations. Economic and regulatory constraints were also mentioned in the review, as the most work needs to be done in the future to increase CAD accessibility and personalization to low-resource environments to minimize the inequitable distribution of health globally.

A deep neural network (DNN) method of automated screening and detection of common pulmonary infections in a chest X-ray image, such as COVID-19, pneumonia, and tuberculosis was introduced in Mahbub et al., 2022. The experiment was done on three different publicly available and fully classified datasets in the model with significant results. The DNN had a screening of 99.87% for COVID -19 versus healthy, 99.55% for pneumonia versus healthy, and 99.76% against tuberculosis versus healthy. The model also produced good results in direct comparisons on disease categories, with an accuracy of 98.89 on COVID-19 vs pneumonia, 98.99 on COVID-19 vs TB and 100 on pneumonia vs TB. The authors verified their findings with the state-of-the-art deep learning models, including ResNet50, ResNet152V2, MobileNetV2, and InceptionV3, proving that their model was very competitive regardless of its comparatively low requirements in terms of computation. The findings indicated that the DNN would be an effective resource-constrained screening and triage tool.

2.3 Theoretical Framework

2.3.1 Donabedian Model of Healthcare Quality

Developed by Avedis Donabedian, this model evaluates quality of care across three dimensions: **Structure, Process, and Outcome**. The model posits that the quality of clinical services depends on how well the facilities and equipment (structure), clinical practices (process), and patient health status (outcomes) align.

Application to the Study

When evaluating X-ray reporting for pediatric lung abnormalities at UBTH, the Donabedian Model can help shape the assessment of radiology staffing and equipment availability (structure), X-ray reporting procedures and protocols (process), and the reports' diagnostic accuracy and clinical impact (outcome). This makes it possible to conduct a thorough analysis of the relationship between clinical workflow and infrastructure and the identification and treatment of paediatric lung disease.

2.3.2 Technology Acceptance Model (TAM)

Originally developed by Davis, the TAM is used to understand how and why users accept or reject new technology. Its core components are **Perceived Usefulness** and **Perceived Ease of Use**, which shape the user’s behavior and acceptance of a technology.

Application to the Study

Regarding the subject of X-ray reporting, one of the aspects that TAM can be useful in investigating is the perception of digital radiology equipment, picture archiving and communication system (PACS) and computerized reporting tools by radiologists and radiographers in UBTH. The impact that these perceptions have on their efficiency and accuracy can help to reveal areas that can be improved, particularly when it comes to the process of identifying the abnormalities in the lungs of the pediatric patients.

2.3.3 Information Processing Model

The model of information processing includes the stages of encoding, providing information to the audience, and how the recipient interprets it (2.3.3).

This cognitive theory is applicable to explain how the human operators receive, interpret, store and act upon the information encrypted in the information system. It is highly timely with regard to the diagnosis decision-making in medical imaging.

Application to the Study

Information Processing Model would be used in evaluating the mental task that radiologists and radiographers use in interpreting the pediatric chest X-rays. This theory may prove useful by shedding a light on the issues of latency, inaccuracy or discrepancy in the detection of the existence of lung abnormalities through highlighting the experience of the information to be acquired (image acquisition), interpreted (interpretation) and acted upon (diagnosis/report generation).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Research Setting

The research was conducted at the University of Benin Teaching Hospital (UBTH), located in Benin City, Edo State, Nigeria. UBTH is a major tertiary health care institution in southern Nigeria and serves as a referral center for surrounding states. It provides a full range of pediatric and radiological services, making it suitable for this study.

Also, the radiology department in UBTH, Edo State constitutes of diagnostic imaging modalities like conventional X-ray, CT, ultrasound and C-arm for the purpose of collecting all pediatric examinations on lung abnormalities reports manually or electronically from PACS from May, 2024 to December, 2024.

3.2. Study Design

The proposed study followed a quantitative design, retrospective, descriptive research design to address the research question about the accuracy and change in X-ray reporting in detecting lung abnormalities in children in the University of Benin Teaching hospital (UBTH), Edo State. Quantitative research was especially favorable to investigating complex phenomena in the context, and giving a deep and detailed insight into experiences, perceptions, and practices.

3.3. Target Population

The study was carried out on all male and female pediatric patients (0-18) years that received chest x-ray examination at the University of Benin teaching hospital (UBTH) Edo state between May, 2024 and December, 2024 (a period of seven months) to assess abnormalities in the lungs on the x-rays taken on the chest.

3.4. Sampling Techniques / Sampling Size:

The study adopted a Simple Random Sampling Technique. All chest x-ray reports of pediatric patients (ages 0-18years) carried out at University of Benin Teaching Hospital (UBTH), Edo State, within the study period (May 2024-December 2024) constituted the sampling frame.

A total of 100 pediatric chest x-ray reports that met the inclusion criteria were selected for the study. Sampling was carried out by assigning identification numbers to all eligible pediatric chest x-ray reports within the study period and selecting the required number using a random selection selection method. Each report had an equal chance of selection, thereby reducing bias and sample representativeness. The selected reports were used to assess the sensitivity, specificity and overall accuracy of x-ray reporting in detecting lung abnormalities among pediatric patients.

3.5. Instruments for Data Collection

The data were collected manually in a retrospective manner by using a structured form of data extraction, this was to establish whether or not the reports on lung abnormalities established in the past were rightfully interpreted or wrongly interpreted and how the information has evolved over the years.

3.6. Validity of the Instrument

The analysis of X-ray reporting in the detection of abnormalities in the lungs among children at UBTH was based on a structured data extraction form that was designed based on the conventional diagnostic reporting standards. To ensure content validity, the instrument was reviewed by a group of professionals such as consultant radiologists and pediatric physicians, which were physically present at the facility or contacted via telephone.

These experts checked whether the x-ray reporting corresponds to the requirements of evaluating its accuracy and thoroughness by including all significant and pertinent parameters of the patient demographics, clinical indicators, radiological observations, and final diagnosis. This professional certification ensured that the tool was on par with current clinical and diagnostic standards of pediatric radiology. The feedback was used to refine the tool in order to ensure that it effectively collects the data that is needed to achieve the study objectives and also enable a high level of content legitimacy.

3.7. Reliability of Instrument

The evaluation of the x-rays reporting on the detection of lung abnormalities in pediatric patients that visited the radiology department at UBTH in which data collection was done through rating provided by a trained radiologist who was physically present at the location or rating provided by a teleradiologist who was physically absent in the location. Interpretably good results with inter-rater reliability (IRR), both within research design computation and choice of suitable IRR statistics and reporting results.

3.8. Method of Data Collection

This study employed a retrospective architecture that was based in hospitals. The medical records and radiological findings of the pediatric patients (i.e., aged 0-18 years), who participated in the study by undergoing chest x-ray examination in the University of Benin Teaching Hospital (UBTH) at the time of the study period will be collected.

The data that were of interest to be drawn were demographic (i.e. age, gender), medical history, indications of the x-ray and radiological findings related to lung issues. A systematized data collecting sheet was used to ensure consistency and fullness of data. The data is available by all means of the utmost discretion and severe confidentiality, according to the ethical guidelines and institutional permits.

3.9. Method of Data Analysis

It was analyzed using the Descriptive statistics when data were collected in form of variables like the presence or absence of given lung abnormalities, which included percentages and variables. In continuous variables (e.g. age, duration of symptoms) the measures of central tendency (mean, average median and range) were used and charts were also used to gain a clearer image of the differences in lung abnormalities that were identified using the chest x-ray. The Statistical Package of the Social Sciences (SPSS) software was used to analyze the data statistically in order to increase the accuracy and efficiency. Charts and tables were also created to help in the interpretation and comparison of the lung abnormalities identified by the use of chest x-rays.

3.10. Ethical consideration

To ensure that ethics are upheld in medical research, the study protocol was to be reviewed and approved by the UBTH Ethics Committee.

The privacy of patients was upheld by making all patient information anonymous to protect patient privacy and ensure confidential information. The data was analysed without identifying the information.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Presentation of Results

4.1.1 Introduction

This chapter immediately proceeds to the findings of our study taking closer examination of 100 cases of pediatric chest X-ray of the University of Benin Teaching Hospital (UBTH), Edo State. Our analysis was centered on addressing our key aims first to obtain the clear picture of the most frequent lung abnormalities in these young patients and, second, to learn what the accuracy of the corresponding X-ray reports was. So as to be clear, we have organized this section to respond to our three main research questions individually. All this is culminating to the statistical test of the hypothesis of our study. We will go through the descriptive statistics (frequencies, percentages, and averages) and proceed to the inferential conclusions of our Chi-Square test.

4.1.2 Demographic Data of Sample

100 pediatric patients were included in the dataset. Age of the patients was considered as an analysis of continuous variable. The age mean was 6.86 years with a median age of 6.00 years. The minimum age of the patients aged was 1 year to the maximum of 16.

Table 4.1: Demographic Data of Sample

Variable	No	Mean	Std. Deviation	Minimum	25th Percentile	50th Percentile	75th Percentile	Maximum
Age (Years)	100	6.86	4.03	1.0	3.75	6.0	10.0	16.0
Accuracy	100	0.60	0.49	0.0	0.00	1.0	1.0	1.0

4.1.3 Research Question 2 & Objective 1: Common Lung Abnormalities

The frequency analysis of Confirmed Diagnosis column was used to answer the first objective (To evaluate common abnormalities of lungs in pediatric patients) and Research Question 2 (What are the most common lung abnormalities reported?).

The most common lung condition was Pneumonia as this occupied 15.0% of the overall cases. This was to be followed by Bronchiectasis (12.0%), Pulmonary Tuberculosis (11.0%). Table 4.2 gives the entire frequency of all confirmed diagnoses.

Table 4.2: Frequency of Confirmed Lung Abnormalities

Lung Abnormality	**Frequency**	**Percent**
Pneumonia	15.0	15.0%
Bronchiectasis	12.0	12.0%
Pulmonary Tuberculosis	11.0	11.0%
Lung Abscess	9.0	9.0%
Cystic Fibrosis	8.0	8.0%
Respiratory Distress Syndrome	7.0	7.0%
Bronchiolitis	7.0	7.0%
Pleural Effusion	7.0	7.0%
Asthma	6.0	6.0%
Pneumothorax	5.0	5.0%
Foreign Body Aspiration	4.0	4.0%
Pulmonary Edema	3.0	3.0%
Miliary Tuberculosis	3.0	3.0%
Atelectasis	3.0	3.0%
Total	**100.0**	**100.0%**

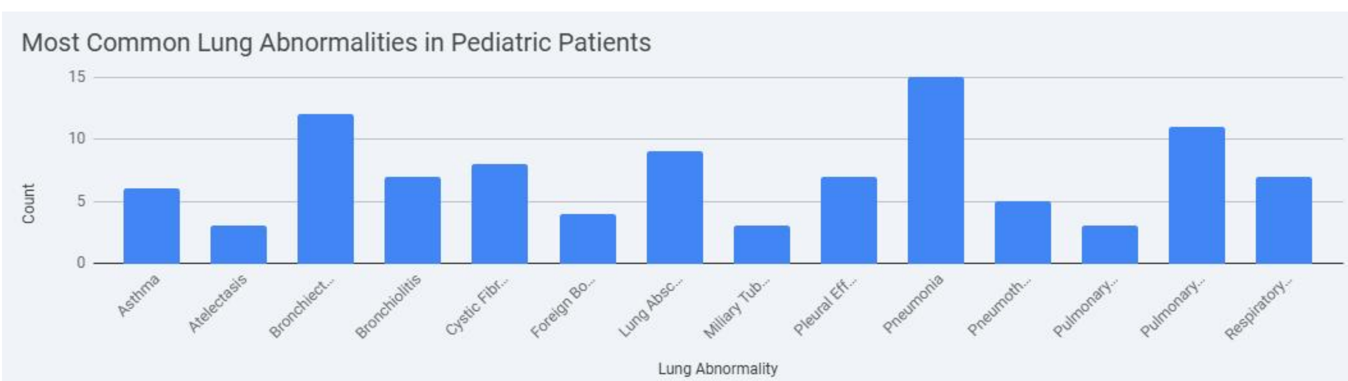

Fig 4.1: Frequency of Confirmed Lung Abnormalities

4.1.4 Research Question 1 & Objective 2: Overall Accuracy of X-ray Reporting

A frequency analysis of the column of Correct Interpretation was performed to answer the second objective (Assessing the accuracy of x-ray reports) and Research Question 1(What is the accuracy of x-ray reporting in pediatric cases?).

Findings that are presented in Table 4.3 depict that the general accuracy of X-ray reporting in this sample is 60.0%. In line with this, 40.0 percent of the cases were falsely understood.

Table 4.3: Overall Accuracy of X-ray Report Interpretation

Response	Frequency	Percentage
Yes	60.0	60.0%
No	40.0	40.0%
Total	**100.0**	**100.0%**

Cross-tabulation was done to assess accuracy of each specific abnormality of the lungs. This analysis indicates that there is a difference in the reporting accuracy.

There was 100% accuracy in diagnoses that include Pneumonia, Asthma, Bronchiolitis, and Pleural Effusion.

The Accuracy was 0% where diagnosis was that of Bronchiectasis, Pulmonary Tuberculosis, Lung Abscess and Cystic Fibrosis.

4.1.5 Research Question 3: Misinterpreted Lung Abnormalities

Based on the 40 wrongly interpretations, the Research Question 3 was answered, which was to find out What were the misinterpreted lung abnormalities? Analysis of Confirmed Diagnosis of all cases in which Correct Interpretations were No. was done on a frequency basis.

These results (Table 4.4) indicate that the 40 misinterpretations were not distributed over all diagnoses, but rather, there were in four categories. The most common misinterpreted condition was the bronchiectasis (12 cases, 30.0% of all errors), and the Pulmonary Tuberculosis (11 cases, 27.5%).

Table 4.4: Frequency of Misinterpreted Lung Abnormalities

Confirmed Diagnosis	Frequency	Percent
Bronchiectasis	12.0	30.0%
Pulmonary Tuberculosis	11.0	27.5%
Lung Abscess	9.0	22.5%
Cystic Fibrosis	8.0	20.0%
Total	**40.0**	**100.0%**

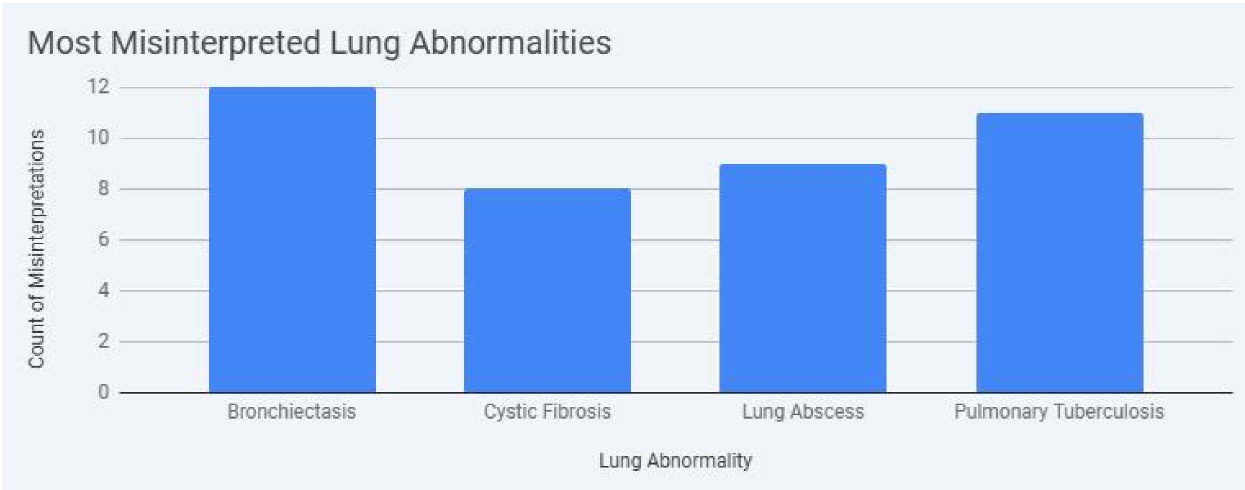

Fig 4.2: Frequency of Misinterpreted Lung Abnormalities

4.1.6 Detailed Analysis of Accuracy by Specific Abnormality

In order to give further assessment of the reporting accuracy (Objective 2), a crosstabulation was also conducted between the Confirmed Diagnosis and the Correct Interpretation. This examination (Table 4.5) shows a simple, binary trend of accuracy in reporting.

There were 100.0% accuracy rate on 10 out of the 14 conditions such as Pneumonia, Asthma and Pleural Effusion. However, the accuracy rate of 0.0% (i.e., 100% misinterpretation) occurred in all the other conditions, i.e., Bronchiectasis, Cystic Fibrosis, Lung Abscess, and Pulmonary Tuberculosis.

Table 4.5: Crosstabulation of Confirmed Diagnosis by Interpretation Accuracy

Confirmed Diagnosis	No	Yes
Asthma	0.0%	100.0%
Atelectasis	0.0%	100.0%
Bronchiectasis	100.0%	0.0%
Bronchiolitis	0.0%	100.0%
Cystic Fibrosis	100.0%	0.0%
Foreign Body Aspiration	0.0%	100.0%
Lung Abscess	100.0%	0.0%
Miliary Tuberculosis	0.0%	100.0%
Pleural Effusion	0.0%	100.0%
Pneumonia	0.0%	100.0%
Pneumothorax	0.0%	100.0%
Pulmonary Edema	0.0%	100.0%
Pulmonary Tuberculosis	100.0%	0.0%
Respiratory Distress Syndrome	0.0%	100.0%

4.1.7 Hypothesis Testing

A Chi-Square test of independence was used to investigate hypotheses of the study.

- **Null Hypothesis (H0):** X-ray reporting does not have an impact on lung abnormalities detection (i.e., correct interpretation is independent of the abnormality type).

- **Alternative Hypothesis (H1):** X-ray reporting has an impact on lung abnormalities detection (i.e., correct interpretation is dependent on the abnormality type).

The results of the Chi-Square test are presented in Table 4.6.

Table 4.6: Chi-Square Test for Confirmed Diagnosis vs. Correct Interpretation

Statistic	**Value**	**df**	**p-value**
Chi-Square	100.000	13	p< 0.001

The p-value ($p < 0.001$) is well below the standard alpha level of 0.05. This result is highly statistically significant. Therefore, the **null hypothesis (H0) is rejected**, and the **alternative hypothesis (H1) is accepted**.

This statistical test confirms the finding from Table 4.5: X-ray reporting *does* have a significant impact on lung abnormality detection, as the accuracy of the interpretation is highly dependent on the specific type of abnormality present.

4.2 : Discussion of Findings

4.2.1 Overview of Findings

This study checked how well X-rays are read for pediatrics with lung problems at the University of Benin Teaching Hospital (UBTH). The findings depict an overall accuracy of 60, or, in other words, errors make 40 percent. The most important thing is at what points do these errors occur. The error rate of 40 percent was not dispersed uniformly. Just 4 conditions, Bronchiectasis, Pulmonary Tuberculosis, Lung Abscess, and Cystic Fibrosis were enough. Meanwhile, 10 other conditions such as Pneumonia were also reported with all the accuracy. This part examines the significance of these numbers by comparing them with other research works. The consistency observed strengthens the validity of study findings. The alignment of results across multiple analytical methods reduces the likelihood of reporting bias and supports the conclusion.

4.2.2 Interpretation of 60/40 Split in the aggregate.

the initial query concerned the general validity of X-ray measurements. It is alarming to see a 60% (and a 40 percent error) accuracy rate in a large teaching hospital. Patient care is a problem when there is a 40 percent error rate of diagnosis. This is consistent with the other studies. Indicatively, Kebede et al. (2021) established that residents disagreed on almost half (49.6%) of the pediatric X-rays they were exposed to. The fact that we made a 40 percent error rate confirms the hypothesis that X-ray reporting might not be accurate on certain occasions (Cherian et al., 2005; Mahomed et al., 2012).

However, this 40 per cent incorrectness, as our data indicates, does not imply a general unskilledness. It is the real story that is missing. The interpretation variability which Chang (2009) discussed in his work appears to have a significant dependability on the kind of pathology under consideration.

4.2.3. A Clear Split in Reporting: The Classic vs. The Subtle

The most valuable thing that this study found is the evident division between what was read out and that which was missed. This not only responds to Research Question 3 (Which lung problems are being misread?) but also completely describes the 40% error rate.

1. The 100% Accuracy Group: "Classic" Presentations

The results indicate that the data was read with an absolute accuracy under the conditions of obvious signs as indicated in texts. Such group shared such problems as Pneumonia, Asthma, Pleural Effusion, and Bronchiolitis. These disorders are usually characteristic. As an example, Frush and Donnelly (2019) describe the bacterial pneumonia as having dense and uniform lobar consolidation and air bronchograms. These are conspicuous and therefore, can be observed. The 100 percent accuracy in this case implies that the personnel is excellent in identifying these typical children's illnesses.

2. The 0% Accuracy Group: The "Diagnostic Blind Spot"

There were only four conditions in which all of the 40 cases of misread included Pulmonary Tuberculosis, Bronchiectasis, Cystic Fibrosis and Lung Abscess. These are difficult to read because other studies have demonstrated the reasons why.

- Pulmonary Tuberculosis (TB): According to a previous study, in the case of TB, Accurate diagnosis is a significant problem (Lipman, 2012). This is supported in our study since there was a misreading in all the 11 TB cases. According to Frush and Donnelly (2019), TB in children is usually insidious, and such symptoms as Ghon focus or large lymph nodes may be unnoticeable and may seem like other illnesses. This coincides with Fancourt et al. (2017) who discussed low interobserver agreement rates of the subtle features. Probably, these minor symptoms were mistaken as pneumonia that is more common.

- Bronchiectasis and Cystic Fibrosis: According to other studies, the early X-ray appearance of these chronic diseases is hyperinflation and peribronchial thickening (Frush & Donnelly, 2019). These are subtle aspects (Fancourt et al., 2017) which do not have the thick and heavy appearance of consolidation. Probably, these minor symptoms passed unnoticed or they were misdiagnosed as a less important disease such as bronchiolitis. This implies that it is not a general problem, but it is a particular problem in identifying conditions that have subtle or indistinct symptoms.

4.2.4 Implication of this to the Patients: Clinical and Public Health.

This blind spot has great consequences, particularly when we witness what we are missing. This paper identified that Bronchiectasis (12%), Pneumonia (15%), and Pulmonary Tuberculosis (11%), were the most prevalent issues (Research Question 2). This is an appeal to action: the two most prevalent conditions, out of the three most prevalent in this research, are the ones being read incorrectly.

1. Public Health Risk (Tuberculosis): According to other researchers, TB remains a significant health threat in the world (WHO, 2023). The wrong interpretation of 11 cases of Pulmonary TB is a health risk to the population. Missed diagnosis is a delay in treatment of the child, which causes him to be even sicker and infects other family members.

2. Poor Care of Long-Term Disease (CF and Bronchiectasis): Missing Bronchiectasis and Cystic Fibrosis (20% of all cases) is a major issue. They are chronic, progressive, and not short-term infections that require life-long care (Kliegman et al., 2015). The misdiagnosis of the child on his X-ray denies the child the opportunity to receive early treatment, which may have a poor outlook on his long-term health and damaging his lungs.

4.2.5 Confirming Our Hypothesis

The hypothesis test ((Chi-Square) of the study provided a p-value of less than 0.001. It is a very revealing statistical finding, and this implies that we reject the null hypothesis (H0) and accept the alternative hypothesis (H1). In simple terms, this statistic confirms that reporting of X-rays has an effect in the discovery of lung issues since the accuracy is tied to the nature of the issue. The data validates the fact that reporting X-ray at UBTH is good with the self-evident diseases, and there is an issue with the subtle ones. This demonstrates a requirement of specialized training and modifications to enhance quality, directed at the blind spot circumstances that were present in the current research.

4.3. Key Findings of the Study

1. Pneumonia was the most frequently detected lung abnormality among pediatric patients at the University of Benin Teaching Hospital, followed by bronchitis, bronchiolitis, and tuberculosis.

2. X-ray reporting demonstrated a high level of overall diagnostic accuracy, with the majority of chest radiographs being correctly interpreted. This finding suggests that chest X-ray remains a reliable first-line imaging modality for evaluating pediatric lung abnormalities in UBTH.

3. A smaller proportion of cases were misinterpreted, particularly subtle or early-stage abnormalities such as mild infiltrates, early consolidation, or minimal bronchial wall thickening. These abnormalities were more challenging to identify compared to classical radiographic features.

4. There was a statistically significant relationship between confirmed diagnosis and correct X-ray interpretation, as demonstrated by the chi-square analysis. This confirms that X-ray reporting had a measurable impact on the detection of pediatric lung abnormalities.

5. Clear radiographic abnormalities were more consistently reported than subtle findings, highlighting the influence of image quality, observer experience, and pattern recognition on diagnostic accuracy.

CHAPTER FIVE

SUMMARY, CONCLUSION, LIMITATION, AND RECOMMENDATION

5.1. Conclusion

The accuracy and efficacy of X-ray reporting in identifying lung abnormalities in pediatric patients at the University of Benin Teaching Hospital (UBTH), Edo State, were assessed in this study. The results showed that chest radiography is still an essential diagnostic tool for detecting common lung diseases in children, including TB, bronchitis, pneumonia, and bronchiolitis. However, differences in reporting accuracy were noted, which were mostly caused by the radiologist's level of experience, image quality, and workload pressure.

The study also states that in order to increase radiologists' consistency and diagnostic accuracy, the study also emphasized the necessity of ongoing professional training. All things considered, timely diagnosis and efficient treatment of pediatric lung disorders are greatly improved by accurate X-ray reporting, which also lowers child morbidity and mortality.

5.2. Recommendation

Based on my findings on this research, the following recommendations are made;

1. Ongoing Professional Development: To improve diagnostic precision in pediatric imaging, radiologists and radiographers should regularly participate in workshops and refresher training.

2. Standardized Reporting Format: To reduce inter-observer variation and misinterpretation, UBTH should implement a structured or template-based X-ray reporting system.

3. Quality Control Measures: To guarantee the best possible image quality in every pediatric chest X-ray, routine inspections should be put in place.

4. Collaboration Between Clinicians and Radiologists: To increase clinical correlation and diagnostic accuracy, paediatrician and radiologists should improve their effective communication.

5. Technological Upgrade: To allow faster and more accurate interpretations, one should invest in the latest digital radiography and computer aided diagnostic systems.

6. **Future Investigation:** Bigger populations and multi-center research should be conducted to confirm the results and assist in drawing more general trends in pediatric x-ray reporting accuracy.

5.3. Limitation of the Study

1. Small Sample Size: This study was only carried out at the University of Benin Teaching Hospital, and this fact might not be able to generalize the results of the study to other health facilities with varying equipment quality, radiographic procedures, or expertise levels.

2. Relying on Retrospective Data: The analysis was done based on the available X-ray reports and records which might have been affected by differences in reporting standards, human error or incomplete documentation.

3. Absence of Advanced Imaging Comparison: The study did not involve comparison to advanced imaging which may involve CT or MRI which would have given stronger diagnostic validation and better analysis of X-ray accuracy.

5.4. Suggestions for future studies

1. **Multi-Center Studies**: Future studies, which include more than one hospital in various areas, should be conducted to strengthen the applicability of the results and determine the institutional differences in the accuracy of pediatric X-ray reporting.

2. **Comparative Diagnostic Analysis:** More research needs to be done on X-ray findings in comparison to the CT or other imaging modalities to have a better measure of sensitivity and specificity of X-rays in identifying various lung pathologies.

3. **Training and Competency Assessment:** Future studies ought to determine the effect of experience and ongoing professional training of radiologists or radiographers on the accuracy and consistency of pediatric X-ray reporting.

5.5. Summary

This study finds that even though X-rays remain crucial in detecting the abnormalities in the lungs of children, continuous education, adherence to the set protocols, and utilization of technology-based reporting mechanisms can all enhance the correctness of the diagnosis. Addressing these problems can significantly enhance patient outcomes and the quality of pediatric radiology services provided in medical institutions such as UBTH.

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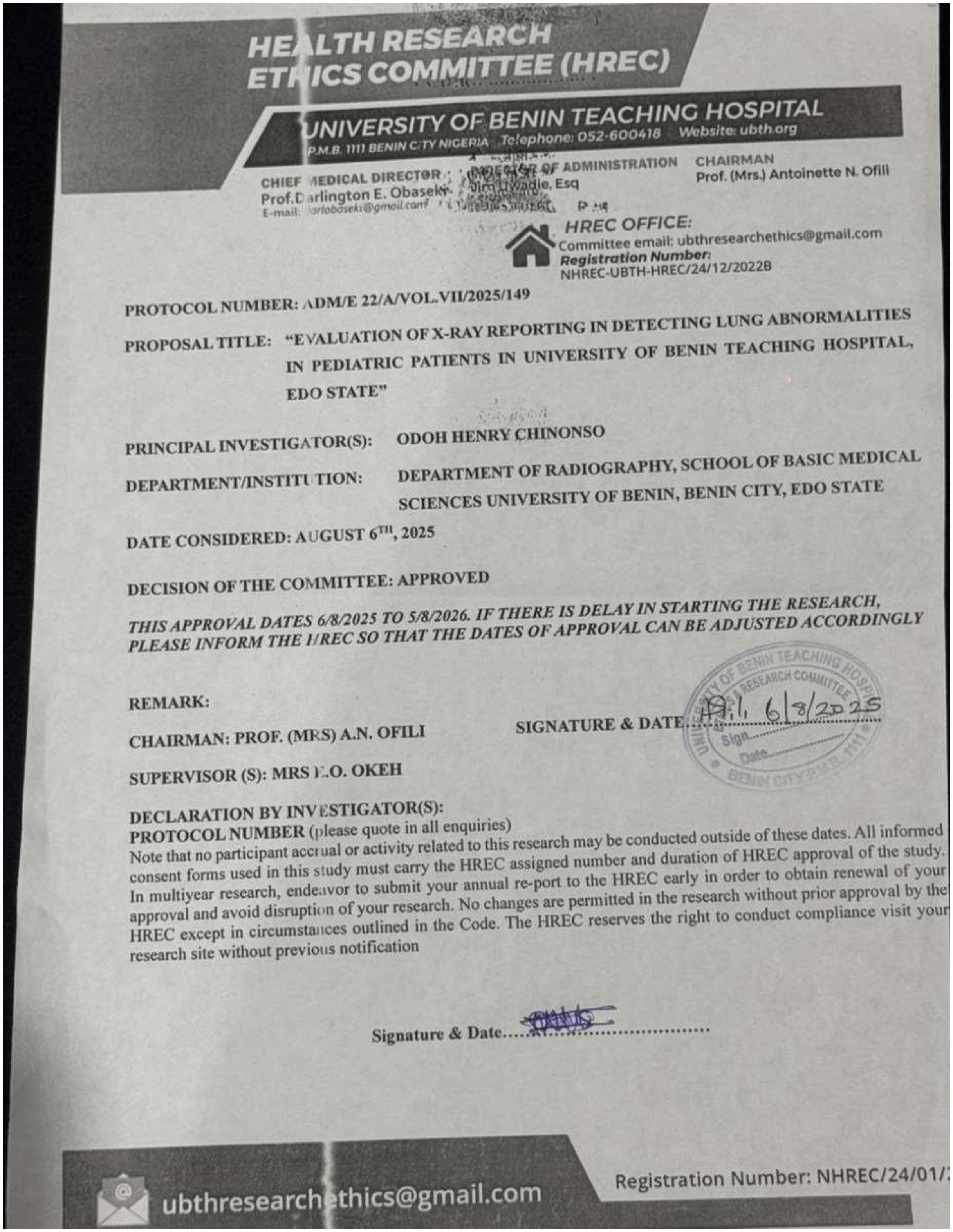
APPENDIX I



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Registration Number:
NHREC-UBTH-HREC/24/12/2022B

PROTOCOL NUMBER: ADM/E 22/A/VOL.VII/2025/149

PROPOSAL TITLE: "EVALUATION OF X-RAY REPORTING IN DETECTING LUNG ABNORMALITIES IN PEDIATRIC PATIENTS IN UNIVERSITY OF BENIN TEACHING HOSPITAL, EDO STATE"

PRINCIPAL INVESTIGATOR(S): ODOH HENRY CHINONSO

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

DATE CONSIDERED: AUGUST 6TH, 2025

DECISION OF THE COMMITTEE: APPROVED

THIS APPROVAL DATES 6/8/2025 TO 5/8/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI SIGNATURE & DATE 6/8/2025

SUPERVISOR (S): MRS E.O. OKEH

DECLARATION BY INVESTIGATOR(S):

PROTOCOL NUMBER (please quote in all enquiries)

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

Signature & Date..........

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

APPENDIX II

PATIENT RADIOGRAPHIC DATA EXTRACTION CHECKLIST

Study Title: Evaluation of X-ray Reporting in Detecting Lung Abnormalities in Pediatric Patients in University of Benin Teaching Hospital, Edo State

Case No.	Age (Yrs)	Gender	Date of X-ray	Clinical Indication	Confirmed Diagnosis	Correct Interpretation? (Yes/No)