ENSIGN GLOBAL UNIVERSITY

KPONG, EASTERN REGION, GHANA

DEPARTMENT OF COMMUNITY HEALTH

PATTERNS AND OUTCOMES OF PAEDIATRIC ADMISSIONS AT THE HO TEACHING HOSPITAL IN THE VOLTA REGION OF GHANA (JANUARY 2021-DECEMBER 2023)

BY

NANA AKOSUA AMOAH

JUNE 2025

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A Thesis submitted to the Department of Community Health in the Faculty of Public Health in partial fulfilment of the requirements for the degree

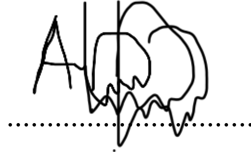
MASTER OF PUBLIC HEALTH

JUNE 2025

DECLARATION AND CERTIFICATION

I confirm that this thesis is my original work, guided by my supervisor. All sources have been appropriately cited, and this work has not been submitted for any other degree.

Nana Akosua Amoah



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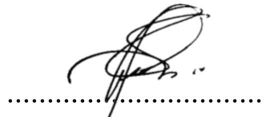

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(Head of Academic Programme) Signature Date

DEDICATION

I dedicate this work solely to my ever-present, ever-loving mother, Ms Mabel Naa-Abam Ahingwah, who has been my most outstanding support and encouragement throughout this life journey.

ACKNOWLEDGEMENT

I sincerely thank God Almighty for giving me the strength and grace to finish this project successfully. I profoundly appreciate the invaluable guidance and steadfast support from my supervisor, Dr. Edward Kofi Sutherland. Furthermore, I want to express my gratitude to my mother, Ms. Mabel Naa-Abam Ahingwah, for her continuous encouragement and support throughout my pursuit of this degree. I also thank Dr. (Med) Jennifer Nana Efua Adrah and Mr. Amos Sorengmen Ziema for helping me with institutional approval and data handling, respectively. A special mention goes to all my friends and family who consistently checked in on me and offered their guidance during this journey. Lastly, I commend myself for the dedication and effort I put into completing this project, despite the obstacles I faced.

LIST OF ABBREVIATIONS

CHER	Child Health Emergency
COVID-19	Coronavirus Disease
DAMA	Discharged Against Medical Advice
DOAD	Developmental Origins of Adult Disease
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immunodeficiency Syndrome
HTH	Ho Teaching Hospital
ICD-10	International Classification of Diseases- 10th Edition
ICD-11	International Classification of Diseases- 11th Edition
ID	Identification
LHIMS	Lightwave Health Information Management System
LOS	Length of Stay
MS Excel	Microsoft Excel
NHIS	National Health Insurance Scheme
NICU	Neonatal Intensive Care Unit
NGO	Non-Governmental Organization
OPD	Outpatient Department
PML	Princess Marie Louise children hospital
SCD	Sickle-Cell Disease
SDG	Sustainable Development Goals
SD	Standard Deviation
U5MR	Under-five Mortality Rate
URTI	Upper Respiratory Tract Infection
UK	United Kingdom
WHO	World Health Organisation

ABSTRACT

Background: Assessing paediatric admissions and outcomes is essential for understanding disease burden and identifying causes of mortality. This study aimed to document paediatric admissions' morbidity patterns and outcomes at the Ho Teaching Hospital in the Volta Region, Ghana.

Methodology: This retrospective descriptive study assessed paediatric admissions and outcomes (from 0 to 11 years) at the Ho Teaching Hospital, Volta Region in Ghana, from January 1, 2021, to December 31, 2023. The age, sex, insurance status, diagnoses, length of stay, and outcome of paediatric admissions within the study period were retrieved from the LHIMS. The data were analysed using Microsoft Excel. Diagnoses were grouped under the 22 broad ICD-10 classifications.

Results: There were 6298 paediatric cases admitted over the study period. Males were 3596 (57.1%) and females were 2702(42.9%), giving a male: female ratio of 1.3:1.80% of these patients were aged < less than 5 years. Certain conditions originating from the perinatal period (32.4%), certain infectious and parasitic diseases, and respiratory system diseases were the leading broad ICD-10 classifications. Neonatal jaundice 781(30.8%), neonatal sepsis and infections 401(15.8%), and prematurity 336(13.3%), then malaria 507(13.5%), trauma/poisoning 443(11.8%), sickle-cell disease and all other forms of anaemia 291(7.7%) and pneumonia 280(7.4%) were the specific leading causes for neonates and children 1month and above, respectively. Average LOS was 6.8 ± 17.1 days, while the overall mortality rate was 5.6% and the neonatal mortality rate was 9.2%. Certain conditions originating in the perinatal period (49.7%) contributed the most to deaths.

Conclusion: There are many neonatal admissions at Ho Teaching Hospital, which contributes mainly to more non-infectious causes of paediatric admissions than expected. Neonatal jaundice, malaria and trauma were the leading causes of morbidity. Mortality among neonates was higher than observed in other studies.

Keywords: Paediatric admissions, length of stay, outcomes, Teaching Hospital, Ho, Infectious, Non-infectious

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Assessing paediatric admissions and outcomes in any population is fundamental for understanding the disease burden and determining the primary causes of mortality. According to the World Health Organisation (WHO, 2022), childhood mortality has significantly reduced since 1990. As of 2022, under-five mortality had decreased by 59%, with a slower decline observed for neonatal mortality (WHO, 2022). Research has shown that, in 2022 alone, 4.9 million under-5 deaths were recorded, of which 47% were newborn deaths (WHO, 2022). Though global trends indicate a slow decline, childhood survival varies significantly among the regions of the globe (WHO, 2022). The global under-5 mortality rate (i.e. probability of dying by age 5 per 1000 live births) is 37%, with the African region leading all regions with a 70% rate. Unfortunately, children born in Sub-Saharan Africa and Southern Asia are more likely to die in their first month of life than those born in the Australian and New Zealand regions (WHO, 2022). 80% of the 4.9 million under-5 deaths were recorded in Sub-Saharan Africa and Southern Asia, with the former having the highest neonatal mortality rate of 27 per 1000 live births (WHO, 2022).

However, in the Sub-Saharan region, the childhood mortality rate varies by country. Nigeria leads with an under-5 mortality rate of 107.20 %, while Ghana's rate is 42.34% (WHO, 2022). Nigeria's neonatal mortality rate is about 34%, and Ghana's is 21.1%, revealing the peculiarities of child mortality burdens in specific countries in the region (WHO, 2022).

Additionally, it is worth mentioning that the children, adolescents and youth (5-24 years) mortality rate is less than half that of under-5 deaths, i.e., an estimated 2.1 million deaths in 2022 (Hug et al., 2023) as against U5MR of 4.9 million in the same year. However, 62% of the

deaths occurred in the age bracket of 15-24 years, and over 69% of the 5-24 years deaths occurred in Sub-Saharan Africa and Southern Asia (Hug et al., 2023). Ahmed et al. (2022) state that "mortality indicators are still considered a starting point for health status evaluation even after marked decline in mortality rates" and consider childhood mortality a vital indicator for evaluating child health. Enyama et al. (2024) also consider child health as a fundamental human right, and thus, illness of a child often leads to disability and impairment in the child's activities as well as distortions in family activities following admissions. Child morbidity and hospital admissions come with financial burdens to the government, health system and parents, according to Ahmed et al.(2022). Hence, reducing preventable causes of hospital admissions will reduce this burden.

Moreover, unlike in developed countries where mortality from non-communicable diseases is increasing, preventable, infectious, and communicable diseases are the leading causes of childhood morbidity and mortality in Sub-Saharan Africa (Ahmed *et al.*, 2022). A systematic review and meta-analysis by Kortz et al. (2024) on the aetiology of hospital mortality in children in low and middle-income countries showed that the most common causes of paediatric admissions were respiratory, non-organ-specific infectious diseases and gastrointestinal conditions. Central Europe saw the highest rate of hospital admissions for respiratory conditions. In contrast, Sub-Saharan Africa led in admissions for non-specific contagious diseases, and South Asia had the highest admissions rate for gastrointestinal issues (Kortz *et al.*, 2024). According to Enyama et al. (2024),various patterns in disease conditions lead to mortality in the Sub-Saharan region. For instance, in Ethiopia, lower respiratory tract infections and asthma are the leading causes of admissions, whilst malnutrition and infections account for most mortalities. In contrast, severe malaria, septicaemia and pneumonia were both the leading causes of hospital admissions and mortality in Nigeria. Severe malaria alone was the leading cause of hospital admission, but coma and impaired consciousness were associated

with deaths in Cameroon. A study conducted by Tette et al. (2016) at the Princess Marie Louise Hospital in Accra, Ghana, to identify the changing patterns of disease and mortality over 10 years (2003-2013), highlighted a tripling in admissions for malaria, malnutrition and HIV. However, mortality rates from these diseases had declined, but the mortality rate for pneumonia was rising. There are very few published studies on current admission patterns and outcomes of children in Ghana, which is what this research seeks to describe.

1.2 Problem Statement

Paediatric morbidity and mortality to date are considered a significant public health threat, and thus, measures have been put in place to curb the situation. Work is progressing from Millennium Development Goal 5 to Sustainable Development Goal 3 to reduce U5MR and neonatal mortality by 2030. However, looking at the regional and country trends, it is estimated that 59 countries will not meet the U5MR of 25 deaths per 1000 live births (Hug et al., 2023). Consequently, 64 countries will not meet the target of 12 neonatal deaths per 1000 live births (Hug et al., 2023). Ghana, among many other sub-Saharan countries, is a victim of this predicament. To accelerate our efforts to reach the SDG targets, local data on the disease conditions leading to morbidity and mortality in the paediatric population must be gathered.

Moreover, Fathalla and Fathalla (2005) stated clearly in the practical guide for health researchers that relying solely on mortality rates to gauge a health issue's severity has limitations. The first is that mortality at a young age cannot be equated with mortality at old age, but rather, it is the number of life years lost that matters, not the mortality rate. Secondly, morbidity leads to disability, which dramatically affects the quality of life and hence must not be ignored. The entire family, community, and nation are affected when a child falls ill.

Therefore, this study seeks to describe the patterns in paediatric admissions and their outcomes (considering both morbidity and mortality) at a tertiary referral hospital serving a larger rural

population in the Sub-Saharan region. In comparison, countries like Nigeria and Kenya (Kortz *et al.*, 2024) are keenly researching to identify key areas in paediatric mortality to work on; however, only a few articles have been published on this subject in Ghana. This study, therefore, will illuminate the significant causes of paediatric admissions and their outcomes within this urban-rural population to inform interventions and reach the SDG Target 3.

1.3 Rationale of Study

The rationale for this study is to first contribute to scientific knowledge and evidence-based practices relating to patterns in paediatric admissions and outcomes in sub-Saharan Africa, considering the burden of paediatric mortality experienced in the sub-region. Additionally, it is worth noting that patterns in hospital admissions and their outcomes are likely to reflect the disease burden in a population and, therefore, can offer surveillance data for paediatric health interventions (Leone et al., 2023).

Furthermore, this study is being conducted to provide a broader view of the patterns of paediatric admissions and their outcomes in the only tertiary facility in the Volta region, serving as a foundational study for further studies on paediatric health. Again, the highest level of healthcare in the Volta region was chosen for this study because, over the years, a more significant number of rare genetic diseases diagnosed in children at the Korle-bu Teaching Hospital (which was and still is the country's major referral centre) have been traced to come from the region (Badoe, 2016).

1.4 Conceptual Framework

The conceptual framework for this study is a modified form of the ecological systems theory crafted by Urie Bronfenbrenner, an American psychologist. He used the framework to explain

how children's inherent qualities and environments interact to influence their growth and development (The Psychology Notes Headquarters, 2024).

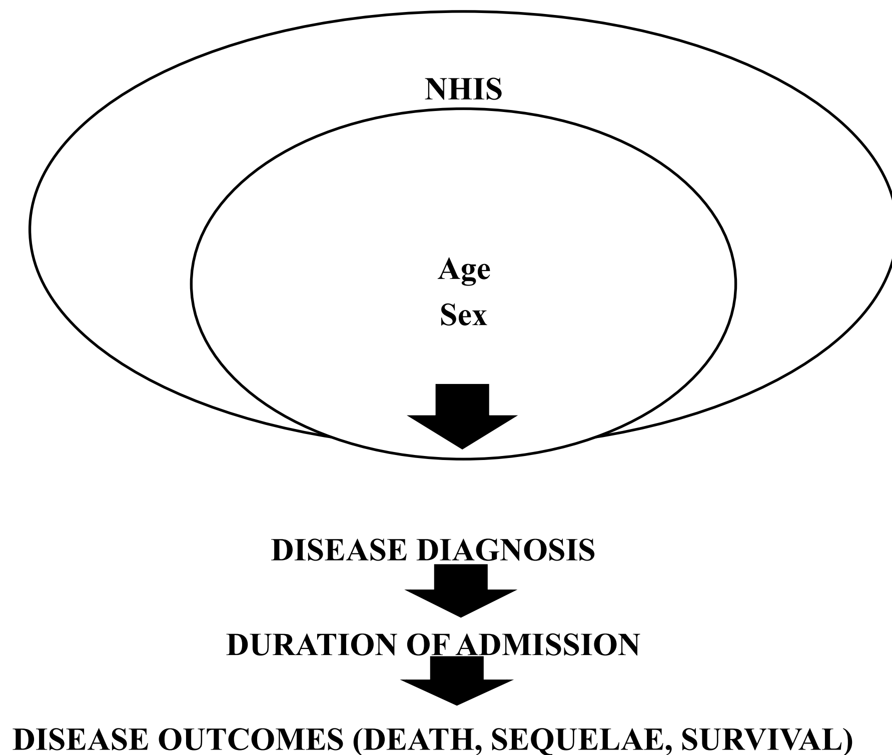

Figure 1.4. 1 *A modified conceptual framework from Bronfenbrenner's Ecological Systems Theory*

The modified framework describes how a child’s age, sex, and status on National Health Insurance may influence their disease diagnosis, which will further impact the duration of admission and overall outcome. This model was applied descriptively to determine these variables among paediatric admissions at the Ho Teaching Hospital.

1.5 Research Questions

1. What socio-demographic patterns are observed with paediatric admissions at the Ho Teaching Hospital?
2. What is the pattern of disease conditions admitted at the paediatric department of the

Ho Teaching Hospital?

3. What is the average length of stay at the paediatric department following admission to the Ho Teaching Hospital?
4. What are the outcomes of paediatric admissions (death, sequelae, and survival) at the Ho Teaching Hospital?

1.6 General Objective

To describe the patterns and outcomes of paediatric admissions at the Ho Teaching Hospital in the Volta Region of Ghana.

1.7 Specific Objectives

1. To assess the socio-demographic characteristics (age, sex, insurance status) of paediatric admissions at the Ho Teaching Hospital.
2. To describe the pattern of disease conditions admitted at the paediatric department of the Ho Teaching Hospital.
3. To determine the average length of stay of paediatric admissions at the Ho Teaching Hospital.
4. To describe the outcomes (death, sequelae and survival) of paediatric admissions at the Ho Teaching Hospital.

1.8 Profile of Study Area

The Paediatric department is one of the major departments of the Ho Teaching Hospital. The hospital was formerly known as the Volta Regional Hospital until April 29, 2019, when it was re-commissioned as a teaching hospital, becoming the fifth public teaching hospital (Ho

Teaching Hospital, 2024). It is the main tertiary referral point in the Volta Region. The hospital in the region's capital, Ho, attracts patients from neighbouring regions and other West African countries such as Togo, Benin, and Nigeria. The hospital also serves as a teaching facility for the University of Health and Allied Sciences (Ho Teaching Hospital, 2024).

The hospital has a 345-bed capacity overall. It provides specialised healthcare services in all four major medical disciplines: medicine, surgery, obstetrics, and gynaecology, as well as a range of subspecialist services.

The Paediatric inpatient department comprises a Child Health Emergency Unit (CHER), which was established in September 2023 - where all emergency paediatric cases are received, a Neonatal Intensive Care Unit (NICU) - where all newborns who require medical care are managed, a Babies Unit – which serves as a ward for all babies below 6months of age, and a Children's Unit- for all children 6months to 12years. The Children's ward is a 25-bed ward with an average yearly admission of about 950 children (Orish *et al.*, 2022).

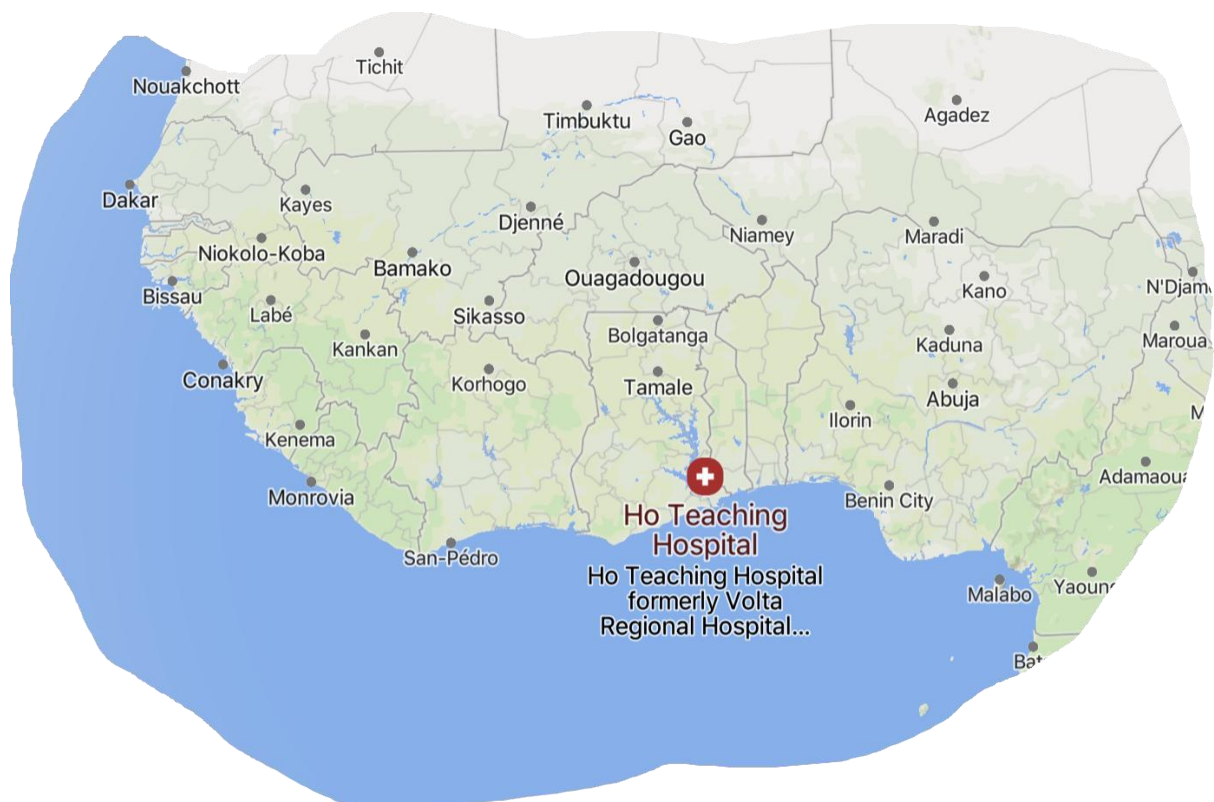

Figure 1.8. 1 *The Ho Teaching Hospital of Ghana in the Western Sub-Saharan Region*

Source: https://www.bing.com/maps

1.9 Scope of Study

This is a descriptive retrospective study of paediatric admissions and outcomes at the Ho Teaching Hospital, Volta Region, Ghana, from January 1, 2021, to December 31, 2023. Paediatric patients aged 0 to 12 admitted within the study period were enrolled.

1.10 Organisation of Report

The study is organised into six chapters. Chapter One covers the study's setting, including the background, problem statement, rationale, research questions, and objectives. Chapter Two presents a detailed literature review relevant to the topic. The methodology, including the research design, study population, sampling, pretesting, and inclusion and exclusion criteria, is outlined in Chapter Three. Chapter Four presents the findings from the data analysis, while Chapter Five discusses the study's major findings. Finally, Chapter Six provides conclusions drawn from the study and offers recommendations for improvement in the research area.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of the Health System in Ghana

A health system overview report by the Demographic Health Survey Program in Ghana highlighted that healthcare in the country faces challenges, including combating diseases linked to poverty, addressing HIV/AIDS, dealing with inadequate resources, and managing a growing population. The report adds that health reforms aim to improve access, quality, efficiency, and community engagement, and health service delivery encompasses public, private, NGO-led, and traditional health services. Health facilities in Ghana range from health centres and district hospitals to regional and teaching hospitals. Most public health priorities focus on reproductive and child health, immunisation programs, and addressing significant diseases like malaria, respiratory infections, malnutrition and, more recently, non-communicable diseases among the working and ageing population. A significant challenge is the disparity in healthcare provider distribution across regions, particularly in rural areas, resulting in shortages partly due to high rates of professionals seeking opportunities abroad (Overview of the Health System in Ghana, 2017).

2.1.1 Teaching Hospitals

Teaching hospitals serve as specialised centres for advanced health care and demonstrate excellence in their services. The governance of these hospitals is unique due to the involvement of various stakeholders, including the Ministry of Health, the Ministry of Education, and local political influences; they hold significant social and political importance. The care provided in these institutions requires advanced technology and a skilled workforce. They possess a high concentration of resources, making their operation relatively costly. Additionally, they play a

crucial role in training health professionals through preservice and in-service education. Teaching hospitals fulfil several key functions, including:

- Health care delivery- They deliver complicated tertiary care and contribute to preventive services while participating in public health initiatives for the local community and the primary health care network. These facilities receive referrals from both the district and regional levels. They are also pivotal in disseminating information on various health issues and diseases. Furthermore, they offer alternatives to hospitalisation, such as day surgery, home care, home hospitalisation, and outreach services.

- Quality of care - Teaching hospitals are expected to lead in establishing high clinical standards and treatment guidelines. The highest quality of care available in the country should be accessible at these institutions.

- Access to care - Patients may only reach teaching hospitals through a comprehensive referral system.

- Research - Due to the abundant resources and skilled personnel, teaching hospitals are vital in addressing local and national health challenges through research.
- Teaching and training - One of the primary roles of teaching hospitals is their educational function, as they provide both basic and advanced training for healthcare professionals (Overview of the Health System in Ghana, 2017).

Ghana has five main teaching hospitals, starting with the Korle-Bu Teaching Hospital located in Accra. The second is the Komfo Anokye Teaching Hospital in Kumasi. Additionally, there are the Ho Teaching Hospital in the Volta Region and the Cape Coast Teaching Hospital in the Central Region. The fifth teaching hospital is the Tamale Teaching Hospital in the Northern

Region. These hospitals are strategically positioned as referral centres for health facilities in their respective regions (Teaching Hospitals in Ghana: About, Location, and Contact Details, 2025).

2.2 Paediatrics

The term “paediatric,” or “pediatric,” as it is spelt in some regions, has its roots in the Greek language. It combines the words “paedo,” which means “children,” and “iatros,” which means “physician.” This specialised field of medicine is dedicated to the comprehensive healthcare of children, addressing their unique physical, emotional, and developmental needs. Childhood, a pivotal stage of life, is typically defined as the period from birth to puberty. However, the scope of paediatrics extends beyond this period to embrace adolescent medicine, with various definitions considering the adolescent phase to last until the age of 21 (Strouse, Trout and Offiah, 2022).

This broader perspective suggests that the transition from childhood to adulthood is not marked by a single, definitive moment, such as reaching 18 or 21, but rather unfolds gradually as individuals progress through various stages of growth and maturation. In this way, paediatrics is crucial in guiding young people through their early years and adulthood, providing necessary medical care and support during this vital transition. The US Department of Health and the Food and Drug Administration provide guidelines for selecting paediatric experts for advisory panels that outline age brackets for different life stages. These stages are defined as: (1) infancy, which encompasses birth to 2 years; (2) childhood, covering ages 2 to 12; and (3) adolescence, spanning from 12 to 21 years. Furthermore, the American Academy of Paediatrics’ Bright Futures guidelines categorise adolescence as occurring between 11 and 21 years, further breaking it down into early adolescence (ages 11–14), middle adolescence (ages 15–17), and late adolescence (ages 18–21) (Hardin et al., 2017).

According to the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the age stages of paediatric terminology include preterm neonatal- the period at birth when a newborn is born before the full gestational period, term neonatal- birth to 27 days, infancy, 28 days–12 months, toddler-13 months–2years, early childhood-2–5years, middle childhood-6–11 years early adolescence-12–18 years, late adolescence-19–21 years (Williams *et al.*, 2012).

In almost all Ghanaian hospitals, including tertiary hospitals, paediatric admissions have an age cut-off of 12 years, which affects the age range of patients admitted to the paediatric wards. However, in exceptional situations, as children who are being managed for childhood cancers and transition into adolescence, they are still provided care by their paediatricians even when they turn 12 years old and sometimes over when they are being treated. This differs in other countries, for instance, in rural Sierra Leone, children aged up to 14 years are admitted to the paediatric ward (Afolabi *et al.*, 2023).

2.3 Relevance of Paediatric Research

Over the years, adult medical research has identified that events in foetal and neonatal life can have profound consequences for the whole of adult life in those who survive; some adult conditions, such as metabolic syndromes and cardiovascular diseases, have been classified under Developmental origins of adult diseases (DOAD) (Stephenson, 2024; Barker, 2004; Gitterman, Hay and Langford, 2022). This has highlighted the importance of the early years of life and how early interventions for childhood conditions will help survival in adulthood. To identify, implement and measure these interventions, paediatric research becomes mandatory. This goes to the extent of involving children in clinical trials (Speer *et al.*, 2023).

2.4 Paediatric Admissions

In the hospital setting, admissions are made in various ways (Leyenaar *et al.*, 2023). One standard route is through the emergency department, where patients are admitted, stabilized, and then transferred to the ward for continued care. Another standard admission route is through the Outpatient Department; based on the management mode, the clinician attending to the patient determines whether it is appropriate according to the management protocol. More often, a patient attending the outpatient department (OPD) is likely to be discharged rather than admitted to the ward, unlike the emergency room, where a patient presenting is more likely to be admitted or transferred to the main paediatric ward for further care and management (Umar, Muhammed and Gwarzo, 2018; Abhulimhen-Iyoha and Okolo, 2012). The emergency room is also considered a ward, and from there, a patient can be discharged home, referred to another facility, die, abscond, request a discharge against medical advice, or transferred to the main paediatric ward for further management (Agbesanwa *et al.*, 2023). The above-mentioned routes of admission are the most common in the hospital setting.

Peculiar to the paediatric department is the neonatal and baby unit, which also receives admissions in the ways mentioned above, but also receives direct admissions from the obstetrics department to the NICU. Even in cases where a patient is referred from one hospital to another, the patient either goes through the paediatric emergency department, the paediatric outpatient department if stable enough, or is directly admitted to the NICU, as neonates are often received from the obstetrics department.

Information regarding trends in paediatric admissions and the underlying causes of mortality among children is essential for guiding efforts to enhance child survival. Understanding these patterns enables a more targeted approach to addressing the most significant threats to child health. It ensures that resources are allocated effectively to improve outcomes for vulnerable populations (Afolabi *et al.*, 2023).

2.4 Disease Classification in Paediatrics

The International Classification of Diseases (ICD) is the global standard for diagnostic health information in adult and paediatric medicine. For many years, this framework has served as the primary standard for analysing and comparing statistics related to the causes of death and illness across different geographic regions and throughout various periods (Harrison *et al.*, 2021). This comprehensive approach allows researchers, policymakers, and public health officials to track trends, identify patterns, and assess the effectiveness of interventions in addressing health crises. A consistent evaluation method enables a better understanding of the factors influencing mortality and morbidity rates, contributing to more informed decisions to improve population health.

The International Classification of Diseases (ICD) was created by the World Health Organisation (WHO) in 1948 to track, report, and analyse global health data accurately. Its origins date back to the 18th century, with contributions from François Bossier de Sauvages de Lacroix and others (Teyie, 2024). The ICD-10, which replaced ICD-9 after being endorsed by the WHO in 1992, features an alphanumeric coding system that enhances granularity; the first three digits represent disease categories, while subsequent characters provide further detail. This classification comprises 22 chapters, covering a range of health conditions, from certain infectious and parasitic diseases in chapter one to codes for special purposes in chapter 22 (ICD-10-CM TABULAR LIST of DISEASES and INJURIES, 2022).

Since the late 1800s, the International Classification of Diseases and Related Health Problems (ICD) has been essential for tracking cause-of-death statistics (Wood, 1990). Over time, countries have expanded the use of the ICD beyond just mortality data to include statistics on illness, health funding, research, and patient care (Boerma *et al.*, 2016). The ICD is regularly updated to reflect new medical knowledge (Jetté et al., 2010; Boerma et al., 2016). The latest

version, ICD-11, is designed for digital use and includes coding, browsing, translation, review, and mapping tools. It also aims to work well with other classifications and terminologies

(Boerma *et al.*, 2016). New coding tools for low-resource settings have also been added to the ICD. The 11th revision of the ICD, known as ICD-11, is the most recent update and has been developed with the help of medical professionals, statisticians, classification experts, and other users. ICD-11 is unique because it creates specific classifications using a foundational database containing approximately 47,000 entries (Boerma *et al.*, 2016). These entries have 13 properties: body system, cause, effects, and symptoms. This foundation supports the main structure of the ICD, which now includes 26 chapters and specialised classifications tailored to different fields (Boerma *et al.*, 2016). The World Health Assembly approved ICD-11 in May 2019, and transitioning to its implementation is underway (Harrison *et al.*, 2021).

2.5 Socio-demographic characteristics of paediatric admissions

The demographic features of patients admitted to hospitals provide valuable information about the health dynamics of the study population, helping to identify the distinct healthcare needs of various societal groups. Numerous studies have highlighted the importance of demographic information in understanding disease trends and healthcare utilisation.

According to Ahmed et al., a retrospective 1-year review conducted in Gadarif Hospital in Eastern Sudan in 2022 showed that most, 453 (61.2%) of the admissions were males, as compared to 287 (38.8%) who were female, with a male: female ratio of 1.57:1. In a similar study conducted by Okoronkwo, Onyearugha and Ohanenye, (2018). In a private hospital in Nigeria, the Living Word Mission Hospital, Aba, Nigeria, a 3-year review in this case also showed a male-to-female ratio of 1.5:1. Both studies above excluded neonates. A similar survey on neonatal admissions highlighted more male than female admissions (Ali, Ahmed and

Lohana, 2013; Tette et al., 2020). Another close-to-home study by Adadey et al. (2019), looking at the patterns of frequently diagnosed paediatric morbidities in hospitalised children below age 5 in the Volta of Ghana, also showed that there were more male admissions compared to females.

Additionally, the commonest age groups mostly admitted to the paediatric wards are less than 5 years old and predominantly between the ages of 1 and 5 years in the developing regions (Abhulimhen-Iyoha and Okolo, 2012; Ahmed et al., 2022; Enyuma et al., 2019; Kareem, 2022 Oguonu et al., 2014; Okoronkwo, Onyearugha and Ohanenye, 2018). This trend is also seen among the genders admitted as well (Mehdi *et al.*, 2020). However, in the European region, there were more attendings for the age group 5- 15 years in a comparison study in the paediatric emergency departments of two European hospitals with different paediatric primary care setups (Poropat *et al.*, 2017).

Furthermore, health insurance is one requirement that alleviates the burden of hospital admissions for all persons, including children. According to Anaba et al., enrolment in health insurance offers financial access to healthcare services and minimises the chances of facing overwhelming healthcare costs. The study, conducted in 2022, analysed the factors associated with insurance enrolment among Ghanaian children under five years using secondary data from the 2017/18 Ghana Multiple Indicator Cluster Survey. The study found that more under-fives have health insurance, just as another study by Orish et al. (2022). Also, children from urban areas and females tend to be enrolled on health insurance than males and those from rural areas.

In an adult study by Amu et al., to understand the variations in health insurance coverage in four African countries in 2018, including Ghana, the implementation system used in the country caused Ghana to have the highest coverage.

2.6 Patterns of disease conditions among paediatric admissions

In a 2009 study in one of Pakistan's secondary hospitals on neonatal admissions by Ali, Ahmed and Lohana, (2013), it was found that prematurity and infection were the main reasons for admission (27.9% and 20.33%, respectively), followed by birth asphyxia (13%) and neonatal jaundice (11.3%). In a similar study in a tertiary hospital in Addis Ababa, it was found that the most common primary diagnoses at admission to the neonatal care unit were pre-maturity with respiratory problem (36.6%), neonatal sepsis (22.7%), and asphyxia (16.2%)(Tekleab, Amaru and Tefera, 2016).

Another registry-based cohort study over 10 years in Kilimanjaro Christian Medical Centre, Northern Tanzania among neonates also found that the leading causes of admission were birth asphyxia (26.8%), prematurity (18.4%), risk of infection (16.9%), neonatal infection (15.4%), and birth weight above 4000 g (10.7%) (Mmbaga *et al.*, 2012). Additionally, a study in a regional and district hospital in the Upper West region of Ghana by Tette et al., in (2020), found that neonatal sepsis was the most typical cause of admission as well as the commonest infection occurring in 747(37.3%) neonates, followed by birth asphyxia in 303 (15.1%), prematurity in 265(13.2%), low birth weight, 199 (9.9%), neonatal jaundice155 (7.7%), pneumonia 42 (2.1%), cord sepsis 38 (1.9%), macrosomia baby 36 (1.8%), impetigo 31(1.5%) and congenital malformations 25 (1.2%).

Infectious diseases, particularly malaria, were the most common reason for paediatric admission in sub-Saharan Africa, mostly among children less than 5 years old, excluding the neonatal period (0-28 days) (Abhulimhen-Iyoha and Okolo, 2012; Agbesanwa et al., 2023; Kareem, 2022; Isezuo et al., 2024). However, within this same age group in the European region, it is noticed that gastroenteritis and bronchiolitis were the leading causes of paediatric emergency admissions (Poropat *et al.*, 2017). This is due to the endemicity of malaria in the

African sub-region. Developed and developing countries face the admission burden of acute respiratory tract conditions (Isezuo et al., 2024; Kaiser et al., 2015; Schneuer et al., 2023).

According to an Australian study among children below 16 years, the leading causes for hospitalisation were respiratory conditions, digestive system diseases, and traumatic injuries (Schneuer *et al.*, 2023). Similarly, in a US study comparing pediatric admissions in 2020 against the decade before the COVID-19 pandemic, it was found that after birth admissions, the most common causes of admission were bronchiolitis, trauma, asthma, mental health, appendicitis, diabetic ketoacidosis, sepsis, dehydration, Kawasaki syndrome, Tetralogy of fallot, Hypoplastic Left Heart Syndrome, Atrial Septal Defect, Coarctation of the Aorta, S. Pneumoniae and cardiac arrest (Pelletier *et al.*, 2021). There is an obvious burden of heart-related paediatric admissions in the US.

Whereas in Eastern Sudan, visceral leishmaniasis, acute severe malnutrition, severe malaria, sickle cell disease, acute watery diarrhoea, severe anaemia (regardless of its cause), septicaemia and acute respiratory infections were the most common causes of admission (Ahmed *et al.*, 2022). Also, in a tertiary hospital in Port Harcourt, Nigeria, the six common indications for emergency room visits were all infectious diseases, and they included malaria, sepsis, gastroenteritis, upper respiratory tract infections, bronchopneumonia, and meningitis, where most were below 6 years (Onubogu and West, 2022). In the same study, trauma, acute asthma, and sickle cell disease were the common non-infectious indications for emergency room visits in the tertiary hospital in Port Harcourt. In another research conducted at the emergency unit of the Usmanu Danfodiyo University Teaching Hospital located in Sokoto State, Nigeria, sickle cell disease (SCD) was identified as the most prevalent non-infectious health issue and was the primary cause of numerous re-admissions (Isezuo et al., 2024). These non-infectious conditions were commonly found in age groups 6-12 and > 12 years (Onubogu and West, 2022).

2.7 Length of Stay of Paediatric Admissions

Ensuring an appropriate length of stay (LOS) in hospitals is a crucial objective, as an extended stay can lead to various clinical risks and pose significant organisational challenges (Cesare et al., 2025; Heys, Rajan and Blair, 2017). This concern is particularly pronounced for children and adolescents, who may have a heightened vulnerability to prolonged hospitalisations (Cesare *et al.*, 2025). Factors such as recurrent health issues and specific developmental disabilities can complicate their care, necessitating additional monitoring and specialised attention (Cesare *et al.*, 2025). The unique needs of this demographic require healthcare providers to be vigilant in managing their hospital stays to mitigate risks and enhance overall patient outcomes. (Cesare et al., 2025; Heys, Rajan and Blair, 2017).

In the UK study by Heys, Rajan and Blair, at the accident and emergency departments of two hospitals, the average length of stay for paediatric admissions in days was 1.8 (standard deviation (SD) 2.5, variance 6.6), while a US study showed an average length of stay between 59.3- 61.1 hours (2.5 days) (Brown *et al.*, 2021). A fifth of children (21.1%) were admitted for less than 24 h (0 days), and the length of stay in days was positively skewed and showed evidence of over-dispersion (variance greater than SD) (Heys, Rajan and Blair, 2017). This positive skewness was seen in a US study comparing paediatric admissions in 2020 against a decade before the COVID-19 pandemic (Pelletier *et al.*, 2021). In Australia, on the other hand, patients with chronic conditions experienced a longer duration of hospitalisation (3.0 days compared to 1.6 days) (Bell et al., 2020; Irwin, Currie and Davis, 2022).

Additionally, a systematic review and meta-analysis of the length of stay of healthcare-acquired bloodstream infections in children and neonates showed that the attributable mean LOS ranged between 4 and 27.8 days and the pooled mean attributable hospital LOS was 16.91 days (95% confidence interval [CI], 13.70–20.11) (Karagiannidou *et al.*, 2020). Also, the median

(interquartile range) length of hospital stay in Gadarif Hospital in Eastern Sudan for paediatric admissions was 9.0 days (Ahmed *et al.*, 2022).

Furthermore, a 3-year population-based cross-sectional study in North South Wales, Australia, including all hospital admissions in children aged < 16 years, found that most admissions were either day/overnight stays (71.9%) or between 2 and 7 days (25.3%). In contrast, admissions lasting more than 7 days accounted for 2.8% of the total. The highest percentage of admissions was among children aged 1 to 4 years (35%), most of which lasted 7 days or less, while 45.6% of admissions exceeding 22 days involved children aged 12 years and older. Longer stays beyond 7 days were more prevalent among children from the most disadvantaged backgrounds, those living farther from the hospital, and those aged 12 years and older dealing with mental health issues. (Schneuer *et al.*, 2023)

According to Caesar et al. (2025), more extended hospital stays were associated with increased medical diagnoses, nursing diagnoses, and nursing actions. Other significant determinants of length of stay among children and adolescents in Italy, according to Caesar et al. (2025), included emergency admissions, residency in rural areas, and older age.

2.8 Outcomes of Paediatric Admissions

Most paediatric patients are typically considered stable and sent home after treatment. Those not discharged leave the hospital without permission (absconding) or request, often in writing, to be released against medical advice. The remaining patients either pass away or are transferred to a higher-level facility or specialist centre for additional care.

A one-year retrospective study was conducted at Gadarif Paediatric Hospital in Eastern Sudan. This tertiary referral centre employs eight consultants, ten specialists, and twenty-five medical

staff, including registrars and residents, who recorded 740 paediatric admissions throughout the study period. Among these admissions, 42 patients died, leading to a mortality rate of 5.7%.

Additionally, 43 children (5.8%) left the hospital against medical advice, while 638 (86.2%) were discharged in stable health, and 17 (2.3%) were transferred to other facilities. The mortality rate was notably higher among females compared to males [24/287 (8.4%) versus 18/453 (4.0%), $P = 0.01$], and was also greater in children under five years old compared to those older than five years [36/433 (8.3%) versus 6/307 (2.0%), $P < 0.001$]. The overall mortality rate of 5.7% reflected rates previously documented in Sudan (5.8%), Nigeria (5.7%), and Liberia (5.4%). In contrast, it was lower than the rate observed in Ghana (7.12%) but higher than the rates reported in several other African countries, such as Ethiopia (0.042%), Malawi (3.3%), and Nigeria (4.9%), according to a separate study. The primary causes of death within this research group included acute severe malnutrition and its complications, visceral leishmaniasis, septicaemia, and meningitis/encephalitis (Ahmed et al., 2022).

In a cross-sectional study by Tette et al. (2020) examining the morbidity and mortality trends among newborns admitted to a regional and a district hospital in the Upper West Region of Ghana, researchers evaluated a total of 2004 newborns, which included 1,241 (62%) from St Joseph’s District Hospital and 763 (38%) from Upper West Regional Hospital. The rates of neonatal deaths were comparable, with St Joseph’s District Hospital reporting 8.94% and Upper West Regional Hospital 8.91%. In contrast, a secondary care hospital in Pakistan documented a neonatal mortality rate of 6.8% (Ali, Ahmed and Lohana, 2013). The primary conditions contributing to neonatal mortality from the study by Tette et. al (2020) included prematurity, neonatal sepsis, birth asphyxia, low birth weight, neonatal jaundice, and pneumonia. Also, suspected infections, including malaria, accounted for nearly half (45.5%) of the deaths in the study.

An extensive investigation conducted over ten years at Princess Marie Louise (PML) Children's Hospital from 2003 to 2013 by Tette et al. (2016) analysed 37,012 admissions, resulting in 1,314 deaths (3.6%). Most fatalities, 1,187 (90.3%), occurred in children under five years old. Death rates from malaria, malnutrition, HIV, and diarrhoea decreased; however, pneumonia-related deaths increased. Conversely, a five-year study carried out in a teaching hospital in Nigeria from 2017 to 2021 by Isezuo et al. (2024) identified malaria as the leading cause of death across all age groups except infants, for whom sepsis and pneumonia were more common. Among children under five years old, the primary causes of mortality from the PML study included malnutrition, septicaemia, pneumonia, HIV infection, malaria, anaemia, gastroenteritis/dehydration, meningitis, tuberculosis, and hypoglycaemia. For children aged five to nine years, the leading causes of death were malaria, HIV infection, anaemia, septicaemia, meningitis, tuberculosis, pneumonia, encephalopathy, and lymphoma (Tette et al., 2016). A retrospective study conducted in Douala, Cameroon, which focused on understanding the causes and predictors of paediatric mortality in children aged 1 month to 15 years, concluded that infectious diseases were the primary contributors to mortality in this demographic (Koum *et al.*, 2021).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research Methods and Design (Study methods and design)

This study was a three-year descriptive retrospective analysis of secondary data extracted from the LHIMS of Ho Teaching Hospital, specifically the Paediatric Department in the Ho Municipal District of Ghana. This census study included data on all patients admitted to all paediatric wards (NICU inclusive) between January 1, 2021, and December 31, 2023. Patients were admitted through the paediatric emergency or adult accident and emergency, OPD or transferred from other departments, especially the Obstetrics and Gynaecology, to the paediatric department.

3.2 Data Collection Techniques and Tools

The data was extracted in MS Excel format. It included sex, age, NHIS status, date of admission, date of discharge, principal diagnosis, and admission outcome.

3.3 Study Population

The study population consisted of all paediatric patients admitted to the paediatric department, including the neonatal intensive care unit, from January 1, 2021, to December 31, 2023. The age cut-off for paediatric admissions is less than 12 years.

3.4 Study Variables

The six (6) study variables examined were age, sex, NHIS status, principal diagnosis, length of stay, and admission outcome.

3.5 Sampling

In this study, the entire dataset was analysed to enhance the representativeness of the research results. All patient data collected via the LHIMS between January 1, 2020, and December 31, 2023, were cleaned using MS Excel software; therefore, no sample size calculation was necessary.

3.5.1 Inclusion criteria

All paediatric patients aged 0 to less than 12 years admitted to the paediatric department during the study period (January 1, 2021, to December 31, 2023), whose details were captured on the LHIMS, were included in the study.

3.5.2 Exclusion criteria

1. Patients who were not admitted between January 1, 2020, and December 31, 2023.
2. Any patient not admitted through the LHIMS as a paediatric admission (age <12 years).
3. Patients whose principal diagnoses were not captured on the LHIMS.
4. Patients whose diagnoses were not related to a medical condition according to the ICD-10 coding system.

3.6 Pretesting

The observational nature of this research did not require any pretesting. The accuracy and dependability of the information gathered from the LHIMS were rigorously evaluated by looking for inconsistencies and errors in the dataset, such as missing variables and incomplete records. The data was cleaned to eliminate discrepancies and improve its integrity before analysis.

3.7 Data Handling

Data collected from the Ho Teaching Hospital were anonymised, ensuring the confidentiality and privacy of patients. All data had numbers assigned to them. Data was received via mail and stored on a password-protected laptop.

3.8 Data Analysis

The data collected was analysed using MS Excel. Descriptive statistics were used to elucidate the demographic characteristics. The annual trend of sociodemographic patterns of admissions was represented. Principal diagnoses were grouped according to the ICD-10 classification and ranked to identify prevalent conditions admitted to the paediatric department. They were further classified into infectious and non-infectious diseases. Sociodemographic characteristic (age group) was used to describe the principal diagnosis.

The average length of hospital stay was analysed and grouped into length of stay bands such as 24 hours or less, 2- 7 days, 8- 21 days, and > 21 days. The average length of stay was compared with sociodemographic characteristic (age group) and represented in tables. The outcome of admissions was grouped into discharged, referred, died, discharged against medical advice (DAMA), and absconded. The admission outcomes were also compared against the sociodemographic characteristic (age group) and represented in tables. Overall mortality and survival rates were calculated and expressed in tables. Mortality rate was calculated as mortality rate = number of deaths in a population(n)/total population(N) expressed as a percentage, and survival rate = number of discharges in a population(n)/ total population(N) expressed as a percentage.

3.9 Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board of Ensign Global University and the Research and Ethics Committee of Ho Teaching Hospital to access patient hospital records. Data security and confidentiality were among the expected concerns; however, the data was handled with utmost discretion and anonymity. All data quality issues were transparently reported, and any limitations in the analysis have been acknowledged.

3.10 Limitations of Study

Data quality assessment - due to the secondary nature of the data and the large quantity of data extracted, a substantial number of variables were incomplete. Variables such as age, sex, NHIS status, date of admission and date of discharge were mostly completed since they are mandatory fields on the LHIMS software. On the other hand, other variables, such as principal diagnoses, were missing because these fields were not compulsory in the LHIMS software when data was captured. The elements with missing principal diagnosis were excluded from the analysis, and the other variables not relevant to this study. Readmissions and multiple diagnoses were not considered in this study. When an admission had more than one principal diagnosis, the first principal diagnosis captured in the dataset was used for the analysis.

3.11 Assumptions

It was assumed that all variables considered in this study had the most accurate input, enabling comparison with other studies.

CHAPTER FOUR

4.0 RESULTS

4.1 General overview of data

Data from 6,298 paediatric admissions at the Ho Teaching Hospital (HTH) were analysed from January 2021 through December 2023. Among the variables extracted from the Lightwave Health Information Management System (LHIMS) database of HTH, only two had missing data: principal diagnosis (n=400, 6.0%) and additional diagnosis (n=5,122, 76.5%). The analysis of disease patterns did not include additional diagnoses due to the high amount of missing data (76.5%); therefore, only principal diagnoses were considered since they had fewer missing entries (6.0%). The admissions with the missing data on principal diagnosis were also excluded from the analysis; hence, the total sample for analysis is 6,298. Below is a table displaying the variables and the number of missing entries identified. (Table 4.1.1)

Table 4.1. 1 Variables and associated missing entries

Variable	Number of missing entries, n (%)
Age	0 (0.0)
Sex	0 (0.0)
Location	0 (0.0)
Date of Admission	0 (0.0)
Date of Discharge	0 (0.0)
Outcome of Discharge	0 (0.0)
Principal Diagnoses	400 (6.0)
Additional Diagnoses	5122 (76.5)
NHIS Status	0 (0.0)
Total	6698
Total data for analysis	**6698-400= 6298**

4.2 Socio-demographic Characteristics

During the three-year study period from January 1, 2021, to December 31, 2023, the Ho Teaching Hospital saw **6,298** paediatric admissions (patients under 12 years old). This included 3,596 males (57.1%) and 2,702 females (42.9%), resulting in a male-to-female ratio of 1.3:1. The mean age for the neonatal admissions was 3.39 ± 4.76 days, ranging from 1 to 27 days, a median and mode of 1 day while the mean age for the other paediatric admissions aged 1month to 11years was 44.03 ± 38.65 months (3.67± 3.22years). There was no significant age difference between males and females admitted during this study (male neonates 3.55 ± 4.93 days, female neonates 3.40± 4.76days, male children 46.59 ± 38.72 months, female children 44.21 ± 38.35).

The neonatal group from 0-27 days had the highest admissions, accounting for 2534(40.2%), of which 1,390(54.9%) were males and 1,144(45.1%) were females. This was followed by the age group of 1-4 years, which had 1727(27.4%). The age group of 5-11 years constituted 1253(19.9%) admissions, while the 1–11-month age group made up the least of the admissions, totalling 784(12.5%). 80.1% of the admissions were of children aged <5 years. Figure 4.2.1 graphically represents the percentages of each age group by sex.

The National Health Insurance Scheme covered most patients, 5905(93.8%). Figures 4.2.2 and 4.2.3 show NHIS status by sex and age groups, respectively. There were more admissions in 2022, which accounted for 35% of the total, compared to 32.5% in both 2021 and 2023 (as shown in Table 4.2.1).

Table 4.2. 1 Socio-demographic characteristics of children admitted within the study period

Variable	2021 n (%)	2022 n (%)	2023 n (%)	Total N (%)
SEX				
Male	1177(18.7)	1238(19.7)	1181(18.7)	3,596 (57.1)
Female	867(13.8)	969(15.4)	866(13.7)	2,702 (42.9)
Total	**2044 (32.5)**	**2207 (35.0) ***	**2047 (32.5) ***	**6298 (100.0)**
AGE				
0-27days	867(13.8)	880(14.0)	787(12.5)	2534(40.2) *
1-11months	254(4.0)	285(4.5)	245(3.9)	784(12.5)
1-4 years	532(8.4)	610(9.7)	585(9.3)	1727(27.4)
5-11 years	391(6.2)	432(6.9)	430(6.8)	1253(19.9)
Total	**2044 (32.5)**	**2207 (35.0)**	**2047 (32.5)**	**6298 (100.0)**
NHIS STATUS				
Insured	1908(30.3)	2078(33.0)	1919(30.5)	5905(93.8)
Not insured	136(2.2)	129(2.0)	128(2.0)	393 (6.2)
Total	**2044 (32.5)**	**2207 (35.0)**	**2047 (32.5)**	**6298 (100)**

*Minor discrepancies in percentage totals are due to rounding and do not affect the interpretation of the data

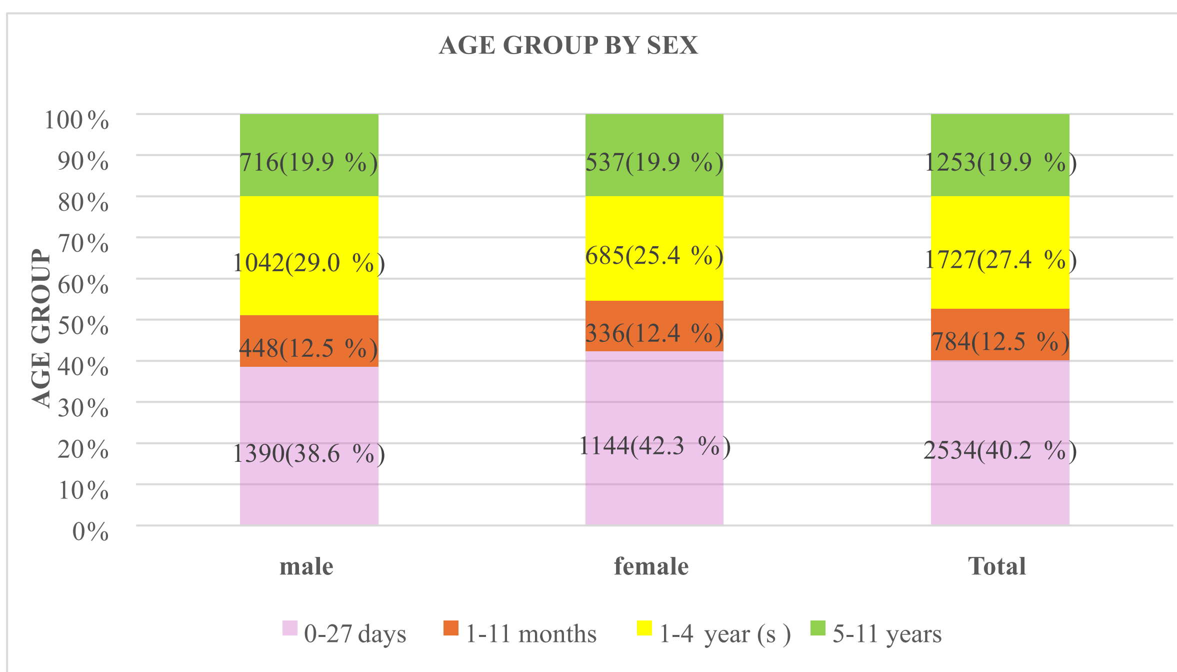

Figure 4.2. 1 Age groups by sex

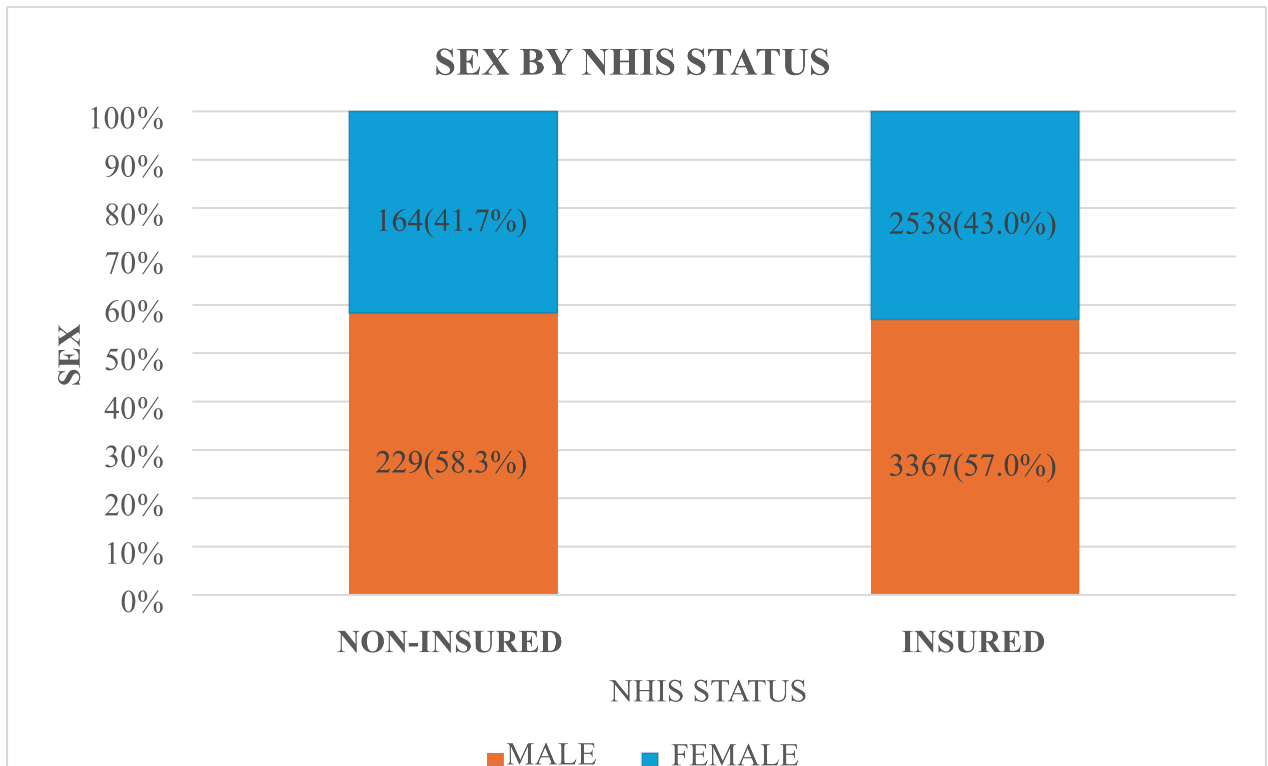

Figure 4.2. 2 Sex by NHIS status

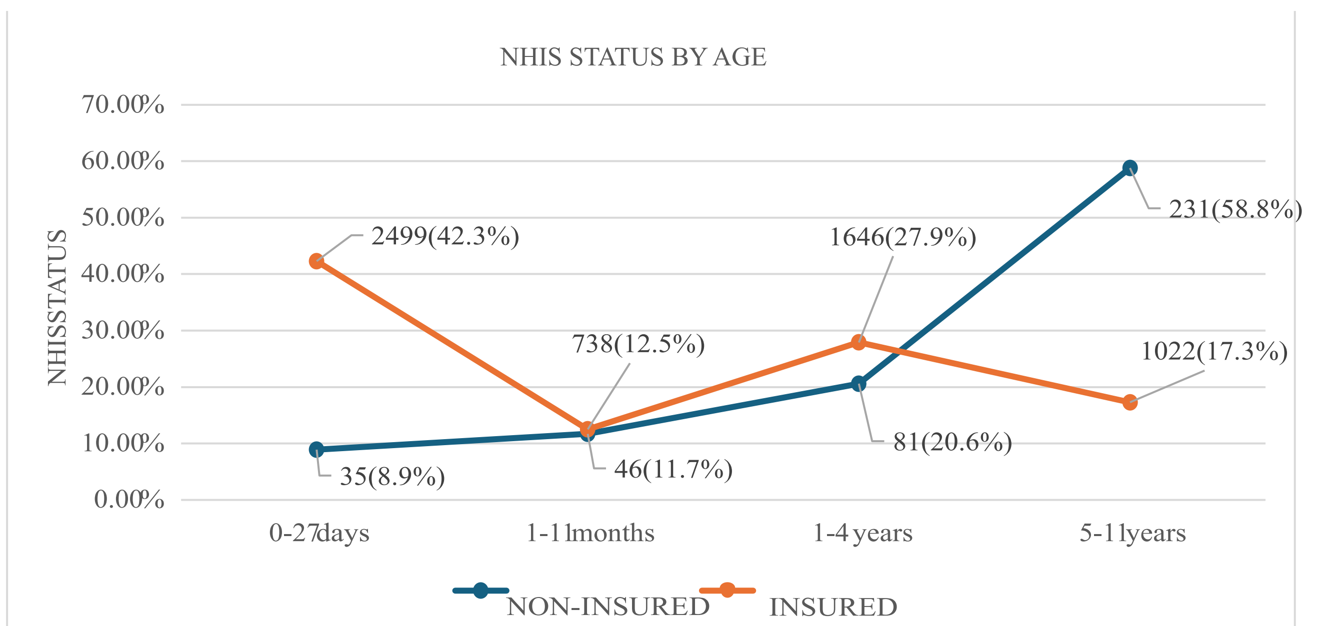

Figure 4.2. 3 NHIS status by age group

Figure 4.2.1 above shows the percentages of each age group among the sexes compared to the total population. It is notable that among the males, 1,390 (38.6%) were 0- 27 days old, 448

(12.5%) were 1- 11 months old, 1,042 (29.0%) were 1-4 years old, and 716(19.9%) were 5- 11 years old. Among the females, 1,144 (42.3%) were 0-27 days old, 336 (12.4%) were 1- 11 months old, 685 (25.4%) were 1-4 years old, and 537 (19.9%) were 5-11 years old. Among both males and females, the age group less than 5 constituted a more significant portion of paediatric admissions at the HTH during the study period, i.e. 2,880(80.1%) of males and 2,165(80.1%) of females compared to 5,045(80.1%) of the total paediatric admissions.

Figure 4.2.2 shows the distribution of sex by NHIS status. Among the non-insured admissions, 229 (58.3%) were males, while 164 (41.7%) were females. For those insured, 3367 (57.0%) were males, while 2538 (43.0%) were females. Subsequently, Figure 4.2.3 shows NHIS status by age, where 35(8.9%) of those non-insured were 0- 27 days old, 46(11.7%) were 1-11 months old, 81(20.6%) were 1-4 years old, 231(58.8%) were 5-11 years old. Among those insured, 2,499 (42.3%) were 0-27 days, 738(12.5%) were 1-11 months, 1,646 (27.9%) were 1-4 years, and 1,022 (17.3%) were 5-11 years old.

4.3 Pattern of Diseases

Non-infectious causes constituted more of the admissions on the paediatric wards, 4191(66.5%), as against 2107 (33.5%) of infectious causes (Table 4.3.1). Table 4.3.1 further shows percentages of paediatric admissions' broad ICD-10 classifications among the disease categories. The top 10 ICD-10 classifications included certain conditions originating in the perinatal period 2039(32.4%), certain infectious and parasitic diseases 932(14.8%), diseases of the respiratory system 601(9.5%), injury, poisoning and other consequences of external causes 456(7.2%), diseases of digestive system 396(6.3%), diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism 291(4.6%), congenital malformations, deformations and chromosomal abnormalities 242(3.8%), diseases of the nervous system 236(3.7%), symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified 189(3.0%), and diseases of the genitourinary system 169(2.7%).

Table 4.3.2 shows the top 10 neonatal causes of admission which include neonatal jaundice 781(30.8%), neonatal sepsis 401(15.8%), prematurity 336(13.3%), birth asphyxia 187(7.4%), respiratory distress and failure in the newborn 166(6.6%), meconium-related 159(6.3%), congenital/chromosomal abnormalities 115(4.3%), low birth weight 98(3.9%), macrosomia 56(2.2%), and birth injury/trauma 55(2.2%). The other neonatal causes of admission were others (bleeding disorders of newborn, maternal-related and newborn examination, etc) 101(4%), gastrointestinal complications in newborns 52(2.1%), cardiac arrest/failure 15(0.6%), and brain death 12(0.5%).

Figure 4.3.1 shows the disease categories (infectious and non-infectious) by age group. Among the infectious causes of admissions, 520 (24.7%) were 0- 27 days old, 350 (16.6%) were 1- 11 months old, 811(38.5%) were 1-4 years old, and 426 (20.2%) were 5-11 years old. For the non-infectious category, 2014(48.0%) were 0-27 days old, 434 (10.4%) were 1-11 months old, 916(21.9%) were 1-4 years old, and 827 (19.7%) were 5-11 years old. 1161(55.1%) of admissions from 1 month to less than 5 years were infectious compared to 1350 (32.3%) non-infectious admissions among the same age group.

Table 4.3. 1 Broad ICD-10 Classification among disease categories

No.	BROAD ICD-10 CLASSIFICATION	INFECTIOUS*	NON-INFECTIOUS*	TOTAL (n%)
1	Certain conditions originating in the perinatal period (P00-P96)	320(5.1)	1719(27.3)	2039(32.4)
2	Certain infectious and parasitic diseases (A00-B99)	932(14.8)	0	932(14.8)
3	Diseases of the respiratory system (J00-J99)	462(7.3)	139(2.2)	601(9.5)
4	Injury, poisoning and certain other consequences of external causes (S00-T88)	0	456(7.2)	456(7.2)
5	Diseases of the digestive system (K00-K95)	24(0.4)	372(5.9)	396(6.3)
6	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)	0	291(4.6)	291(4.6)
7	Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	0	242(3.8)	242(3.8)
8	Diseases of the nervous system (G00-G99)	59(0.9)	177(2.8)	236(3.7)
9	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	9(0.1)	180(2.9)	189(3.0)
10	Diseases of the genitourinary system (N00N99)	69(1.1)	100(1.6)	169(2.7)
11	Diseases of the ear and mastoid process (H60-H95)/Diseases of the eye and adnexa (H00-H59)	114(1.8)	19(0.3)	133(2.1)
12	Factors influencing health status and contact with health services (Z00-Z99)	22(0.4)	102(1.6)	124(2.0)
13	Diseases of the musculoskeletal system and connective tissue (M00-M99)	27(0.4)	79(1.3)	106(1.7)
14	Endocrine, nutritional and metabolic diseases (E00-E89)	0	96(1.5)	96(1.5)
15	Diseases of the skin and subcutaneous tissue (L00-L99)	54(0.9)	21(0.3)	75(1.2)
16	Neoplasms (C00-D49)	0	66(1.0)	66(1.0)
17	Diseases of the circulatory system (I00-I99)	2(0.0)	48(0.8)	50(0.8)
18	Pregnancy, childbirth and the puerperium (O00-O9A)	5(0.1)	41(0.6)	46(0.7)
19	External causes of morbidity (V00-Y99)	0	38(0.6)	38(0.6)
20	Codes for special purposes (U00-U85)	8(0.1)	0	8(0.1)
21	Mental, Behavioural and Neurodevelopmental disorders (F01-F99)	0	5(0.1)	5(0.1)
	TOTAL	**2107(33.5)**	**4191(66.5)**	**6298(100)**

Table 4.3. 2 Top 10 neonatal causes of admission

No	Neonatal causes of admissions	FREQENCY (n%)
1	Neonatal Jaundice (precursors and complications)	781(30.8)
2	Neonatal sepsis/infections	401(15.8)
3	Prematurity	336(13.3)
4	Asphyxia	187(7.4)
5	Respiratory distress/ failure in newborns	166(6.6)
6	Meconium-related / other newborn aspiration with/without distress	159(6.3)
7	Congenital/chromosomal abnormalities	115(4.3)
8	Low birth weight	98(3.9)
9	Macrosomia	56(2.2)
10	Birth Injury/Trauma	55(2.2)
	TOTAL	**2354(92.8) ***

*Percentages are expressed out of the total neonatal admissions, which is 2,534(100%). Other diseases constituted 180(8.2%).

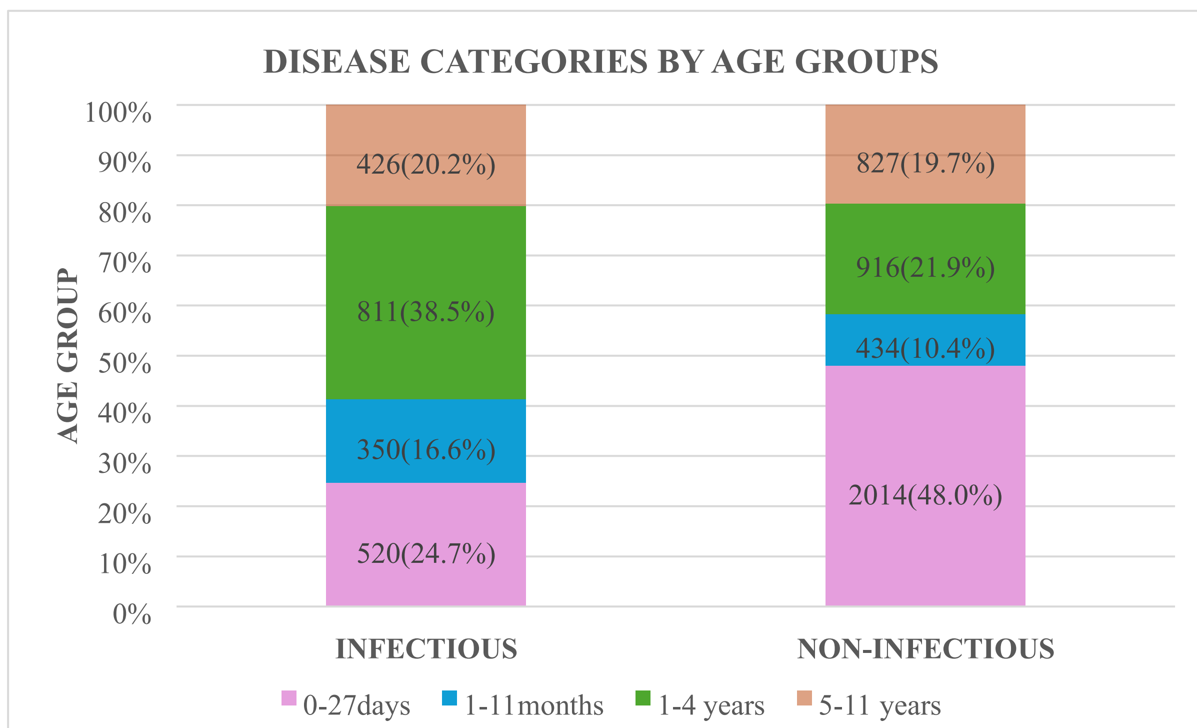

Figure 4.3. 1 Disease categories by age groups

Table 4.3. 3 Broad ICD-10 classification among age groups

No.	ICD-10 CLASSIFICATION	0-27 days (n%)	1-11months (n%)	1-4years (n%)	5-11years (n%)	TOTAL (N%)
1	Certain conditions originating in the perinatal period (P00-P96)	**1949(95.6)**	74(3.6)	14(0.7)	2(0.1)	2039(100.0)
2	Certain infectious and parasitic diseases (A00-B99)	157(16.8)	111(11.9)	**397(42.6)**	267(28.7)	932(100.0)
3	Diseases of the respiratory system (J00-J99)	31(5.2)	166(27.6)	**285(47.4)**	119(19.8)	601(100.0)
4	Injury, poisoning and certain other consequences of external causes (S00-T88)	13(2.9)	27(5.9)	196(43.0)	**220(48.2)**	456(100.0)
5	Diseases of the digestive system (K00-K95)	15(3.8)	108(27.3)	**151(38.1)**	122(30.8)	396(100)
6	Diseases of the blood and bloodforming organs and certain disorders involving the immune mechanism (D50-D89)	5(1.7)	39(13.4)	**125(43.0)**	122(41.9)	291(100)
7	Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	**95(38.3)**	52(21.5)	56(23.1)	39(16.1)	242(100)
8	Diseases of the nervous system (G00-G99)	37(15.7)	33(14.0)	**106(44.9)**	60(25.4)	236(100)
9	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	55(29.1)	40(21.2)	**66(34.9)**	28(14.8)	189(100)
10	Diseases of the genitourinary system (N00-N99)	16(9.4)	23(13.6)	**65(38.5)**	**65(38.5)**	169(100)
11	Diseases of the ear and mastoid process (H60-H95)/Diseases of the eye and adnexa (H00-H59)	4(3.0)	16(12.0)	**83(62.4)**	30(22.6)	133(100)
12	Factors influencing health status and contact with health services (Z00Z99)	**57(46.0)**	22(17.7)	28(22.6)	17(13.7)	124(100)
13	Diseases of the musculoskeletal system and connective tissue (M00M99)	10(9.4)	4(3.8)	39(36.8)	**53(50.0)**	106(100)
14	Endocrine, nutritional and metabolic diseases (E00-E89)	14(14.6)	27(28.1)	**45(46.9)**	10(10.4)	96(100)
15	Diseases of the skin and subcutaneous tissue (L00-L99)	11(14.7)	16(21.3)	**25(33.3)**	23(30.7)	75(100)
16	Neoplasms (C00-D49)	4(6.0)	11(16.7)	24(36.4)	**27(40.9)**	66(100)
17	Diseases of the circulatory system (I00-I99)	14(28.0)	8(16.0)	8(16.0)	**20(40.0)**	50(100)
18	Pregnancy, childbirth and the puerperium (O00-O9A)	**44(95.6)**	1(2.2)	1(2.2)	0(0.0)	46(100)
19	External causes of morbidity (V00-Y99)	0(0.0)	4(10.5))	11(28.9)	**23(60.5)**	38(100)
20	Codes for special purposes (U00-U85)	2(25.0)	2(25.0)	1(12.5)	**3(37.5)**	8(100)
21	Mental, Behavioural and Neurodevelopmental disorders (F01-F99)	1(20.0)	0(0.0)	1(20.0)	**3(60.0)**	5(100)
	TOTAL	**2534(40.2)**	**784(12.5)**	**1727(27.4)**	**1253(19.9)**	**6298(100)**

Table 4.3. 4 Top 10 paediatric admissions from 1 month to 11 years

No.	Disease Conditions	Frequency(n%)
1	Malaria	507(13.5)
2	Trauma and poisoning	473(12.6)
3	Sickle-cell disease and all other forms of anaemia	291(7.7)
4	Pneumonia	280(7.4)
5	Ear, nose and throat infections	225(6.0)
6	Hernia	157(4.2)
7	Cerebral palsy and other seizures	148(3.9)
8	Congenital malformations, deformations and chromosomal abnormalities	147(3.9)
9	Gastroenteritis and Typhoid infection	146(5.8)
10	Intestinal obstruction and other non-infectious gastroenteritis	128(3.4)
	TOTAL	**2502(66.5)**

*Percentages are expressed out of the total admissions above 1 month to 11 years, which is 3764(100%). Other diseases outside the top 10 constituted 1,262(33.5%)

Table 4.3.3 shows the broad ICD-10 classifications among age groups. Notably, certain conditions originating in the perinatal period (P00-P96) 1949(95.6%), congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) 95(38.3%), factors influencing health status and contact with health services (Z00-Z99) 57(46.0%), and pregnancy, childbirth and the puerperium (O00-O9A) 44(95.6%) were higher in the age group 0-27 days while certain infectious and parasitic diseases (A00-B99) 397(42.6%), diseases of the respiratory system (J00-J99) 285(47.4%), diseases of the digestive system (K00-K95) 151(38.1%), diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89) 125(43.0%) among others were higher in the age group 14 years. Also, injury, poisoning and certain other consequences of external causes (S00-T88)

220(48.2%), neoplasms (C00-D49) 27(40.9%), diseases of the circulatory system (I00-I99) 20(40.0%) and mental, behavioural and neurodevelopmental disorders were more prevalent in the 5-11 years age group.

Table 4.3.4 shows the top 10 causes of paediatric admissions from 1 month to 11 years old. Malaria leads with 507(13.5%), followed by trauma and poisoning 473(12.6%), sickle-cell disease and all other forms of anaemia 291(7.7%), pneumonia 280(7.4%), Ear, nose and throat infections 225(6.0%), hernia 157(4.2%), cerebral palsy and other seizures 148(3.9%), congenital malformations, deformations and chromosomal abnormalities 147(3.9%), gastroenteritis/typhoid fever 146(5.8%), and intestinal obstruction and other non-infectious gastroenteritis 128(3.4%).

4.4 Length of Stay

The length of stay was determined by calculating the difference between the discharge and admission dates. Among paediatric ward admissions, the length of stay ranged from 0 to 962 days. In this analysis, the descriptive statistics indicated that the average length of stay was 6.8 days with a standard deviation of 17.1 days. The median length of stay was 4 days, and most admissions lasted 2 days. The average length of stay for each group is also elaborated on in the table below (see Tables 4.4.1 and 4.4.2).

Table 4.4. 1 Average length of stay

Variable (days)	Mean	SD	Min	Max	Median	Mode
Length of Stay	6.8	17.1	0	962	4	2

Table 4.4. 2 Average length of stay among the age groups

Age groups	Mean/days	SD/days	Min/days	Max/days	Median/days	Mode/days
0-27days	5.6	5.9	0	148	4	2
1-11months	6.1	7.7	0	193	4	2
1-4years	6.7	15.6	0	962	4	2
5-11years	7.6	18.0	0	962	5	2

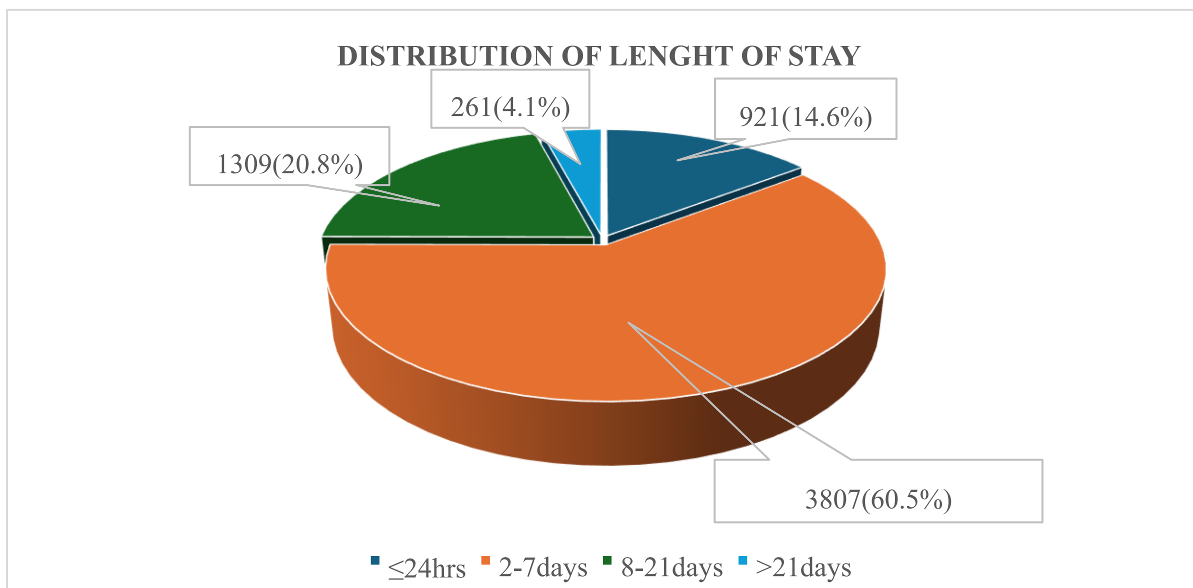

Figure 4.4. 1 Distribution of length of stay

The above shows the distribution of length of stay in band lengths of 24 hours and less, 921(14.6%), 2- 7 days, 3807(60.5%), 8- 21 days, 1309(20.8%), and greater than 21 days, 261(4.1%). Figure 4.4.2 shows the distribution among the age groups. Most of those who stayed 24 hours or less were 1-4 years old, 306(33.2%), while those 0-27 days were discharged more at 2- 7 days (40.8%), 8-21 days (46.5%) and > 21 days (37.8%).

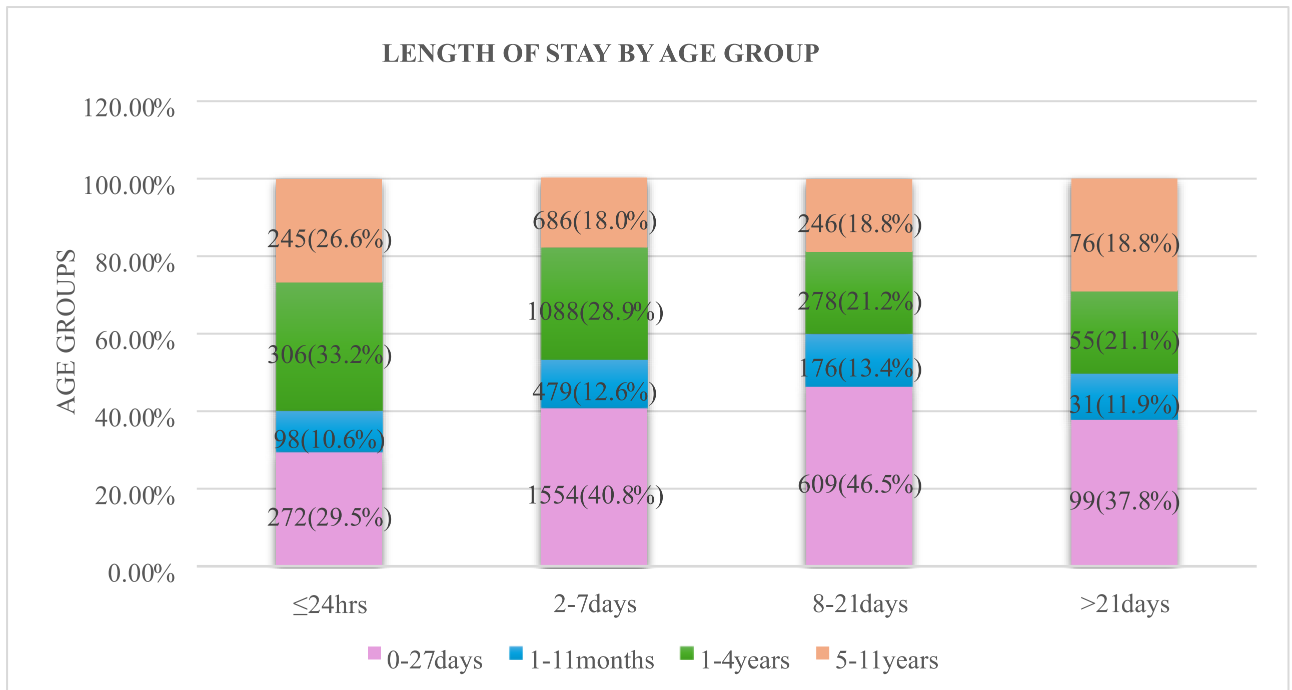

Figure 4.4. 2 Length of admission by age groups

4.5 Outcome of Admissions

The outcome of admissions was analysed using the variable "admission outcome." The results were as follows: 5,798 patients (92.1%) were discharged, 25 patients (0.4%) absconded, one patient (0.0%) was discharged against medical advice (DAMA), 130 patients (2.1%) were referred to another tertiary facility, and 344 patients (5.6%) died. This indicates an overall survival rate of 92.1%, a mortality rate of 5.6%, and a neonatal (0- 27 days) mortality rate of 9.2%. The under-five mortality rate, excluding the neonates, was 83/2511(3.3%).

The most common causes of death based on the broad ICD-10 classification included certain conditions originating in the perinatal period (49.7%), symptoms, signs, and abnormal clinical and laboratory findings not elsewhere classified (8.7%), diseases of the nervous system (6.7%), and certain infectious and parasitic diseases (6.5%). The above data is presented in Table 4.5.1, 4.5.2, and Figure 4.5.1 below.

Table 4.5. 1 Outcomes of Admissions among age groups

Outcome of admission	0-27days (n%)	1-11month (n%)	1-4years(n%)	5-11years(n%)	Total(N%)
Discharge (Survival rate)	**2247(88.7)**	**711(90.7)**	**1646(95.3)**	**1194(95.3)**	**5798(92.1)**
Absconded	9(0.4)	8(1.0)	5(0.3)	3(0.2)	25(0.4)
DAMA	0	0	0	1(0.1)	1(0)
Referred	44(1.7)	25(3.2)	33(1.9)	28(2.2)	130(2.1)
Died (Mortality rate)	**234(9.2)**	**40(5.1)**	**43(2.5)**	**27(2.2)**	**344(5.6)**
TOTAL	**2534(100)**	**784(100)**	**1727(100)**	**1253(100)**	**6298(100)**

*DAMA: Discharge Against Medical Advice

Table 4.5. 2 Deaths per broad ICD-10 classifications

ICD-10 CLASSIFICATION	Death	
	Frequency	**Percentage (%)**
Certain conditions originating in the perinatal period (P00P96)	171	49.7
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	30	8.7
Diseases of the nervous system (G00-G99)	23	6.7
Certain infectious and parasitic diseases (A00-B99)	21	6
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	18	5.2
Diseases of the circulatory system (I00-I99)	15	4.7
Diseases of the respiratory system (J00-J99)	14	4
Endocrine, nutritional and metabolic diseases (E00-E89)	12	3.5
Diseases of the digestive system (K00-K95)	10	2.9
Injury, poisoning and certain other consequences of external causes (S00-T88)	7	2
Pregnancy, childbirth and the puerperium (O00-O9A)	5	1.5
Diseases of the genitourinary system (N00-N99)	4	1.2
Diseases of the ear and mastoid process (H60-H95)/ Diseases of the eye and adnexa (H00-H59)	4	1.2
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50D89)	3	0.9
Neoplasms (C00-D49)	2	0.6
External causes of morbidity (V00-Y99)	2	0.6
Diseases of the musculoskeletal system and connective tissue (M00-M99)	1	0.3
Diseases of the skin and subcutaneous tissue (L00-L99)	1	0.3
Codes for special purposes (U00-U85)	1	0.3
Factors influencing health status and contact with health services (Z00-Z99)	0	0
Mental, Behavioural and Neurodevelopmental disorders (F01-F99)	0	0
TOTAL	**344**	**100**

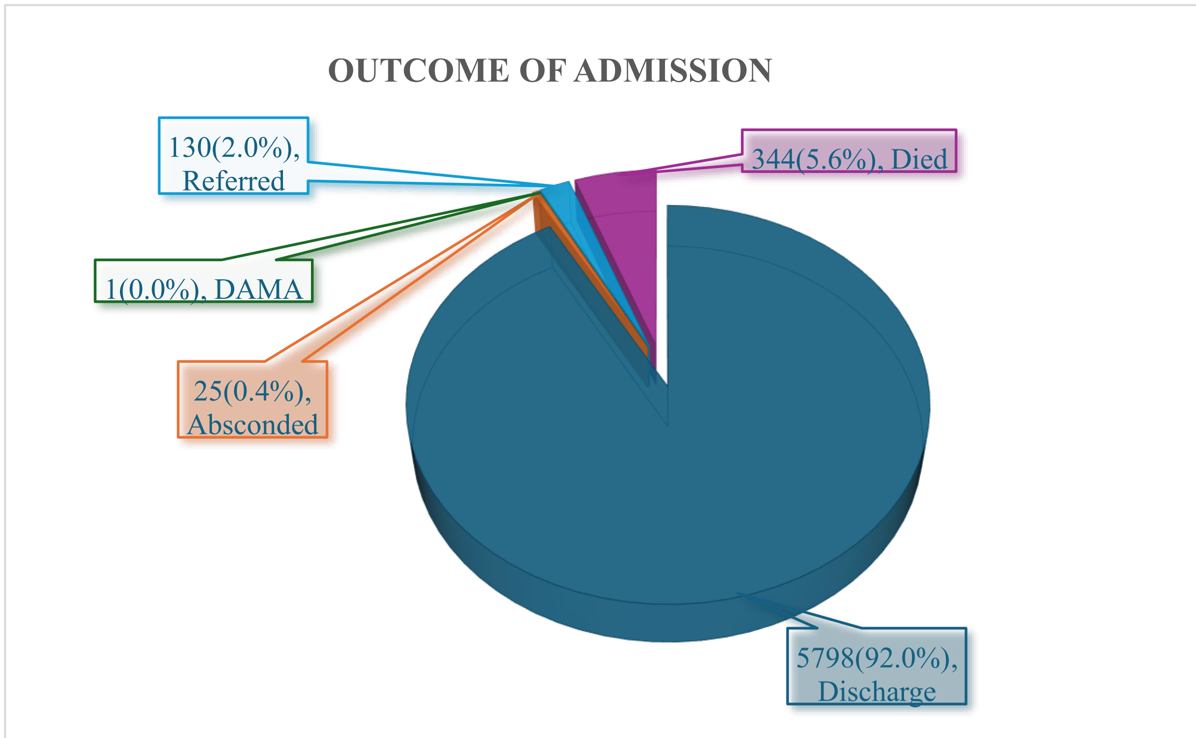

Figure 4.5. 1 Outcome of admission

CHAPTER FIVE

5.0 DISCUSSIONS

This study examined the patterns of paediatric admissions at the Ho Teaching Hospital in Ghana. It focused on describing the socio-demographic characteristics of patients, the types of diseases, the duration of hospital stays, and the outcomes of these admissions. The goal was to gain a deeper insight into the admission patterns within the paediatric department, which would assist in enhancing care quality, optimising resource distribution, and guiding policy development.

5.1 Socio-demographic Characteristics

In this study, there was an overall higher number of males 3,596(57.1%), than females, 2,702(42.9%), on admission for the study period with a general male to female ratio of 1.3:1. This was observed to be similar among the neonate subset (ages 0 to 27 days), where 1,390(54.9%) were males and 1,144(45.1%) were females. This is consistent with earlier studies in Ghana, where more males were admitted than females (Adadey et al., 2019; Tette et al., 2020). While Adadey et al. (2019) did not include neonates, Tette et al. (2020) studied neonatal morbidities only. In two other studies in Eastern Sudan and Nigeria, the male: female ratio was 1.5:1 and 1.57:1, respectively, which were slightly higher than the ratio from this study (Ahmed et al., 2022; Okoronkwo, Onyearugha and Ohanenye, 2018).

Furthermore, the mean age of admission in this study was approximately 3 days for the neonates and 3 years for those above 1 month. There was an overall higher neonatal admission (40.2%) followed by the age 1- 4 years (27.4%), then 5- 11 years (19.9%) and 1-11 months (12.5%). This is obviously due to the higher birth admissions from increased hospital deliveries. The age group under 5 years had the highest admissions in this study, consistent with other studies in

the African sub-region, like the studies by Kareem (2022) and Enyuma et al. (2019). This, however, is not the case in East England and Italy, where most of their paediatric admission are within the ages of 5- 15 years according to a study by Poropat et al. (2017). This is due to the age cut-off for paediatrics in these countries. In Ghana, unlike these countries, the age limit for admission to the paediatric ward is less than 12 years, unless in very few cases. Also, among males and females, the age group below 5 years was more than those 5 years and above, as the neonatal group was included in this study. However, this pattern was similar in the study describing paediatric hospital admissions according to gender by Mehdi et al. (2020). It did not include neonates (those 0- 27 days).

Additionally, most admissions had NHIS coverage in this study, 93.8% against 6.2% noninsured admissions. This is consistent with the study by Amu et al. in 2018, which noted that the high coverage in Ghana compared to other African countries, such as Nigeria, Kenya, and Tanzania, resulted from the implementation system being used in Ghana. Also, among the non-insured group in this study, 58.3% were males while 41.7% were females. Though according to Anaba et al. (2022), females tend to be enrolled more than males among adults, it may not apply in this case, considering this is a paediatric study and there were more male than female admissions. Also, more than half (58.5%) of the non-insured admissions were 5 years and above. This is consistent with the studies by Anaba et al. (2022) and Orish et al. (2022), which found that NHIS coverage was higher among children under five than among others.

5.2 Pattern of Diseases

This study showed more non-infectious 4191(66.5%) causes of admission than infectious 2107(33.5%). Compared with other African sub-region studies reviewed, which indicated higher infectious causes of admission (Agbesanwa et al., 2023; Abhulimhen-Iyoha and Okolo, 2012; Isezuo et al., 2024; Kareem, 2022). In those studies, neonates were excluded, implying

that only children above 1 month old were included. In this study, most of the non-infectious causes of admission were among the 0-27-day age group in 2014(48.0%), whereas most of the infectious causes of admissions were among the ages 1-4 years 811(38.5%). The neonatal period is burdened with more non-infectious causes of admission; hence, their addition in this study shifted it from the norm. However, among the infectious causes of admission, the dominant age group was the group 1-4 years, which was always included in these studies. Hence, the infectious causes dominated in those studies.

The topmost causes of neonatal admissions in this study included neonatal jaundice 781(30.8%), neonatal sepsis and infections 401(15.8%), prematurity 336(13.3%), birth asphyxia 187(7.4%), respiratory distress/failure in newborns 166(6.6%), meconium-related /other newborn aspiration with/without distress 159(6.3%), congenital/chromosomal abnormalities 115(4.3%), low birth weight 98(3.9%), macrosomia 56(2.2%) and birth injury/trauma 55(2.2%). In a similar study in a tertiary hospital in Addis Ababa, the top primary causes of admissions at the NICU were prematurity with respiratory problems (36.6%), neonatal sepsis (22.7%) and asphyxia (16.3%) (Tekleab, Amaru and Tefera, 2016). Neonatal jaundice was not among the top three, unlike in this study. In a secondary hospital in Pakistan, the top causes of neonatal admissions are also prematurity (27.9%), infection (20.33%), birth asphyxia (13%) and neonatal jaundice (11.3%) (Ali, Ahmed and Lohana, 2013). Though neonatal jaundice was among the first four, it was not the topmost cause, like in this study. Another Tanzanian study did not include neonatal jaundice among the top four causes of admission. Still, it included asphyxia, prematurity, infection, and macrosomia, which is ninth in this study (Mmbaga *et al.*, 2012). A study in a district and regional hospital in the Upper West region of Ghana showed neonatal jaundice as the fifth cause of admissions (Tette *et al.*, 2020)The high prevalence of neonatal jaundice in this study could be attributed to increased awareness about the condition and care providers' extreme caution about its complications,

which led to a low threshold criterion of admission for neonatal jaundice at the HTH. Aside from neonatal sepsis, most neonatal conditions for admissions are non-infectious, contributing to the higher non-infectious causes of admissions seen in this study.

Furthermore, among children aged one month and above in this study, the common causes of admission include malaria 507(13.5%), followed by trauma and poisoning 473(12.6%), sicklecell disease and all other forms of anaemia 291(7.7%), pneumonia 280(7.4%), ear, nose and throat infections 225(6.0%), hernia 157(4.2%), seizure, cerebral palsy and other seizures 148(3.9%), congenital malformations, deformations and chromosomal abnormalities 147(3.9%), gastroenteritis/typhoid fever 146(5.8%), and intestinal obstruction and other noninfectious gastroenteritis 128(3.4%). This affirms the literature that malaria is the commonest cause of paediatric admissions in sub-Saharan Africa (Agbesanwa et al., 2023; AbhulimhenIyoha and Okolo, 2012; Isezuo et al., 2024; Kareem, 2022). This study shows a triple disease burden among the age group 1 month and above, which is the presence of infectious causes of disease (malaria, pneumonia, ear, nose and throat infections, gastroenteritis and typhoid fever), injuries (trauma and poisoning) and others (sickle-cell disease and all other forms of anaemia, hernia, cerebral palsy and other seizures, congenital and chromosomal abnormalities, and intestinal and non-infectious gastroenteritis).

Additionally, while most studies from the African sub-region reviewed primarily focused on medical wards, those that examined emergency admissions indicated the prevalence of trauma and poisoning as notable non-infectious causes of admission, alongside sickle cell disease and anaemia (Onubogu and West, 2022; Isezuo et al., 2024). The prevalence of congenital and chromosomal abnormalities in this study is anticipated, as the facility is a tertiary teaching hospital, and most abnormalities identified in children born and raised in the Volta Region would first be referred there for further management. This also supports one of the rationales of the study, based on case reports of specific chromosomal abnormalities in children referred

to Korle-bu Teaching Hospital, traced back to the region (Badoe, 2016). In contrast to other studies examined in the literature, hernia and intestinal obstruction were identified as part of the primary reasons for admission in this study, since paediatric surgical cases are handled together with medical admissions in the paediatric wards at Ho Teaching Hospital.

This study represented all 22 chapters of the broad ICD-10 classifications. It underscores the significant health issues children face and the importance of comprehending these specific conditions to facilitate effective prevention and precise treatment. The top 10 ICD-10 classifications included certain conditions originating in the perinatal period 2039(32.4%), certain infectious and parasitic diseases 932(14.8%), diseases of the respiratory system 601(9.5%), injury, poisoning and other consequences of external causes 456(7.2%), diseases of digestive system 396(6.3%), diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism 291(4.6%), congenital malformations, deformations and chromosomal abnormalities 242(3.8%), diseases of the nervous system 236(3.7%), symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified 189(3.0%), and diseases of the genitourinary system 169(2.7%).

The prevalent ICD-10 classifications in this study are somewhat consistent with the Australian study among children below 16 years, where respiratory conditions, digestive system diseases, and traumatic injuries were the leading causes of hospitalisation (Schneuer *et al.*, 2023). The only difference is the high prevalence of certain infectious and parasitic diseases in this study due to the geographical area of the study site and the socioeconomic status of Ghana compared to Australia. Notably, this study has a low prevalence of mental health conditions compared to other studies in the United States, where mental health is among the common causes of admissions (Pelletier *et al.*, 2021). This could be due to the paediatric age range for care in the study area, which is below 12 years, because most mental health conditions are prevalent among the adolescent age group or older children.

5.3 Length of Stay

This study's average length of stay was 6.8 days, with a standard deviation of 17.1 days, a median of 2 days, and a mode of 2 days. This stay is more extended than that observed in a study in the UK. The 2017 study in the UK by Heys, Rajan and Blair at two hospitals' accident and emergency departments found that the average length of stay for paediatric admissions in days was 1.8 (standard deviation (SD) 2.5, variance 6.6). This is expected as emergency inpatient admissions comparatively have a shorter stay than medical and surgical inpatient admissions. Similarly, it is longer compared to the US study by Brown et al. (2021). The average length of stay for paediatric admissions from 42 children's hospitals in the Paediatric Health Information System was 2.5 days.

Moreover, a systematic review and meta-analysis of the length of stay of healthcare-acquired bloodstream infections in children and neonates showed that the attributable mean LOS ranged between 4 and 27.8 days and the pooled mean attributable hospital LOS was 16.91 days (95% confidence interval [CI], 13.70–20.11) according to Karagiannidou et al., 2020. This was more than the mean in this study because most healthcare-acquired bloodstream infections require prolonged inpatient treatment.

Also, the median (interquartile range) length of hospital stay for paediatric admissions at Gadarif Hospital in Eastern Sudan was 9.0 days, compared to 4 days in this study, according to Ahmed et al. (2022). An Australian study indicated an extended stay of 3 days for chronic and 1.6 days for acute conditions (Bell et al., 2020; Irwin, Currie and Davis, 2022). Discrepancies may arise from these countries' health system structures and wealth indexes.

Developed countries typically have shorter lengths of stay than developing countries.
Additionally, there is an increasing difference in the average length of stay with increasing age group in this study 0-27 days (5.6, SD 5.9), 1-11 months (6.1, SD 7.7), 1-4years (6.7, SD 15.6), and 5-11years (7.6, SD 18.0) all in days. However, this cannot be conclusive due to possible

outliers in some age groups' lengths of stay. This could be from a data-capturing error on the LHIMS and cannot be conclusive.

It is worth noting that most of the admissions in this study stayed between 2 and 7 days (60.5%), among which most were between the ages of 1 and 4 years, just as was seen in the study by Schneuer et al. (2023). Though less than a fifth (15%) were admitted for a day or less, the length of stay was positively skewed, as in other US studies by Heys, Rajan and Blair (2017) and Pelletier et al. (2021).

In this study, most of those admitted beyond 7 days were those aged 0- 27 days (see Figure 4.4.2), not the older aged, as seen in the surveys by Schneuner et al. (2023) and Caesar et al. (2025). This is due to the cut-off age for paediatrics in this study, which is below 12 years and the high number of the 0- 27 days (40.2%) age group among the study population.

5.4 Outcome of Admissions

Among the 6,298 paediatric admissions in this study, 5,798 (92.1%) were discharged, 25 (0.4%) absconded, 1 (0.0%) were discharged against medical advice (DAMA), 130 (2.1%) were referred to another tertiary facility, and 344 patients (5.6%) died. This indicates an overall survival rate of 92.1%, an overall mortality rate of 5.6%, and a neonatal mortality rate of 9.2%. These outcomes generally align with the existing literature reviewed, as most of the admissions were discharged home (Ali, Ahmed and Lohana, 2013; Okoronkwo, Onyearugha and Ohanenye, 2018; Ndung'u et al., 2019; Ahmed et al., 2022).

Whereas in this study the overall mortality rate was (5.6%), it is lower in comparison with other studies done in Ghana (7.12%), Sudan (5.8%), and Nigeria (5.7%) but higher in contrast to Liberia (5.4%), Ethiopia (0.042%), and Malawi (3.3%) (Ahmed *et al.*, 2022). Also, the neonatal

mortality rate in this study was 9.2%, which is higher compared to the studies done in St Joseph's District Hospital (8.94%) and Upper West Regional Hospital (8.91%), all in the Upper West Region (Tette *et al.*, 2020). It is far higher in comparison to the neonatal death rate in a Pakistani secondary care hospital, 6.8% (Ali, Ahmed and Lohana, 2013). The reason for this could be attributed to the fact that the study site is a tertiary teaching hospital, hence receives the worst state neonatal admissions, which lead to death.

The most common ICD-10 classifications leading to death in this study included certain conditions originating in the perinatal period (49.7%), symptoms, signs, and abnormal clinical and laboratory findings not elsewhere classified (8.7%), diseases of the nervous system (6.7%), certain infectious and parasitic diseases (6.0%), congenital malformations, deformations and chromosomal abnormalities (5.2%), diseases of the circulatory system (4.7%), diseases of the respiratory system (4.0%), endocrine, nutritional and metabolic diseases (3.5%), diseases of the digestive system (2,9%), and injury, poisoning and other consequences of external causes (2%). This is consistent with the high neonatal mortality rate seen in this study, as certain conditions originating from the neonatal period led to more deaths. As certain infectious and parasitic diseases rank third in leading to death in this study, it confirms that infectious diseases form part of the major contributors to mortality in children aged 1 month and above (Koum *et al.*, 2021).

5.5 Implications of the Study

The implications of this study's findings are essential for improving paediatric health, especially in Ghana and Africa. They will also be a reference material for other developing and developed countries worldwide. This study has shown that morbidities in children cut across all broad ICD-10 classifications. Hence, there is a need to invest more in paediatric research to widen the scope of diagnosis and improve treatment outcomes. This has also shown that children bear

the triple burden of disease (infectious, non-infectious and injuries) the most. Policies should be strengthened to reduce and eliminate preventable diseases, such as infections and injuries. Also, the study has shown the need for a specialised focus on neonatology. Speciality training in neonatology must be comprehensively developed, not to include paediatricians only. Finally, this study has shown that institutional data can yield many benefits, and hence, accurate data input and evaluation are needed for the future to have access to quality data.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In conclusion, the study found a predominance of male paediatric admissions at the Ho Teaching Hospital and a high coverage on the National Health Insurance Scheme (NHIS) among the study population. It also identified that non-infectious causes contributed more to the overall paediatric admissions due to the high prevalence of non-infectious causes of admission among the neonatal groups. The common non-infectious causes of admission in this study included neonatal jaundice, prematurity, asphyxia, respiratory distress/failure in newborns, meconium-related/other newborn aspiration with/without distress, congenital and chromosomal abnormalities, low birth weight, macrosomia, birth injury, trauma/poisoning, sickle cell disease/anaemia, hernia, cerebral palsy and other seizures, and intestinal obstruction and non-infectious gastroenteritis. The infectious causes prevalent in the admissions included malaria, pneumonia, ear, nose and throat infections, neonatal sepsis, and gastroenteritis/typhoid infections.

While this research might not completely capture the circumstances throughout Ghana, it establishes a foundation for additional studies in different areas of the country. Its findings highlight the need for enhanced resources and education within the healthcare system targeted at child health.

Furthermore, the duration of hospital stays showed that numerous admissions continued for 2 to 7 days, which is longer than commonly observed in developed nations. This comparison implies that measures can be adopted to shorten hospital stay.

The overall survival rate for paediatric admissions at the Ho Teaching Hospital was higher, while mortality was lower. However, the neonatal mortality rate subset was higher compared to other studies. This highlights the necessity for improved neonatal care outcomes at the hospital, as conditions arising from the perinatal period significantly contribute to mortality.

6.2 Recommendations

Based on the findings from this study, here are a few proposed recommendations:

1. The hospital management and heads of the paediatric department should develop and implement targeted strategies aimed at reducing neonatal mortality and minimizing unnecessary neonatal admissions. These strategies may include improving early diagnostic protocols, strengthening perinatal care practices, enhancing staff training, and ensuring timely referral and discharge planning.
2. The Regional Health Directorate, in collaboration with the hospital's public health unit, should strengthen existing policies and programs to reduce the incidence of paediatric diseases. This includes enhancing childhood immunisation coverage and expanding health education and promotion strategies to reduce injuries and poisoning.
3. The Health Information Unit should regularly evaluate data captured in the Lightwave Health Information Management System (LHIMS) to enhance health records' accuracy, completeness, and reliability for future research and decision-making.
4. The Lightwave Health Information System developers ought to transition to ICD-11 to enhance the precision of disease categorisation and support international comparison and reporting.

5. Researchers and public health specialists should conduct studies to identify the factors contributing to regional variations in disease trends, hospitalisation duration, and paediatric admission outcomes across healthcare facilities in Ghana, especially given the limited availability of similar in-country research. Such evidence is essential to inform equitable resource allocation and evidence-based policy formulation.

REFERENCES

Abhulimhen-Iyoha, B. and Okolo, A. (2012) 'Morbidity and mortality of childhood illnesses at the emergency paediatric unit of the University of Benin Teaching Hospital, Benin City.', *Nigerian Journal of Paediatrics*, 39(2). Available at: https://doi.org/10.4314/NJP.V39I2.7.

Adadey, S.M., Ayee, R., Languon, S., Quansah, D. and Quaye, O. (2019) 'Patterns of Frequently Diagnosed Pediatric Morbidities in Hospitalized Children in the Volta Region of Ghana', *Global Pediatric Health*, 6. Available at: https://doi.org/10.1177/2333794X19889230.

Afolabi, M.O., Ayieko, P., Njie, Y., Kowuor, D., Adetola, H.H., Kamara, B., Jalloh, A.B., Sesay, F., Swaray, E., Odeny, L., Pearce, R.M., Samai, M.H., Deen, G.F., Koedoyoma, S., Sesay, I.G., Ishola, D., Leigh, B., Watson-Jones, D. and Greenwood, B. (2023) 'What factors are associated with paediatric admissions and their outcomes in a rural hospital in northern Sierra Leone? Insights from a pilot observational study', *BMJ Public Health*, 1(1), p. e000545. Available at: https://doi.org/10.1136/bmjph2023-000545.

Agbesanwa, T.A., Babatola, A.O., Fatunla, O.A., Ibrahim, A., Aina, F.O., Ogundare, E.O., Adeniyi, A.T., Egbedi, F., Olubamiwa, T., Olanipekun, B. and Olatunya, O.S. (2023) 'Pattern of admissions and outcome in the children emergency department of a tertiary health institution in Southwestern Nigeria: A four-year review', *African Journal of Emergency Medicine*, 13(2), pp. 45–51. Available at: https://doi.org/10.1016/J.AFJEM.2023.02.001.

Ahmed, M.A.A., Musa, I.R., Mahgoub, H.M., Al-Nafeesah, A., Al-Wutayd, O. and Adam, I. (2022) 'Patterns, Outcomes and Predictors of Pediatric Medical Admissions at Gadarif Hospital in Eastern Sudan', *Frontiers in Pediatrics*, 10. Available at: https://doi.org/10.3389/fped.2022.764028.

Ali, S.R., Ahmed, S. and Lohana, H. (2013) 'Disease patterns and outcomes of neonatal admissions at a secondary care hospital in Pakistan', *Sultan Qaboos University Medical Journal*, 13(3), pp. 418–421. Available at: https://doi.org/10.12816/0003265.

Amu, H., Dickson, K.S., Kumi-Kyereme, A. and Maafo Darteh, E.K. (2018) 'Understanding variations in health insurance coverage in Ghana, Kenya, Nigeria, and Tanzania: Evidence from demographic and health surveys', *PLoS ONE*, 13(8). Available at: https://doi.org/10.1371/JOURNAL.PONE.0201833.

Anaba, E.A., Tandoh, A., Sesay, F.R. and Fokukora, T. (2022) 'Factors associated with health insurance enrolment among ghanaian children under the five years. Analysis of secondary data from a national survey', *BMC Health Services Research*, 22(1), p. 269. Available at: https://doi.org/10.1186/S12913-022-07670-7.

Badoe, E. V. (2016) 'Consanguinity and rare neurological disease. A five year experience from the Korle Bu Teaching Hospital, Accra, Ghana', *eNeurologicalSci*. Elsevier B.V., pp. 33–34. Available at: https://doi.org/10.1016/j.ensci.2016.01.002.

Barker, D.J.P. (2004) 'The developmental origins of adult disease', *J. Am. Coll. Nutr.*, 23, pp. 588S-595S. Available at: https://doi.org/10.1080/07315724.2004.10719428.

Bell, J., Lingam, R., Wakefield, C.E., Fardell, J.E., Zeltzer, J., Hu, N., Woolfenden, S., Callander, E., Marshall, G.M. and Nassar, N. (2020) 'Prevalence, hospital admissions and costs of child chronic conditions: A population-based study', *Journal of Paediatrics and Child Health*, 56(9), pp. 1365–1370. Available at: https://doi.org/10.1111/jpc.14932.

Boerma, T., Harrison, J., Jakob, R., Mathers, C., Schmider, A. and Weber, S. (2016) 'Revising the ICD: explaining the WHO approach', *Lancet*, 388(10059), pp. 2476– 2477. Available at: https://doi.org/10.1016/s0140-6736(16)31851-7.

Brown, C.M., Williams, D.J., Hall, M., Freundlich, K.L., Johnson, D.P., Lind, C., Rehm, K., Frost, P.A., Doupnik, S.K., Ibrahim, D., Patrick, S., Howard, L.M. and Gay, J.C. (2021) 'Trends in length of stay and readmissions in Children's Hospitals', *Hospital Pediatrics*, 11(6), pp. 554–562. Available at: https://doi.org/10.1542/HPEDS.2020004044.

Cesare, M., D'Agostino, F., Nurchis, M.C., Magliozzi, E., Damiani, G., Cocchieri, A., Cristofori, E., De Vita, V., Martinelli, S., Nisticò, A., Olivo, L. and Pascucci, D. (2025) 'Determinants of Prolonged Hospitalization in Children and Adolescents: A Retrospective Observational Study', *Journal of Nursing Scholarship* [Preprint].

Available at: https://doi.org/10.1111/JNU.13045.

Enyama, D., Koum, D.-C.K., Tounde, B.T., Njinkui, D.N. and Mapoure, Y.N. (2024) ‘Challenges in the Management of Childhood Epilepsy in a Rural Area with Endemic Onchocerciasis in Cameroon’, *Pediatric Oncall*, 21(2). Available at: https://doi.org/10.7199/ped.oncall.2024.19.

Enyuma, C.O.A., Anah, M.U., Pousson, A., Olorunfemi, G., Ibisomi, L., Abang, B.E. and Imoke, E.J. (2019) ‘Patterns of paediatric emergency admissions and predictors of prolonged hospital stay at the children emergency room, University of Calabar Teaching Hospital, Calabar, Nigeria’, *African Health Sciences*, 19(2), pp. 1910–1923. Available at: https://doi.org/10.4314/AHS.V19I2.14.

Fathalla, M.F.. and Fathalla, M.M.F.. (2005) *A practical guide for health researchers*. World Health Organization, Regional Office for the Eastern Mediterranean.

Gitterman, D.P., Hay, W.W. and Langford, W.S. (2022) ‘Making the case for pediatric research: a life-cycle approach and the return on investment’, *Pediatric Research 2022 93:4*, 93(4), pp. 797–800. Available at: https://doi.org/10.1038/s41390-02202141-5.

Harrison, J.E., Weber, S., Jakob, R. and Chute, C.G. (2021) ‘ICD-11: an international classification of diseases for the twenty-first century’, *BMC Medical Informatics and Decision Making*, 21(6), pp. 1–10. Available at: https://doi.org/10.1186/S12911-02101534-6/FIGURES/3.

Heys, M., Rajan, M. and Blair, M. (2017) ‘Length of paediatric inpatient stay, socioeconomic status and hospital configuration: a retrospective cohort study’, *BMC Health Services Research*, 17(1), p. 274. Available at: https://doi.org/10.1186/s12913017-2171-x.

Ho Teaching Hospital (2024) *Ho Teaching Hospital*, *https://www.moh.gov.gh/ho-teachinghospital/*. Available at: https://doi.org/https://www.moh.gov.gh/ho-teaching-hospital/.

Hug, L., Liu, Y., Nie, W., Sharrow, D., You, D., Cao, B., Ma Fat, D., Ho, J., Retno Mahanani, W., Strong, K., Wang World Bank Group Emi Suzuki, H., Butler, D., Dorion, C., Gerland, P., Hertog, S., Kamiya, Y., Kantorova, V., Kyaw Lay, K., Lattes,

P., Molitoris, J., Murthy Palacharla, S., Riffe, T., Spoorenberg, T., Wheldon, M., Williams, I., Zeifman, L., Cruz Castanheira, H., Acosta, E., Alkema, L., Feehan, D. and Guillot, M. (no date) *The Demographic and Health Surveys (DHS) Program, ICF*.

ICD-10-CM TABULAR LIST of DISEASES and INJURIES (no date). Available at: https://ftp.cdc.gov/pub/health_statistics/nchs/publications/ICD10CM/2022/icd10cmtabular-2022-April-1.pdf (Accessed: 23 April 2025).

Irwin, N., Currie, M.J. and Davis, D. (2022) 'Trends in hospitalisation for common paediatric infections: An Australian experience', *Journal of Paediatrics and Child Health*, 58(4), pp. 655–661. Available at: https://doi.org/10.1111/jpc.15808.

Isezuo, K.O., Sani, U.M., Waziri, U.M., Garba, B.I., Adamu, A., Jiya, F.B., Jibrin, B., Adeyemo, I.A., Amodu-Sanni, M.S., Ugege, M.O., Umar, S. and Gusau, A.B. (2024) 'Patterns and outcomes of Emergency Pediatric Unit admissions in Usmanu Danfodiyo University Teaching Hospital in Sokoto State, Nigeria: a five-year review', *Pyramid Journal of Medicine*, 7(1). Available at: https://doi.org/10.4081/pjm.2024.498.

Jetté, N., Quan, H., Hemmelgarn, B., Drosler, S., Maass, C., Moskal, L., Paoin, W., Sundararajan, V., Gao, S., Jakob, R., Üstün, B. and Ghali, W.A. (2010) 'The development, evolution, and modifications of ICD-10: challenges to the international comparability of morbidity data', *Med Care*, 48(12), pp. 1105–1110. Available at: https://doi.org/10.1097/mlr.0b013e3181ef9d3e.

Kaiser, S. V., Bakel, L.-A., Okumura, M.J., Auerbach, A.D., Rosenthal, J. and Cabana, M.D. (2015) 'Risk Factors for Prolonged Length of Stay or Complications During Pediatric Respiratory Hospitalizations', *Hospital Pediatrics*, 5(9), pp. 461–473. Available at: https://doi.org/10.1542/hpeds.2014-0246.

Karagiannidou, S., Triantafyllou, C., Zaoutis, T.E., Papaevangelou, V., Maniadakis, N. and Kourlaba, G. (2020) 'Length of stay, cost, and mortality of healthcare-acquired bloodstream infections in children and neonates: A systematic review and meta-analysis', *Infection Control and Hospital Epidemiology*, 41(3), pp. 342–354. Available at: https://doi.org/10.1017/ICE.2019.353.

Kareem, A.J. (2022) 'Pattern and Outcome of Childhood Admissions in a Public Tertiary Health-care Facility in South-Western Nigeria Article in Nigerian Journal of Health Sciences'. Available at: https://doi.org/10.4103/njhs.njhs_22_20.

Kortz, T.B., Mediratta, R.P., Smith, A.M., Nielsen, K.R., Agulnik, A., Gordon Rivera, S., Reeves, H., O'Brien, N.F., Lee, J.H., Abbas, Q., Attebery, J.E., Bacha, T., Bhutta, E.G., Biewen, C.J., Camacho-Cruz, J., Coronado Muñoz, A., deAlmeida, M.L., Domeryo Owusu, L., Fonseca, Y., Hooli, S., Wynkoop, H., Leimanis-Laurens, M., Nicholaus Mally, D., McCarthy, A.M., Mutekanga, A., Pineda, C., Remy, K.E., Sanders, S.C., Tabor, E., Teixeira Rodrigues, A., Yuee Wang, J.Q., Kissoon, N., Takwoingi, Y., Wiens, M.O. and Bhutta, A. (2024) 'Etiology of hospital mortality in children living in low- and middle-income countries: a systematic review and metaanalysis', *Frontiers in Pediatrics*. Frontiers Media SA. Available at: https://doi.org/10.3389/fped.2024.1397232.

Koum, D.K., Penda, C.I., Endale, L.M., Essome, H., Moukongo, C.M., Foko, L.P.K., Ebongue, C.O., Noukeu, D., Enyama, D., Eposse, C., Rhita, M., Eboumbou, P.E., Mboudou, E.T. and Ndombo, P.K. (2021) 'Paediatric Mortality: Aetiologies and Predictors among Children Aged 1 Month to 15 Years in a Tertiary Hospital in Douala, Cameroon', *Open Journal of Pediatrics*, 11(03), pp. 360–378. Available at: https://doi.org/10.4236/ojped.2021.113033.

Leone, S., Afolabi, M.O., Ayieko, P., Njie, Y., Kowuor, D., Adetola, H.H., Berber Jalloh, A., Swaray, E., Odeny, L., Pearce, R.M., Samai, M.H., Fadlu Deen, G., Koedoyoma, S., Sesay, I.G., Ishola, D., Leigh, B., Watson-Jones, D., Greenwood, B. and Afolabi, M. (no date) 'Piloting a pragmatic clinical audit tool for quality improvement in rural paediatric'. Available at: https://doi.org/10.1101/2023.02.01.23285336.

Leyenaar, J.A.K., Hill, V., Lam, V., Stern, R., Vaughan, K.W., Rauch, D.A., House, S., Hsu, B., Mauro-Small, M., Ortiz-Mato, N., Vinocur, C., Webb, N., Ernst, K. and Lam, Faapv. (2023) 'Direct Admission to Hospital for Children in the United States', *Pediatrics*, 151(3). Available at: https://doi.org/10.1542/peds.2022-060973.

Mehdi, A.H., Riaz, K., Ghazal, N., Kamran, N.S., Saboohi, E., Malick, A.H.H. and Tariq, A. Bin (2020) 'Disparities among pediatric hospital admissions according to gender',

International Journal of Scientific Reports, 6(7), p. 269. Available at: https://doi.org/10.18203/ISSN.2454-2156.INTJSCIREP20202642.

Mmbaga, B.T., Lie, R.T., Olomi, R., Mahande, M.J., Kvåle, G. and Daltveit, A.K. (2012) 'Cause-specific neonatal mortality in a neonatal care unit in Northern Tanzania: a registry based cohort study', *BMC Pediatrics*, 12. Available at: https://doi.org/10.1186/1471-2431-12-116.

Ndung'u, A., Sun, J., Musau, J. and Ndirangu, E. (2019) 'Patterns and outcomes of paediatric trauma at a tertiary teaching hospital in Kenya', *African Journal of Emergency Medicine*, 9, pp. S47–S51. Available at: https://doi.org/10.1016/J.AFJEM.2018.12.004.

Oguonu, T., Adaeze Ayuk, C., Edelu, B.O. and Ndu, I.K. (2014) 'Pattern of respiratory diseases in children presenting to the paediatric emergency unit of the University of Nigeria Teaching Hospital, Enugu: A case series report', *BMC Pulmonary Medicine*, 14(1), pp. 1–8. Available at: https://doi.org/10.1186/1471-2466-14-101/TABLES/5.

Okoronkwo, N.C., Onyearugha, C.N. and Ohanenye, C.A. (2018) 'Pattern and outcomes of paediatric medical admissions at the Living Word Mission Hospital, Aba, South East Nigeria', *Pan African Medical Journal*, 30. Available at: https://doi.org/10.11604/pamj.2018.30.202.15966.

Onubogu, U.C. and West, B.A. (2022) 'Pattern and Outcome of Diseases among Children Presenting in the Emergency Room of a Tertiary Hospital in Port Harcourt, Nigeria', *Open Journal of Pediatrics*, 12(03), pp. 538–553. Available at: https://doi.org/10.4236/OJPED.2022.123057.

Orish, V.N., Akake, K., Lokpo, S.Y., Kwadzokpui, P.K., Amegan-Aho, K.H., Mac-Ankrah, L., Boakye-Yiadom, E., Ibrahim, J. and Kwofie, T.B. (2022) 'Evaluating the impact of COVID-19 pandemic on complicated malaria admissions and outcomes in the paediatric Ho Teaching Hospital of the Volta Region of Ghana', *PLOS Global Public Health*, 2(9 September). Available at: https://doi.org/10.1371/journal.pgph.0000509.

Overview of the Health System in Ghana (2017). The DHS Program. Availabe at: https://www.dhsprogram.com/pubs/pdf/spa6/02chapter02.pdf

Pelletier, J.H., Rakkar, J., Au, A.K., Fuhrman, D., Clark, R.S.B. and Horvat, C.M. (2021) 'Trends in US Pediatric Hospital Admissions in 2020 Compared With the Decade Before the COVID-19 Pandemic', *JAMA Network Open*, 4(2), p. e2037227. Available at: https://doi.org/10.1001/jamanetworkopen.2020.37227.

Poropat, F., Heinz, P., Barbi, E. and Ventura, A. (2017) 'Comparison of two European paediatric emergency departments: Does primary care organisation influence emergency attendance?', *Italian Journal of Pediatrics*, 43(1). Available at: https://doi.org/10.1186/S13052-017-0339-Y.

Schneuer, F.J., Demetriou, E., Bond, D., Lain, S.J., Guastella, A.J. and Nassar, N. (2023) 'Child characteristics and health conditions associated with paediatric hospitalisations and length of stay: a population-based study', *The Lancet Regional Health - Western Pacific*, 32. Available at: https://doi.org/10.1016/J.LANWPC.2023.100706.

Speer, E.M., Lee, L.K., Bourgeois, F.T., Gitterman, D., Hay, W.W., Davis, J.M. and Javier, J.R. (2023) 'The state and future of pediatric research—an introductory overview: The state and future of pediatric research series', *Pediatric Research* [Preprint]. Available at: https://doi.org/10.1038/S41390-022-02439-4.

Stephenson, T. (2024) 'Importance and benefits of investing in child health and research', *Global Pediatrics*, 9, p. 100217. Available at: https://doi.org/10.1016/j.gpeds.2024.100217.

Teaching Hospitals in Ghana: About, Location, and Contact Details — April 2025 (no date). Available at: https://asetena.com/teaching-hospitals-in-ghana-about-location-andcontact-details/ (Accessed: 23 April 2025).

Tekleab, A.M., Amaru, G.M. and Tefera, Y.A. (2016) 'Reasons for admission and neonatal outcome in the neonatal care unit of a tertiary care hospital in Addis Ababa: a prospective study', *Research and Reports in Neonatology*, p. 17. Available at: https://doi.org/10.2147/RRN.S95455.

Tette, E.M.A., Nartey, E.T., Nuertey, B.D., Azusong, E.A., Akaateba, D., Yirifere, J., Alandu, A., Seneadza, N.A.H., Gandau, N.B. and Renner, L.A. (2020) 'The pattern of neonatal

admissions and mortality at a regional and district hospital in the Upper West Region of Ghana; a cross sectional study', *PLoS ONE*, 15(5). Available at: https://doi.org/10.1371/journal.pone.0232406.

Tette, E.M.A., Neizer, M., Nyarko, M.Y., Sifah, E.K., Nartey, E.T. and Donkor, E.S. (2016) 'Changing Patterns of Disease and Mortality at the Children's Hospital, Accra: Are Infections Rising?', *PLOS ONE*. Edited by A.P. Arez, 11(4), p. e0150387. Available at: https://doi.org/10.1371/journal.pone.0150387.

Teyie, E. (2024) Ensign Global College Department of Community Health Patterns and Outcomes of Admissions at The Medical Wards of Ho Teaching Hospital in the Volta Region of Ghana: -A Retrospective Review (2020-2024).

Umar, U.I., Muhammed, I.L. and Gwarzo, G.D. (2018) 'Pattern and outcome of admissions at the Emergency Pediatric Unit of Federal Medical Centre Nguru, Yobe State, Nigeria', *Pyramid Journal of Medicine*, 1(1). Available at: https://doi.org/10.4081/PJM.2018.1.

Williams, K., Thomson, D., Seto, I., Contopoulos-Ioannidis, D.G., Ioannidis, J.P.A., Curtis, S., Constantin, E., Batmanabane, G., Hartling, L., Klassen, T. and Offringa, M. (2012) 'Standard 6: Age groups for pediatric trials', in *Pediatrics*. Available at: https://doi.org/10.1542/peds.2012-0055I.

Wood, P. (1990) 'Applications of the international classification of diseases', *World Health Stat Q*, 43, pp. 263–268.

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