

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG



Development of a Protocol for Holistic Paediatric Burns Management, Korle Bu Teaching Hospital, Ghana

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Philosophy.

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DECLARATION

I, Alberta Amissah Nyarko, certify that the work in this thesis is entirely original with no assistance. The thesis is being submitted to the University of The Witwatersrand in Johannesburg, South Africa, for consideration.

The published articles included in this Thesis I confirm to be the lead authorship.



Signature of Candidate

3rd October, 2025

Date

DEDICATION

May you rest in peace, Mr Stephen Kwadwo Nyarko and Mrs Ruth Edith Croffie Nyarko, to whom this work is dedicated.

ABSTRACT

Background: Burns remain a significant cause of morbidity and mortality globally, particularly among children in low and middle income countries (LMIC). In Ghana, data on the prevalence of paediatric burns and the lived experiences of affected children and their caregivers remain limited, highlighting a critical gap in local knowledge. Even after hospital discharge, paediatric burn survivors face multiple complications, including pain, reduced mobility, metabolic and neurological issues, skin-related concerns, as well as emotional and psychological challenges, necessitating a holistic approach to their care and rehabilitation. Despite the existence of international evidence-based guidelines for paediatric burn management, these may not always be applicable to resource-limited settings such as Ghana. Currently, no standardised protocol has been developed for the management and rehabilitation of paediatric burns in Ghana, necessitating this study to develop a set of context specific, expert validated protocol for paediatric burns management.

Aim and Objectives: The overall aim of the study was to develop a protocol for holistic paediatric burns management at Korle Bu Teaching Hospital. The specific objectives were: (1) to establish the prevalence and characteristics of paediatric burn injuries at Korle Bu Teaching Hospital, (2) to explore the experiences of paediatric burn patients and their caregivers on burns management, (3) to assess the perceptions of healthcare practitioners on paediatric burns management practices, and (4) to develop a set of expert validated recommendations for paediatric burns management within this setting.

Methods: A four-phase, mixed methods approach was employed. Phase 1 involved a retrospective cohort study of medical records from 335 paediatric burn patients admitted to the Burns Centre at Korle Bu Teaching Hospital between 2020 and 2022, using descriptive statistics and univariate logistic regression. Phase 2 comprised an exploratory qualitative study with semi structured interviews involving 12 paediatric burn patients and 12 caregivers, analysed using thematic content analysis. Phase 3 involved focus group discussions with 15 multidisciplinary health professionals to understand their perspectives, with thematic content analysis applied. In Phase 4, a modified Delphi study was conducted with seven rehabilitation specialists to develop and validate a set of recommendations through a three round iterative process.

Results: Children accounted for 50.6% of burn admissions during the study period, with the majority being male (57.6%) and aged 1 to 5 years (70.1%). Superficial partial thickness burns were most common (51.9%), and hot water was the leading cause of injury (58.4%). Most burns involved less than 20% of total body surface area (59.0%), and the mortality rate was 21.0%. Higher TBSA was significantly associated with increased mortality ($p < 0.001$). The qualitative studies revealed six themes including causes of burns, care pathways, challenges following discharge, and reintegration concerns. Although participants expressed some satisfaction with care, procedural pain, scarring, and limited post discharge support were noted. Healthcare providers acknowledged the strengths of existing multidisciplinary care but cited the absence of standardised protocols, infrastructural limitations, financial barriers, and socio cultural challenges. The Delphi process resulted in a 40-item set of expert validated recommendations for paediatric burns care.

Conclusion: This study highlights the significant burden of paediatric burns with prevalence of 50.6% at the KBTH, Ghana. Causes of child burns were mainly from hot water and food related incidents. It identifies gaps in post burn care, systemic challenges, and the need for structured, context specific approaches to care. The final set of recommendations provides a practical framework for multidisciplinary management of paediatric burns in low-resource settings, with potential for improving consistency and quality of care at Korle Bu Teaching Hospital and similar LMIC contexts.

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LIST OF ABBREVIATIONS

ABA	American Burn Association
ADHD	Attention Deficient Hyperactivity Disorder
AFRO	Africa Region Organization

AOSIS	African Online Scientific Informative Systems
ASD	Acute Stress Disorder
ASPEN	American Society for Parenteral and Enteral Nutrition
BSA	Body Surface Area
CDC	Center for Disease Control
EAs	Emergency Attendees
EBA	European Burn Association
ED	Emergency Department
FGD	Focused Group Discussion
FPCC	Family Patient Centered Care
HICs	High Income Countries
ICF	International Classification of Functioning, Disability and Health.
ISBI	International Society for Burn Injuries
LMIC	Low Middle Income Countries
KBTH	Korle Bu Teaching Hospital
MDT	Multidisciplinary Team
NPWT	Negative Pressure Wound Therapy
NRPS & BC	National Reconstructive Plastic Surgery and Burns Center
PTSD	Post-Traumatic Stress Disorder
REE	Resting Energy Expenditure
SCCM	Society for Critical Care Medicine
TBSA	Total Body Surface Area
UK	United Kingdom
WHO	World Health Organisation

OPERATIONAL DEFINITIONS

Burns: An injury to the skin or other organic tissue of the body that is mostly brought on by heat, radiation, radioactivity, electricity, friction or chemicals (Rossella et al., 2022). Burns vary in severity and is commonly categorised as Superficial Partial Thickness Burns (SPTB), Deep Partial Thickness Burns (DTB) and Full Thickness Burns (FTB).

Clinical Practice Guidelines: Clinical practice guidelines are systematically developed statements designed to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances. They are usually evidence-based and provide recommendations derived from rigorous reviews of current research and expert consensus (Pereira et al. 2022).

Holistic: In the context of this study, holistic refers to a comprehensive, multidisciplinary approach to the rehabilitation of paediatric burn patients that address all aspects of care, from acute management upon admission through to full integration of the child into family, school, and community life. This includes the coordinated involvement of all relevant rehabilitation professionals and support systems throughout the continuum of care.

Paediatrics: The medical specialty of paediatric focuses on the treatment of newborns, toddlers, infants, preschool children and teenagers, often from birth to age 18 (Burns et al., 2012).

Prevalence: The percentage of people in a population who display a particular condition or trait over a given period of time is known as prevalence (Spronk et al., 2019).

Protocol: A protocol is a set of guidelines and procedures that outline the best practices for the diagnosis, treatment, and management of a particular medical condition or procedure. In this study, the protocol development was facilitated through a consensus process involving rehabilitation professionals (Physiotherapists and Occupational Therapist). However, the protocol items were informed by insights gathered in the earlier phase of the study (Study 3), which captured the perspectives of a broader multidisciplinary team of paediatric burns management.

Practice Recommendations: Practice recommendations are suggested courses of action based on the best available evidence, clinical experience, and contextual factors. Unlike full clinical guidelines or protocols, they may be less prescriptive and allow room for professional judgment and local adaptation.

RESEARCH OUTPUT

Published Article

Rockson, A. A., Benjamin-Damons, N., & Pilusa, S. I. (2024). Prevalence and characteristics of paediatric burns at the National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana. *Burns Open*, 8(4), 100358.

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Manuscript to be submitted to journal

Nyarko, A. A., Benjamin-Damons, N., & Pilusa, S. I. (2025). Holistic Paediatric Burns Management Protocol For Low-Resource Settings: A Modified Delphi Study. *Disability and Rehabilitation*.

SCIENTIFIC PRESENTATIONS

Oral Conference Presentation: “Paediatric Burn Survivors Tell Their Stories: A Qualitative Exploration at Ghana's Premier Burn Centre”-African Interdisciplinary Health Conference, The University of the Witwatersrand, South Africa, 21st of August 2024.

Poster Conference Presentation: “Caregiver Experiences and Perceptions on Paediatric Burn Injuries and Management at Ghana's Premier Burns Center: A Qualitative Study”- International Society of Burn Injuries Conference at Birmingham Conference center, 21st of August 2024.

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 Introduction

Children's burn injuries remain a major public health concern, particularly in low- and middle-income countries like Ghana, where the burden is often exacerbated by limited resources and deficiencies in the healthcare delivery system (WHO, 2018). Cultural beliefs and practices also significantly influence the management of burns, creating unique challenges in such settings (Doku et al., 2019). Despite advancements in burns management globally, many protocols are often designed for high-resource settings, making them challenging to implement in contexts like Ghana. This chapter provides an overview of paediatric burn injuries, its multifaceted impact on the child and caregivers and lays the foundation for the development of a paediatric burns management protocol tailored to the resource-limited settings like Ghana. The chapter begins by providing a detailed background on paediatric burn injuries, highlighting their prevalence, causes, and complications. The aims and objectives of the study are also outlined in this chapter. It further states the justification for developing a contextualized protocol for managing these injuries. Finally, the chapter highlights the scope of the study and organization of the entire research.

1.2 Background of the Study

Burn injuries are among the leading causes of morbidity and mortality in children worldwide (WHO, 2018). Children have the highest likelihood of suffering burns due to their thinner skin, limited risk awareness, and high dependence on adults for supervision, a trend particularly pronounced in developing countries (Nthumba, 2016). According to Sun et al. (2020), burn injuries rank as the third most common cause of death for children aged one to nine. These injuries have

long-term physical (e.g. hypertrophic scarring), psychological (e.g. depression and PTSD), and financial (e.g. treatment and rehabilitation costs) consequences (Sheridan, 2017). The incidence of burn injuries is higher in Low- and Middle-Income Countries (LMIC) compared to High-Income Countries (HICs) (Mehta et al., 2021; Thompson et al., 2020).

1.2.1 Epidemiology of Paediatric Burns

Burns in children are regarded as one of the most frequent stressful events in the world (WHO, 2018). Europe, the Middle East and Asia have recorded similar burn incidence of 8 out of a 1000 population even considering the higher population of Asia, whereas Africa recorded an incidence of 10 out of a 1000 population. (Thompson et al., 2020). Unfortunately, while the number of burn incidents is declining in high-income countries, Ghana and other LMIC are experiencing the opposite trend (Al-shamsi and Othman, 2017; Yarney et al., 2019). Every year, almost 300,000 new burn cases in children under five occur in sub-Saharan Africa (Broadis et al., 2017). In South Africa burns affect approximately 3.2% of the population every year, with a higher incidence among children and young adults (Janssens *et al.*, 2013). In Gambia, burns represented almost 39% of all paediatric hospital admissions (Epuwat, 2017). It has been found that the weighted annualized incidence in Ghana is 63 per 1000 children (6.4% of children per year) (Mehta et al., 2021). Although this incidence seems small the long-term effects of burns must not be underestimated.

1.2.2 Sequelae of Paediatric Burns

Burns have debilitating long term consequences such as physical deformities, hypertrophic scarring, contractures, chronic pain, reduced mobility, and psychological effects (Santos et al.,

2024; Woolard et al., 2021). Burns may be incredibly painful and disfiguring to a child and have long-term physical and emotional implications (Bairagi et al., 2019). Most paediatric burn patients who have less than 20% total body surface area (TBSA) in Australia survive, according to Allahham et al. (2023). Nevertheless, they suffer from the burn's psychological and physical effects, such as hypertrophic scars and contractures (Kidd et al., 2013) and increased risk of comorbidities such as chronic infections, malnutrition, impaired immune function, and delayed wound healing due to trauma from the burn (Duke et al., 2018). Besides the physical sequelae of burn injuries, mental health is also affected by the injury.

Paediatric burn injuries also affect the psychosocial and mental well-being of children (Gill & Falder, 2017). The psychological sequelae of burns have been reported to cause a lower standard of living compared to a normal population (Allahham et al., 2023). This is because the psychological impacts such as can interfere with their ability to reintegrate into school, work, and social environments, while physical limitations, visible scars, and chronic pain may reduce their independence, productivity, and opportunities for personal and economic development. According to a critical assessment of the psychological effects of paediatric burns, within four weeks of suffering a burn, up to 30% of preschool-aged children may experience significant mental distress (Egberts et al., 2018).

Burn injury also affects the caregivers and negatively impacts on the socioeconomic status of the family. Studies have reported that, the psychological and emotional effect on the child is often shared by the caregiver or parent (Haag & Landolt, 2017; Egberts et al., 2018). Caregivers of burn patients may endure traumatic and distressing experiences. Caring for a child with burns requires a special approach, both in physical care and emotional support (Haag & Landolt, 2017).

Additionally, it puts a financial load on the patient, their family, and the healthcare system due to the high costs of prolonged hospital stays, multiple surgeries, rehabilitation and medications (Bairagi et al., 2019). Thus, a holistic management of paediatric burns is vital.

1.2.3 Holistic Management of Paediatric Burns

A comprehensive strategy that addresses the child's psychological and social needs in addition to their physical injuries is necessary for the effective therapy of paediatric burns. According to Thompson et al., (2020), it has been shown that treating burn injuries holistically can significantly reduce the physical and mental complications and mortality associated with these injuries. Using a multidisciplinary approach, the holistic therapy of paediatric burns addresses the injury's social, emotional, and physical components (Gupta et al., 2016). In high-income nations, established burn management practices have led to children often surviving severe burns up to 60% of their total body surface area (TSBA), with rehabilitation lowering morbidity (Broadis et al., 2017). However, there are particular difficulties in managing paediatric burns in low-and middle-income countries (LMIC), such as a lack of funding, poor infrastructure and cultural norms (WHO, 2018; Albertyn et al., 2014). Therefore, there is a need to investigate the management practices in a LMIC setting and address these barriers to ensure optimal outcomes for paediatric burn patients.

1.3 Problem Statement

Burns are one of the main causes of morbidity worldwide, and they disproportionately impact children in LMIC (Allorto et al., 2018; Thomson et al., 2020; Mehta et al., 2021). Research on the prevalence of paediatric burn injuries and the experiences of caregiving for children and their caregivers is lacking in Ghana, indicating a knowledge gap that need attention. Even after being

discharged from the hospital, paediatric burn injury survivors face a wide range of complications and ongoing symptoms such as pain, joint and movement issues, problems with the nervous and metabolic systems, skin-related concerns, as well, as emotional, and psychological challenges (Santos et al., 2024; Woolard et al., 2021; Luce et al., 2015). These challenges are exacerbated in LMIC, where access to specialised care, rehabilitation, and mental health support is often inadequate.

According to Albertyn et al., (2014), holistic paediatric burn management requires adequate resources, skilled personnel, and accessible healthcare facilities. In Ghana and numerous other African nations, there are no standardised protocols for the management of paediatric burns (Allorto et al., 2018). While evidence-based guidelines for paediatric burn management exist in High-Income Countries, they may not always be applicable to resource-limited settings, such as Ghana due to disparities in health infrastructure, access to specialised technology, and limited training and expertise (Doku et al., 2019). It is essential to contextualise paediatric burn management practices to the specific needs and resources of the Ghanaian healthcare system (Albertyn et al., 2014). To date no published protocol has been proposed or adopted for paediatric burn management in Ghana. Therefore, it is salient to lead a study towards developing a contextual protocol for holistic paediatric burn care in Ghana.

1.4 Aim of the Study

To develop a protocol for holistic paediatric burns management in Korle Bu Teaching Hospital, Ghana.

1.5 Research Questions

1. What is the period prevalence and characteristics of paediatric burn injuries in Korle Bu Teaching Hospital, Ghana?
2. What are the experiences of paediatric patients and their caregivers on burns management?
3. What are perceptions of health care practitioners on the hospital's paediatric burns management practices?
4. What protocol can be recommended as best practice for holistic paediatric burns management in Korle Bu Teaching Hospital, Ghana?

1.6 Research Objectives

1. To determine the period prevalence and characteristics of paediatric burns in Korle Bu Teaching Hospital, Ghana.
 - a. Establish period prevalence of paediatric burns.
 - b. Describe characteristics of burns (type, depth, body part involved).
2. To explore the experiences of burns, management, and post hospitalisation needs.
 - a. Explore the experiences (pain, health related quality of life (HRQoL) and scar) of burns injuries from paediatric patients.
 - b. Explore the caregivers' experiences of how the burns were managed.
 - c. Identify the post hospitalisation needs of paediatric burns patients and their caregivers.
3. To explore the perceptions of health care practitioners on the hospital's paediatric burns management practices.
 - a. To explore contextual factors influencing the hospital's paediatric burns management practices.

- b. Identify barriers and facilitators to the hospital's paediatric burns management practices.
4. To develop a protocol to facilitate holistic paediatric burns management in Korle Bu Teaching Hospital, Ghana.

1.7 Study Justification

Developing a contextualised burns management protocol is crucial in LMIC like Ghana, where cultural beliefs and healthcare limitations influence treatment practices (Doku et al., 2019). Ghana currently lacks a published protocol for treating paediatric burns. Local data on prevalence, patient and caregiver experiences, and practitioner perspectives are scarce. This study fills a major gap in the literature by offering statistical insights and qualitative perspectives, culminating in the proposal of a protocol tailored to the Ghanaian context.

The findings of this study will contribute significantly to clinical practice, healthcare leadership and public health policy. For paediatric patients, the protocol will support timely, consistent, and comprehensive care that addresses both physical and emotional recovery. Caregivers and parents will benefit from improved guidance, reduced uncertainty, and potentially lower financial burden. Healthcare practitioners will gain access to a practical and contextually relevant tool for decision-making. For the healthcare system, a standardised protocol can improve efficiency, optimise resource allocation, and support training and capacity-building initiatives. From a public health policy standpoint, the study provides a timely and contextual evidence base that policymakers can use to draft national or regional guidelines for paediatric burn care. Moreover, the study provides a foundation for future research aimed at refining and expanding holistic care models in LMIC settings.

1.8 Summary of overall study

The overall study comprises four interconnected components aimed at developing a protocol for holistic paediatric burns management at Korle Bu Teaching Hospital (KBTH). A prevalence study, which examines the occurrence and trends of paediatric burn injuries in hospitals, makes up the first part. Exploratory qualitative research that offer deep insights into experiences, difficulties, and viewpoints of patients and caregivers surrounding burn management come next. Focus group discussions then bring together the perspectives of healthcare providers to discuss the practices and challenges associated with paediatric burn management at the KBTH. Finally, a modified Delphi study engages experts to achieve consensus on the critical elements of the proposed protocol. The breakdown of the components of the study is illustrated in Figure 1.

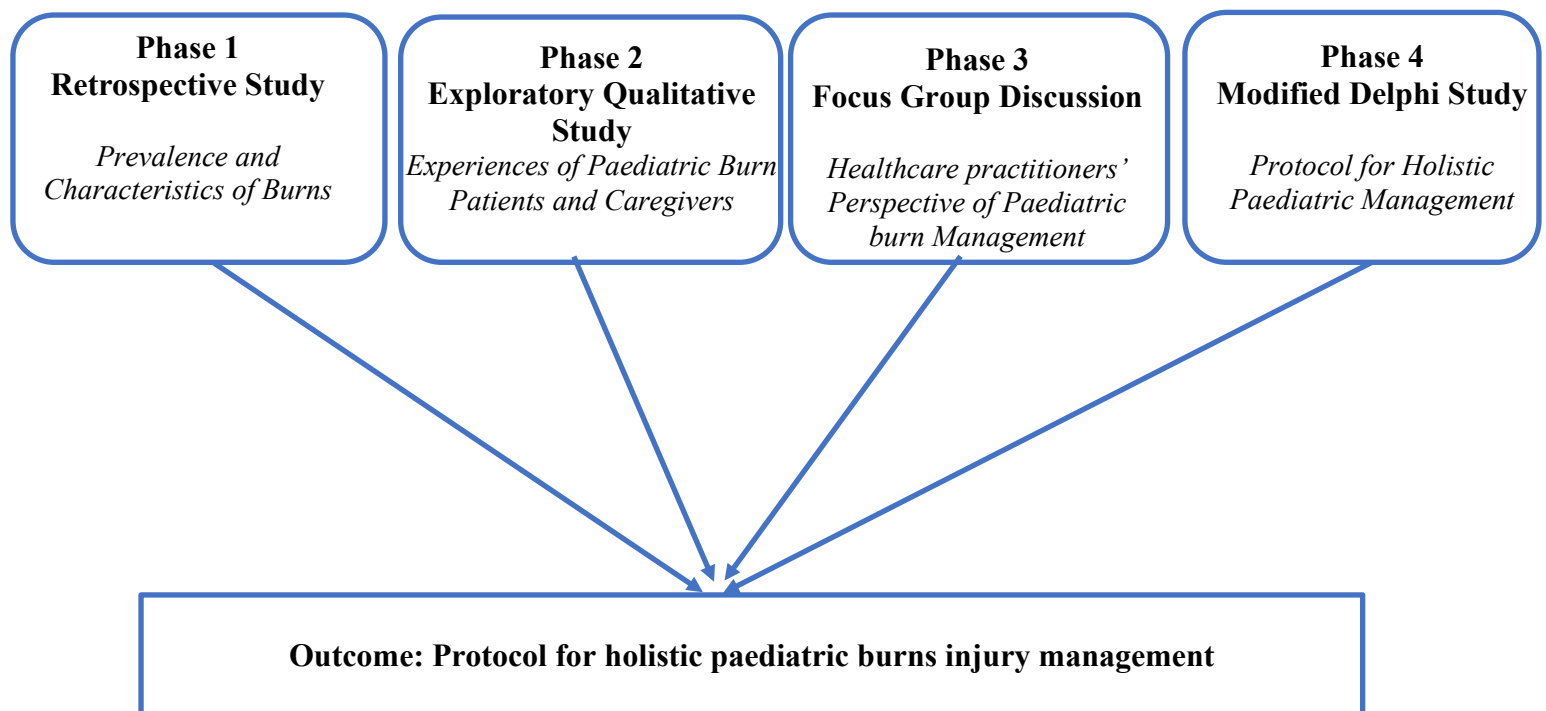


Figure 1.1: Summary of overall study and outcome per study

1.9 Chapter Organisation

There are eight chapters in this thesis. Chapter one provides a general introduction, outlining the background, problem statement, aims, objectives, study justification and scope of the study. Chapter two reviews existing literature on paediatric burn injuries, highlighting global trends, experiences of patients and caregivers, and burn management practices. Chapter three explains the methodology used in the study, detailing the approaches for each of the four components of the overall research. Chapters four to seven present the findings of these studies, with each written as a standalone manuscript published or yet to be published in peer-reviewed journals. Chapter 8 concludes with an integrated discussion of the results, conclusions and suggestions for putting the holistic approach into practice and enhancing the treatment of paediatric burns in Ghana.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of existing literature relevant to the study. In conducting the literature review for this study, searches were conducted using academic databases including PubMed, Google Scholar, ScienceDirect, Scopus, Web of Science, the Cochrane Library, AfricaWide, and PEDro. These databases were selected due to their extensive collections of peer-reviewed journals, systematic reviews, and clinical studies pertaining to burns and paediatric healthcare. The search strategy employed Boolean operators (AND, OR, NOT) and included keywords such as "paediatric burns," "burn injury in children," "burn prevalence," "burn treatment," "burn rehabilitation," "burn pain management," "paediatric wound care," and "burn care guidelines." Where applicable, Medical Subject Headings (MeSH) terms were used to ensure accuracy and specificity of results. Only studies published in English were included in the review. The time frame for the literature search was limited primarily to studies published within the last decade (2015 to 2025), to ensure the relevance and contemporaneity of the evidence reviewed. However, a few seminal and empirical studies published before 2015 were also included where they provided foundational or highly relevant findings. Input from an academic librarian helped to optimise the comprehensiveness and relevance of the literature search.

The review begins by examining epidemiological studies, highlighting the incidence, prevalence, and mortality rates of paediatric burn injuries. It also delves into the characteristics of burn cases, including the demographics of affected children, common causes of injuries, body parts involved, and the depth and severity of burns. The chapter also highlights the experiences of paediatric burn

patients, caregivers, and healthcare professionals involved in burn care. The chapter also highlights current techniques employed in managing paediatric burns, with a focus on the medical, psychosocial, and rehabilitative elements of care. Lastly, the review aims to provide a comprehensive understanding of the subject, identify patterns and gaps within the existing body of literature, and guide the development of an all-encompassing management strategy for paediatric burn injuries in children.

2.2 Epidemiology of Paediatric Burns

2.2.1 Global Epidemiology of Paediatric Burns

The age group that is most vulnerable to burn occurrences is children. On a global scale, nearly 10% of all childhood fatalities resulting from injuries are attributed to burns (WHO, 2018). Among children ages 5-9, burn injuries account for the third-highest number of fatal injuries. Approximately 8 out of every 100,000 children worldwide are admitted to the emergency department due to burns (WHO, 2018, CDC; 2020). Globally, burn injuries are unequally distributed; over 90% of instances occur in LMIC (Price et al., 2021) primarily due to factors such as overcrowded living conditions, unsafe cooking methods (e.g., open fires or kerosene stoves), and poor housing infrastructure (Peck et al., 2008; Afetor et al. 2024).

Children under the age of 14 made up over one-third of all burn incidents in Australia and New Zealand between 2009 and 2020 (BRANZ, 2020). Children account for over one-fourth of all burn injuries in the US (Sharmah and Parashar, 2010). More than half of all burn cases seen in European hospitals are caused by childhood burns (Davies et al., 2020). The incidence of burns in England and Wales varies, with primary care (PC) attendances recorded at 16.1 per 10,000 persons at risk

annually. Emergency attendances (EAs) were higher, reaching 35.1 per 10,000 persons in England and 28.9 per 10,000 persons in Wales. Every year, about 260 children between the ages of 0 and 19 are hospitalised to specialised burn hospitals in the Netherlands (Van Baar, 2013). This indicates that burns are a common cause of healthcare visits, with more cases requiring emergency care than primary care. (Davies et al., 2020).

2.2.2 Epidemiology of Paediatric Burns in LMIC and Africa

The picture of paediatric burns in the low-and middle-income countries (LMIC) shows a different epidemiological picture. Africa has the second highest number of burn cases after South East Asia (Price et al., 2021). The regions with the highest burn rates are Southeast Asia, the Eastern Mediterranean, and the Western Pacific, where an estimated 68, 64, and 49 out of every 100,000 people experience burns each year (Thomson et al., 2020). In India, children account for 17-25% of burn-related hospital admissions (Lal and Bhatti, 2017). Afetor et al. (2024) claim that open fires, dangerous cooking equipment, overcrowding and subpar housing conditions are the main causes of the high burn rate. These hazards are more prevalent in areas with high rates of poverty.

Africa has the highest per capita incidence of burns compared to any other region globally (Albertyn et al., 2015). The African Region, specifically Sub-Saharan Africa, experiences more than 1 million burn incidents annually, resulting in significant illness and death (Collier et al. 2021). Estimates indicate that between 300,000 and 17.5 million children under the age of five sustain burns annually in Africa (Rode et al., 2014), reflecting wide variability depending on population sizes and data sources. Children under ten account for over 80% of all burn cases in

sub-Saharan Africa (Nthumba, 2016), underscoring that the youngest age groups are at greatest risk during critical stages of growth and development.

Specific reports of paediatric burns in some African countries have been mentioned in the literature. In the Gambia, burns are responsible for 38.7% of all paediatric hospital admissions, highlighting the immense burden on health facilities (Tusiime et al., 2020). Determining whether the substantial differences observed across African countries are due to true variations in burn incidence, differences in populations accessing care, or referral and reporting patterns remains challenging (Burd & Yuen, 2005).

Focusing on Ghana, several studies reveal concerning trends. Mehta et al. (2020) reported an annual incidence of 63 burn injuries per 1,000 child years, meaning 6.4% of children aged 0–17 experience burns each year. Notably, Forjuoh (2006) identified that the highest risk was observed among children aged 18–23 months (first 1000 days of life), with a rate of 57.4 burns per 1,000 individuals per year. This aligns with the “first 1,000 days of life” concept, a period crucial for child survival, growth, and development, during which vulnerability to injuries like burns is particularly high due to increased mobility, curiosity, and dependence on caregivers.

The persistently high incidence of burns among very young children in Africa is a significant concern, given the potential for long-term physical and psychological impacts. It highlights the urgent need for effective prevention strategies, community education, and improved access to specialised paediatric burn care throughout the region.

2.3 Characteristics of Paediatric Burns

2.3.1 Demographics of Paediatric Burns (Age and Sex)

Although both sexes are affected by paediatric burn injuries, multiple studies have shown that males are more likely than females to sustain them (Fadeyibi et al., 2011; Nduagubam et al., 2021; Aikawa et al., 2022). A study conducted by Stocken et al., (2014), reported that approximately 60.0% of paediatric burn cases presenting to a specialty paediatric burn centre in Australia were males. In China, Chen et al. (2023) found that male children accounted for 63.23% of burn cases, indicating a significant sex disparity.

In Africa, a study conducted by Mugwena et al. (2025) in South Africa reported that 54.1% of paediatric burn injuries occurred in males ($n = 144$), while Mahlaule et al. (2024) documented a slightly higher prevalence of 61.4% among boys. Furthermore, a Tanzanian prospective study revealed that male children were implicated in 66.7% of paediatric burn cases (Nduagubam et al., 2021). According to a study on the prevalence of burns, among children under five years old in Uganda by Tusiime et al. (2022), males were involved in the majority of cases (52.4%). In Nigeria, a retrospective analysis from 2011 to 2018 recorded a male-to-female ratio of 1.3:1 (109 males and 89 females) (Nduagubam et al., 2021). Mugwena et al. (2025) found that 54.1% of paediatric burn injuries occurred in males in South Africa, while in Uganda, males constituted 52.4% of cases among children under five (Tusiime et al., 2022). This higher prevalence among boys has been attributed to their increased levels of physical activity, greater sense of adventure, and behavioural tendencies such as curiosity and risk-taking, which may increase their exposure to hazardous environments. However, sex-based prevalence may differ across contexts due to variations in cultural roles, domestic responsibilities, and exposure to hazards. In contrast to the global trend,

studies conducted in the Middle East have consistently shown a higher representation of female paediatric burn cases (Taghavi et al., 2010). This deviation may be due to girls in the Middle East spending more time indoors, where they are exposed to domestic hazards such as cooking fires and hot liquids. Additionally, traditional long and loose clothing worn by girls in the region may increase their vulnerability, as such garments can catch fire more easily.

According to the literature, paediatric burn patients range in age from one day to fourteen years. However, children under the age of five are particularly vulnerable to burn injuries (Fadeyibi et al., 2011; Nduagubam et al., 2021; Aikawa et al., 2022). In Uganda, Tusiime et al. (2022) reported that the average age of paediatric burn cases was 2.94 years ($SD = 1.29$), with 70.2% of cases occurring among children aged 2 to 5 years, who were three times more likely to sustain burns than those under 1 year of age. A study by Banga et al. (2022) found that 50% of paediatric burn patients admitted to a facility in Johannesburg, South Africa, had a median age of 25 months, ranging between 15 and 47 months. In a Nigerian study, 40% of cases occurred among toddlers (aged 1–2 years) and 25.5% among the preschool age group (2–5 years) (Fadeyibi et al., 2011). A retrospective study by Nduagubam et al. (2021) reported that just over 13% of patients in South-East Nigeria were aged 12 years or older, while more than 56% were under four years of age.

Several factors contribute to the increased frequency of burn injuries among children aged 0–4 years. At this developmental stage, children are beginning to walk and explore their environment. Their natural curiosity may lead them to pull down tablecloths, reach for hot objects, or tamper with open flames or hot liquids. Their impulsivity, lack of awareness of danger, increased mobility,

and complete dependence on caregivers place them at higher risk for accidental burn injuries (Fadeyibi et al., 2011).

2.3.2 Etiology of Paediatric Burns.

There are various causes of burns, including contact burns, electrical burns, chemical burns, and scalds from hot surfaces. But the most frequent cause of burns in children is scald burns (Rode et al., 2016; Nduagubam et al., 2021). In Australia, Stocken et al. (2014) found that 44.4% of paediatric burn cases were caused by scald injuries. Similarly, a retrospective study conducted in Spain verified that the most common cause of burn injuries in children was scalds, accounting for 70.1% of all burn injuries (García-Díaz et al., 2022). In South Africa, 89.1% of paediatric burn cases were attributed to scald burns (Mugwena et al., 2025). According to researchers at the burn unit at Ngwelezana Hospital in rural KwaZulu-Natal, South Africa, 69.5% of burn injuries were caused by hot water burns (Albertyn et al., 2014). Banga et al. in (2022) in a study conducted in South Africa found that scalding was the predominant mechanism of injury, representing 84% of cases, particularly during the winter season.

In Mozambique, a study assessing 206 children found that hot liquids were responsible for 66% of burns, followed by fire (28%) and electrical burns (6%) (Huo et al., 2024). Similarly, in Ethiopia, 71.7% of 218 paediatric admissions at the Addis Ababa Burn Emergency and Trauma Hospital were for scald burns from hot water, while 20.2% involved flame burns (Atlabachew, 2023). In Ghana's Ashanti Region, scald injuries were the most common, affecting 62% of paediatric burn patients. These patterns were echoed in Nigeria, where Nduagubam et al. (2021) identified hot liquids as the cause of 56.7% of burn injuries. While chemical burns are relatively

rare, caustic soda stored in living spaces has been noted as a cause of injury in Nigeria (Albertyn et al., 2014).

The primary sources of scald burns include hot water, heated food, and beverages (Stocken et al., 2014; Rode et al., 2016; Nduagubam et al., 2021). These injuries often occur during meal preparation or bathing, times when hot liquids are frequently handled. The higher prevalence of scald burns in African countries may be attributed to contextual factors such as the use of open fires or unsafe kerosene stoves for cooking, lack of proper kitchen infrastructure, crowded living conditions, and limited supervision of young children. Additionally, traditional cooking practices involving floor level stoves or containers of hot water left unattended increase the risk of accidental burns among toddlers (Başaran and Özlü, 2022).

Flame burns, though less frequent in younger children, become more common with age. Karami et al. (2012) and Stocken et al. (2014) noted a higher incidence of flame related injuries among older children. Fadeyibi et al. (2011) reported that 66.4% of paediatric burns were caused by open flames. In that study, 59.09% of these cases were due to kerosene lamp explosions, malfunctioning stoves, and electrical devices. Other causes included mattress fires ignited by candles (1.01%) and even a toilet fire explosion (0.3%), although such isolated cases have limited statistical relevance. Tusiime et al. (2022) found that fires and hot solids were responsible for 41% and 17% of paediatric burns, respectively. Examples of hot solids include cooking utensils, heated metals, and irons. Fifty-two percent of the children in a study at the Benin Teaching Hospital in Nigeria had flame burns as a result of kerosene explosions (Rode et al., 2014).

Fireworks have also been identified as a cause of paediatric burn injuries, especially during festive seasons such as New Year's celebrations. In South Africa, Smittenberg et al. (2010) highlighted the role of fireworks in such injuries, although Banga et al. (2022) reported only two firework related incidents in their study. Nevertheless, other research has confirmed that firework related injuries spike during holidays and festivals (Banga et al., 2022).

Van Baar (2013) conducted an epidemiological study revealing that burn injuries in younger children are predominantly caused by hot fluids within the home, while flame burns are more typical among older children aged 5 to 19 years. Mehta et al. (2020) supported this age related distinction, reporting that 53% of burn cases among children aged 0 to 17 years were due to flame exposure, followed by scalds (38%) and contact burns (10%). Interestingly, no electrical burns were reported in that study.

Several indirect and less common causes of paediatric burns have been documented. In a survey of 650 children aged 0 to 5 in Ghana's Ashanti Region, 35 had sustained intentional burns, primarily from flames. These findings underscore the need to consider child protection concerns alongside accident prevention. Kemp et al. (2014) noted that children were particularly susceptible to contact burns from household devices like hair straighteners and irons. Though rare, burns from motorcycle exhausts were also reported. Inhalational injuries, often overlooked initially, represent another serious category of paediatric burns. Rode et al. (2016) analysed 4451 cases at the Red Cross Children's Hospital in South Africa and found that airway burns, affecting either the upper airway or lung tissue, were consistently associated with burns above the collarbone. Such injuries

may present with delayed symptoms but result in significant complications if not promptly identified.

The high prevalence of paediatric burn injuries in low-resource settings has been attributed to multiple systemic factors. These include the lack of safety regulations, unsafe cooking and heating methods, poor supervision, and inadequate awareness among caregivers regarding burn prevention strategies (Mba et al., 2017; Lal and Bhatti, 2017). Enhancing public education on household safety, improving home infrastructure, and increasing caregiver vigilance are essential for reducing the incidence of these preventable injuries.

2.3.3 Socio-economic Factors Associated with Paediatric Burns

Burn injuries in children are shaped by a complex interplay of socioeconomic and environmental factors. To understand these dynamics, it is essential to consider evidence from both high-income and low-and middle-income countries, as these contexts reveal important differences and similarities that inform burn prevention strategies.

Internationally, studies have demonstrated a clear relationship between lower socioeconomic status and higher risk of paediatric burns. For example, in Australia, children from disadvantaged backgrounds were found to have almost twice the hospitalisation rate for burns compared to those from the least disadvantaged households (Ryder et al., 2020). This highlights how economic hardship can exacerbate children's vulnerability to burn injuries, even in high-income countries with advanced healthcare systems.

In African contexts, factors such as poverty, low parental education, overcrowded housing, and inadequate infrastructure further increase the risk of burns among children (Rode et al., 2014). Rapid urban migration has led to the proliferation of overcrowded slums and makeshift settlements, which often lack proper safety measures and infrastructure, placing children at elevated risk for burn-related accidents (Rode et al., 2014; Thomson et al., 2018). Bridging from the international to the African experience underscores the universality of socioeconomic influences, while highlighting the additional burden faced by families in resource-limited settings. Key parental and household characteristics including education levels, income, supervision, understanding of burn prevention and care, and rural versus urban residence significantly influence burn incidence in children (Padalko et al., 2019; Başaran & Özlü, 2022). These are important variables to consider incorporating into data collection tools, such as structured questionnaires or patient file reviews, as they can provide insights into specific risk factors in the study setting. In South Africa, several studies have identified socioeconomic status, housing type, community characteristics, and child dependency as key contributors to paediatric burn hospitalisations (Banga et al., 2023). Collecting detailed information on these determinants from patient records or through caregiver interviews could enhance understanding of burn risk patterns.

In addition to social and economic determinants, certain health conditions also play a role. For example, in parts of Africa, open fire accidents are more common among individuals with epilepsy or other illnesses like pneumonia, meningitis, gastroenteritis, and tuberculosis, particularly when anticonvulsant medications are not taken as prescribed (Peck et al., 2010). Behavioral conditions, such as attention deficit hyperactivity disorder (ADHD), have also been associated with a higher

incidence of childhood burns, likely due to increased impulsivity and reduced hazard awareness (Padalko et al., 2019).

These findings from diverse settings highlight the need for comprehensive interventions that address not only environmental and housing risks, but also socioeconomic and health-related factors. Improved living conditions, targeted education for caregivers, and broader community awareness of burn hazards are critical to reducing the burden of paediatric burns in vulnerable populations.

2.3.4 Seasons, Setting, and Time Related Factors of Paediatric Burns

Burn injuries in children are influenced not only by individual and household factors but also by the setting of injury, seasonal patterns, and time of day, which shape the risk of exposure to hazardous situations. International and regional studies show that the location, season, and timing of burns vary across different socioeconomic and environmental contexts.

Most scald injuries in children occur at home during daily activities such as food preparation or bathing, reflecting the domestic setting as a primary site of risk for paediatric burns (Burgess et al., 2017; Kawalec, 2020). Informal settlements, characterized by overcrowding and congestion, pose an even greater hazard, as they limit caregivers' ability to eliminate environmental risks that infants and young children face (Outwater et al., 2013; Mashreky et al., 2010). In Nigeria, a multicenter retrospective review found that 93.9% of paediatric burn injuries occurred within the home environment, with spilling hot liquids, especially water, being the main cause (Nduagubam et al., 2021). In contrast, Tusiime et al. (2011) reported that approximately 47% of burn incidents

in their study took place outside the home, with almost half of these injuries (44%) occurring during afternoon playtime.

The literature also reveals seasonal variations associated with paediatric burns in various regions. In Sub-Saharan Africa countries such as Egypt, Turkey, and Taiwan, burns were more common during colder, drier winter months. This pattern is attributed to the increased use of traditional heating and cooking methods, such as kerosene stoves and open fires, which families use to keep warm when temperatures drop (Rayner et al., 2011). Similarly, in Taiwan, burns in children were more frequent in winter, likely related to preparing hot tea and using chafing dishes, portable cooking devices that bring hot surfaces closer to children (Rayner et al., 2011). The researcher's interpretation is that colder weather compels caregivers to create heating sources within the home or cooking areas, inadvertently increasing children's exposure to flame and scald hazards, especially when children are confined indoors.

In other settings, burns peaked during warmer months. In Turkey, burns occurred more commonly during the summer, possibly due to increased outdoor cooking and recreational activities (Rayner et al., 2011). In Iran, most paediatric burns happened during summer months, which may reflect increased outdoor activities among older children during school vacations, elevating their risk of contact with fires or hot objects (Karami et al., 2012). A study by Asena et al. (2019) also reported higher frequencies of burn injuries in both summer and autumn, with genital burns notably peaking during these seasons, possibly due to increased exposure during warmer weather. Taş and Yiğit (2023) further observed that scald and electrical burns occurred most frequently in spring, while

flame burns were more prevalent in winter. Burns resultant from contact with hot objects and chemical burns were most commonly reported during the summer.

Temporal patterns further refine the understanding of paediatric burn risk. In the Czech Republic, burn injuries were most frequent on weekends, during winter, and over summer holidays (Celko et al., 2009), indicating times when children are more likely to be at home and engaged in activities that increase burn risk. Data from Banga et al. (2022) found that most child burn admissions occurred in winter (32%), followed by spring (27%) and autumn (24%), underscoring the heightened risk during colder months. Burns at home were found to peak between 11 a.m. and 7 p.m., corresponding with food preparation and mealtimes, whereas outdoor burns reached their maximum around 4 p.m., coinciding with children's afternoon play (Celko et al., 2009). Collectively, these findings emphasize the importance of tailoring burn prevention strategies to seasonal, environmental, and temporal factors, while addressing common causes of burns in paediatric populations.

2.3.5 Severity and Pattern of Paediatric Burn Injuries

Burn injuries can seriously harm the skin. To measure the extent of burns and the damaged area of the skin, the total body surface area (TBSA) percentage is calculated (Holm et al., 2021). There are different methods to calculate TBSA, depending on whether it is for adults or children. The "rule of nines" is commonly used in adults, dividing the body into segments that represent 9% (or a multiple of 9) of the TBSA. The traditional method for estimating TBSA in children is the Lund and Browder Chart, which is based on the rules of nine (Gill and Falder, 2017). This approach considers how the proportions of body surface area change as children grow older. For example,

an infant's head is considered to be 20% of their TBSA, while an adult's head is only 9% based on the rule of nines (Gill and Falder, 2017). TBSA can range from small percentages, such as 1-10%, to more extensive burns, such as 40% or more. The severity of the burn increases with the percentage of TBSA impacted.

In addition to the TBSA, the severity of burns can also be classified based on the depth or thickness of skin damage, which reflects the degree of tissue involvement (Stone et al., 2018). Burn depth is commonly categorized into Superficial Partial Thickness Burns (SPTB), Deep Partial Thickness Burns (DPTB or PTB) and Full Thickness Burns (FTB) (Kuan et al., 2017 Cirillo et al., 2021). SPTB involve only the epidermis and part of the dermis, usually presenting with redness, blistering, and pain, and typically heal without significant scarring. DPTB extend deeper into the dermis, may appear pale or mottled, and are associated with prolonged healing times and a higher risk of scarring (Zhang and Zhou, 2021). FTB, also known as third-degree burns, destroy the full thickness of the skin, including nerve endings, resulting in a dry, leathery texture and insensitivity to pain at the burn site; they often require surgical intervention such as skin grafting. MTB, a term sometimes used interchangeably with extensive full-thickness burns, involve damage beyond the dermis into subcutaneous tissue, muscle, or bone, and are associated with high morbidity and mortality (Zhang and Zhou, 2021). Accurately assessing burn depth is essential for guiding treatment decisions and predicting outcomes in paediatric burn patients.

In a study conducted in South Africa by Mugwena et al. (2025), it was found that 78.2% of patients had less than 10% of their body burned, and 96.6% had superficial partial-thickness burns. In India, the average percentage of body burned was 20%, and burns covering more than 30% of the body

were linked to a higher risk of death (Kumar et al., 2024). Similarly, a study in Bosnia and Herzegovina reported that the average burn area in hospitalised paediatric cases was 8.5% (Zvizdic et al., 2024). According to a study conducted in Nigeria by Nduagubam et al. (2021), superficial partial thickness burns accounted for 75.2% of cases and were the most commonly seen level of injury. The findings of Stockon et al, (2014) reveal that most children typically present to a burn centre with partial thickness burns of small to medium size and are mostly treated as outpatients. These findings highlight the significant variation in burn severity across different regions, with a higher percentage of TBSA burned correlating with increased severity and risk of mortality. In paediatric burn situations, determining the amount of burns using precise TBSA estimating techniques is essential for determining the severity of injuries and directing the proper course of therapy.

Burns injury can occur in any body part. However, there are variations and unique trends in body parts involved in burn injuries among children. According to Banga et al. (2022), out of the 482 participants, a total of 348 anatomical burn sites were identified, indicating that three-quarters of the children had burns in multiple anatomical sites (75%, n = 362). The upper limb was the most commonly affected (23%, n = 303), then lower limb (20%, n = 255). In 97.33% of the patients in the study by Nduagubam et al. (2021), the burns impacted more than one body area and in 30% of the instances, all anatomical parts were injured. The most frequently affected body parts were the upper limbs (73.0%), and right lower limb (28.8%), anterior and posterior trunk (65.8%), neck (24.9%), face (23.4%), and head (18%). Because these limbs are actively employed for exploration, they are frequently exposed and so more prone to injury, which may explain this observation.

According to Stockton et al., (2014), the body part involvement of paediatric burn injuries varied depending on the child's age. In children under 12 months old, hand and upper limb injuries were the most frequent, especially the front of the trunk aligning with global data (Laitakari et al., 2014). Children ages 0–4 naturally explore their environment by tugging, touching, and grabbing items, which frequently results in burns in this area (Nduagubam et al., 2021). However, after reaching 10 years of age, lower limb injuries, especially in boys, became the most prevalent site of injury (Nduagubam et al., 2021). A possible explanation to this observation is that older children, particularly boys, engage more in outdoor and physical activities, increasing exposure to hazards affecting the legs. Contrary to the aforementioned claims, Wang et al. (2016) found that the head and neck were the most often impacted regions in their study conducted in Beijing, followed by the lower limbs.

2.3.6 Paediatric Burn Complications and Prognosis

Paediatric burn injuries frequently lead to hospitalisation, disability, and, in severe cases, death. The severity of burns dictates whether patients require only first aid or intensive hospital care. Banga et al. (2021) reported that burns involving multiple sites, thermal causes, and receiving first aid before hospital admission were linked with more severe outcomes.

2.3.6.1 Mortality Associated with Paediatric Burns

Burn injuries remain a significant cause of child mortality, especially in low- and middle-income countries (LMICs). For example, mortality from burns among children under five in the WHO African Region is nearly double the global average for this age group (Allorto et al., 2018). Studies

estimate that LMICs account for about 95% of the 238,000 annual deaths worldwide from thermal burns (WHO, 2018). Discrepancies between LMICs and high-income countries stem from factors including limited access to specialised burn care, delayed treatment, inadequate emergency response, widespread use of open flames for cooking or heating, and a lack of preventive safety measures in homes. In Nigeria, Nduagubam et al. (2021) found that cause of injury, burn depth, TBSA percentage, and inhalation injury were strongly associated with mortality. Although many children survived and were discharged, 6.6% of patients died from their injuries in that study. In the UK, Davies et al. (2020) reported 12 annual paediatric burn fatalities, half of which involved children under five years old, with an estimated overall mortality rate of 0.1 per 100,000 children. In South Africa, the annual paediatric burn fatality rate was 2.8 per 100,000 children under five, with burns being the third leading cause of external death in children under 18 (Wesson et al., 2013; Hyder et al., 2012). Mortality rates varied widely across African countries, reaching up to 44% in some Nigerian studies, 14.2% in Liberia, and 9.1% in Angola (Rode et al., 2016), with Agbenorku et al. (2013) reporting a 21.3% mortality rate among hospitalised children in Ghana.

Beyond survival, burn injuries can cause long-term complications affecting physical, psychological and emotional well-being (Palmu et al., 2016; Tehranineshat et al., 2020). Although most children with burns covering less than 20% TBSA are likely to survive (Allahham et al., 2020), many face hypertrophic scarring, contractures, chronic pain, and mental health challenges due to the trauma of the injury (Bakker, 2013). Severe burns also disrupt daily life, threaten a child's well-being, and may require prolonged medical care and rehabilitation. Some children may experience lifelong disabilities or limitations in physical function, while families often face significant emotional and social burdens during recovery. These complications highlight the urgent

need for improved prevention strategies, timely treatment, and enhanced burn care services to reduce the burden of paediatric burn injuries, particularly in resource-limited settings.

2.3.6.2 Physical Consequences and Functional Limitations

Children who survive burn injuries are more likely to develop impairments that last a lifetime. This can be attributed, in part, to the fact that young children often suffer burns on their hands and upper limbs (Li-Tsang et al., 2016). Normal growth patterns can worsen the development of contractures, leading to further complications such as limited joint mobility, chronic pain, and impaired function (Thomson et al., 2018). Severe burns cause extensive skin damage, compromising the skin's critical roles: protection against infection, regulation of temperature, sensation, and maintaining fluid balance (Bakker, 2013). During healing, scar tissue can replace normal skin, resulting in thick, discoloured, or uneven scars that affect both function and appearance.

Scarring can also impair temperature regulation, reduce sweat production, and alter sensation due to the destruction of skin structures (Disseldorp, 2015). These changes contribute to long-term physical problems, including restricted movement from contractures and muscle loss caused by the catabolic stress response to burns, which leads to significant lean body mass loss, weakened immunity, and delayed wound healing (Porter et al., 2013; Williams et al., 2011). Notably, muscle breakdown can continue for at least nine months after major burns in children (Disseldorp, 2015). Visible scars or deformities often cause dissatisfaction with appearance, poor self-esteem, and challenges in social and intimate relationships (Disseldorp, 2015). According to Wurzer et al. (2017), children who have had severe burns show notable improvements in their general

impression of scarring and discomfort, but even two years after the burn injury, they still feel self-conscious about their bodies.

Pain is closely linked to burn injuries, and it is a common experience for children who have been affected by burns, regardless of factors such as the cause, size, or severity of the burn. Children who get burns have severe distress and discomfort during the whole injury, treatment and recovery process (Ciornei et al., 2023). Children who survive the injury may have noticeable scars and deformities, necessitating intense physical therapies employing techniques such as splinting, and range-of-motion exercises (Rosenberg, et al., 2018). These therapeutic interventions are necessary to prevent contractures and maintain mobility but can cause discomfort if not managed with proper pain control strategies.

Burn injuries can further limit children's participation in recreational activities. Many avoid formal or outdoor sports due to self-consciousness or physical weakness, preferring informal, home-based play instead (Grice et al., 2014). For example, Patel et al. (2022) noted that physical deformities after burns can contribute to developmental challenges, including delays in achieving motor or cognitive milestones, difficulties with social interactions, and reduced emotional resilience. Parents frequently report that concerns over appearance and fear of negative peer reactions are key barriers to their children's activity engagement. For example, Baldwin et al. (2013) found that 76% of adult burn survivors cited physical weakness as their main obstacle to exercise, a challenge also faced by children. Low confidence, poor body image, and fear of injury may similarly discourage paediatric burn survivors from participating in physical activities, even after minor burns (Willis et al., 2011). Allahhan et al. (2022) found that parent-reported physical function scores were

consistently lower for teenagers, possibly due to increased body image awareness and social pressures during adolescence. Meanwhile, children aged 5 to 7 and 13 to 18 had significantly lower psychosocial function scores, suggesting these age groups are particularly vulnerable to social and emotional difficulties after burns, whereas children aged 8 to 12 displayed more variable outcomes, perhaps reflecting greater adaptability or differing levels of support in this developmental window.

Paediatric burn injuries also impact education. Extended hospital stays, repeated medical visits, and rehabilitation disrupt school attendance and academic progress (Sood et al., 2019). Moreover, the combined physical and psychological effects of burns can impair attention, memory, and learning, requiring specialized educational support to help children succeed academically (Palmieri et al., 2018). These multifaceted consequences demonstrate that paediatric burn injuries extend far beyond the initial trauma, affecting children's physical health, psychological well-being, social integration, and educational attainment, highlighting the urgent need for multidisciplinary approaches in both prevention and recovery.

2.3.6.3 Psychological Consequences

In the long run, paediatric burn patients have greater rates of psychopathology and higher levels of anxiety and traumatic stress symptoms (Woolard et al., 2021). In comparison to non-burn populations, burn survivors typically reported worse psychological functioning (Pate et al., 2021). Without specialized psychological care, paediatric burn survivors face substantial risks of developing mental health disorders and experiencing long-term negative outcomes (Palmu et al., 2016).

Research conducted by Dalal et al. (2010) suggests that a pronounced level of acute pain resulting from burn injuries is associated with psychological ramifications, including suicidal thoughts, depression, acute stress disorder, and Post Traumatic Stress Disorder (PTSD), which can persist for two years or longer following the burn incident. Kurian et al. (2019) emphasize that burn injuries are highly distressing and have wide-ranging psychological, social, economic, and physical impacts on survivors. Consequently, coping with the altered body image after the burn is an arduous task for these individuals. In a study involving preschool children conducted in Australia, it was found that approximately 25-29% of the children experienced acute stress following a burn injury (De Young et al., 2012). Furthermore, one month after the burn injury, 16% of children aged 0-4 years were newly diagnosed with separation anxiety disorder (De Young et al., 2012). Longitudinal analysis revealed that while most children showed resilience or recovery within six months, 8% experienced chronic PTSD, and 2% developed delayed-onset PTSD. These findings suggest that although many children demonstrate remarkable psychological recovery after burns, a notable minority remains vulnerable to persistent or late-emerging PTSD, emphasizing the need for ongoing mental health monitoring and support (De Young et al., 2012).

Stoddard et al. (2017) similarly observed that while only a small percentage of young children with burns met full diagnostic criteria for PTSD, many exhibited posttraumatic symptoms one month after discharge. The most prevalent symptoms observed were intrusion (experienced by 79% of the children), hyperarousal (experienced by 72% of the children), and dissociation and avoidance (experienced by 44% of the children) (Backmann et al., 2023). Additionally, it was found that during hospitalisation, both self-reported and mother-reported state anxiety scores were

higher, indicating a temporary increase in anxiety; however, these scores were lower compared to children awaiting minor surgery (Backmann et al., 2023).

2.3.6.4 Socioeconomic consequences

The economic impact of paediatric burns on society and individuals is substantial. The costs associated with hospitalisation, surgeries, medications, wound care, and rehabilitation can quickly accumulate (Miller, Murphy, & Birch, 2018). In addition, families may face additional expenses related to transportation, accommodation, and lost income due to the need for parental caregiving or extended treatment for the child's burn injury (Lawrence, Burgman, & Fraser, 2020). These financial burdens can lead to increased stress and financial instability for families.\

In Australia, hospital expenses related to burns and scalds for the year 2001–2002 were estimated at approximately \$38.7 million. Additionally, in 2007, the average daily cost of wound dressings for burn patients in an intensive care unit in Australia was \$700.74 (Rayner & Prentice, 2011). There is limited information on costing in Africa with one review indicating that period of hospitalisation is the main cost driver during the direct and acute phase of treatment (Albetyn et al., 2014). The World Health Organization (2018) further highlighted that out-of-pocket expenses for burn care are a major cause of impoverishment in many African households, reflecting both direct medical costs and indirect costs such as lost wages.

The long-term economic consequences of paediatric burn injuries can be far-reaching. Physical and psychological scars may limit a child's future employment opportunities, career choices, and earning potential (Meyer et al., 2017). The need for ongoing medical treatments, rehabilitation,

and cosmetic procedures can persist into adulthood, adding to the financial burden (Wasiak et al., 2019). These prolonged costs can compromise a family's overall quality of life and financial security.

2.4 Caregivers Outcomes

A significant discovery in the field of paediatric injuries is that parents are equally, and at times even more, affected than the child themselves (Bakker et al., 2013; Dillard & Kolomer, 2020). Parents may experience trauma during the acute phase of their child's burn damage, which can significantly affect their psychological health (Bakker et al., 2013). It can be extremely distressing for parents to witness their child's burn episode, worry about their child's life, face the child's suffering and serious skin injuries, and struggle with feelings of helplessness and uncertainty about the future (Bakker et al., 2013).

During the first seven days following a burn injury to their child, parents undergo significant distress, according to a study by McGarry et al. (2014) that emphasises the significance of the acute phase in burn injuries. The functioning of parents is significantly impacted by this high degree of distress. However, parents are unable to assimilate this crucial knowledge because of their compromised functioning brought on by psychological distress (McGarry et al., 2014). Bakker et al. (2013) conducted a study indicating that parents often experience intense feelings of guilt, depression, anxiety, traumatic stress, and numerous concerns about their child's health and future appearance.

Egberts et al. (2017), in a Dutch study examining the long-term effects of paediatric burns, found that within the first month after the injury, clinically significant PTSD was prevalent in 26% of fathers and 48% of mothers. In a study conducted in the United States by Dorn et al. (2007), parents of children who survived severe burns experienced a higher prevalence of mental health problems and cardiovascular complications. Within the first two years following the injury, these parents were at increased risk of experiencing mental health challenges and cardiovascular issues compared to parents of children without burns. Not only do burn injuries impact children and their parents individually, but they also affect the entire family system. This highlights the need for family-centered care approaches, aligning with Sustainable Development Goal 3 (SDG 3), which emphasizes promoting health and well-being for all and prioritizes comprehensive, holistic care that supports both children and their families during recovery.

In interviews conducted in Sweden by Oster et al. (2014), parents of burn survivors expressed concerns about managing their child's injuries, uncertainty regarding at-home treatment, difficulty regulating their children's responses to painful treatments, struggles with adjusting to new daily routines, and strains on family relationships. Parents reported that the adjustment process at home was challenging and isolating, highlighting their need for more support from healthcare professionals, social workers, and community resources to aid in the child's recovery and the family's overall well-being. A Swedish study by Willebrand and Sveen (2017) found that one-fifth of parents of child burn survivors did not receive adequate psychosocial or medical interventions after the injury, indicating a significant gap in post-discharge support.

2.5 Management of Paediatric Burns

A comprehensive strategy that takes into account both the psychological and physical components of treatment is needed for the management of paediatric burns. Specialised therapy approaches are required to guarantee the best results because children and adults differ in their anatomical, physiological and emotional characteristics (Gill and Falder, 2017). It has been demonstrated that efficient care greatly lowers the detrimental effects and death rates related to burns in children. It is widely recognized that optimal treatment for paediatric burns involves a multidisciplinary team comprising surgeons, nurses, social workers, psychologists, occupational and physiotherapists and others (Cambiaso-Daniel et al., 2018). In High-Income Countries (HICs), children with severe burns have better survival rates-up to 60% total body surface area (TBSA)when proper first aid, fluid resuscitation, acute care and long-term wound management are combined. Rehabilitation efforts have further reduced morbidity in these cases (Kim et al., 2012; Kraft et al., 2012). Effective pain management, wound care, airway protection, first aid, fluid resuscitation, and emotional support are essential components of treatment (Thomson et al., 2020). Healthcare providers must be well-trained in the unique challenges of paediatric burn care to improve survival rates and ensure better long-term outcomes for affected children.

2.5.1 Paediatric Burn Management Guidelines and Treatment Recommendations

2.5.1.1 First Aid Management

Applying immediate and adequate first aid with cooling measures has proven to be effective in improving burn outcomes by preventing further tissue damage and associated complications. The use of cool water for treating burn injuries has been recommended in British first aid manuals since 1965 (Hafizurrachman et al., 2023). In the event of paediatric burns, it is advised to provide cool

running water to the burn site for 20 minutes. Even if access to cooling supplies is delayed, cooling should still be done within the window of up to three hours following the injury because it is advantageous (Hafizurrachman et al., 2023). However, for distressed children, implementing this cooling method may be challenging, in which case, applying wet cloths intermittently can be an alternative approach. After cooling the burn, it is advised to cover it with cling film, a clean cloth, or a non-adherent dressing. It is crucial to remember that children are more vulnerable to hypothermia than adults because of the larger surface area to volume ratio, higher heat loss, thinner skin, less subcutaneous fat and non-shivering thermoregulation. Therefore, while cooling the burn, it is essential to ensure the child remains warm (Gill & Falder, 2017).

The study by Nduagubam et al. (2021) in Nigeria, involving 167 paediatric burn patients, found that raw eggs were the most frequently used topical first-aid ingredient (52 cases; 31%). Among the children studied, the most common form of first aid involved applying raw egg directly on the burned area, either alone (19; 9.6%) or in combination with other substances (49; 24%). In 19 cases (9.6%), water was used topically alone; in 44 cases (21.7%), it was applied in conjunction with other components. Additional first aid methods included the topical application of kerosene, herbal mixes, petroleum jelly (vaseline), toothpaste, palm oil, honey, raw pap, gentian violet, aloe vera mashed, cassava, salt and hydraulic and motor oil, typically in combination. Approximately 25.3% of the patients arrived at the hospital without receiving any kind of first aid. Before their hospital stay, just eight children had their burns treated and given any treatment by a medical practitioner. Although these first-aid approaches were reported by participants in the study conducted in Nigeria by Nduagubam et al. (2021), there is limited scientific evidence supporting its effectiveness. These results underline the pressing need for public health initiatives, such as

better access to qualified healthcare professionals, community education on appropriate first-aid techniques, and laws to deter damaging customs.

In a different study by Banga et al. (2022) conducted in South Africa, nearly 63% of patients had received some form of first aid before arriving at the hospital. Of those, specific methods were reported in 75% of cases. The two most commonly used alternative first aid techniques were toothpaste (used in 7% of instances) and eggs (used in 5% (n=8) of cases). In addition, there was a correlation between the use of first aid and more severe burns. This can be attributed to caregivers being more attentive to burns that cover larger areas, thus promptly administering first aid measures (Banga et al., 2022). In Stockton et al's (2014) prospective observational study conducted in Australia, approximately one-third of children were given appropriate first aid at the location of their injury which was a significant progress compared to the 12% reported in an earlier study in 2005. However, about 25% of children received treatments that are not recommended and could be harmful, such as using ice, indicating a potential focus for targeted intervention (Stockton et al., 2014). These findings have direct relevance for Ghana, where similar misconceptions and inappropriate first-aid practices have been observed anecdotally in paediatric burn cases. Integrating targeted education on first-aid best practices for burns into community health programs in Ghana could help improve outcomes for paediatric burn patients and reduce complications associated with harmful traditional methods.

2.5.1.2 Assessment of Paediatric Burns

To ascertain the degree of the burn, or the percentage of Total Body Surface Area (%TBSA), an initial assessment must be carried out. This assessment is crucial for calculating fluid replacement

requirements and identifying paediatric patients who are more prone to complications. It is commonly known that greater mortality rates are linked to higher % TBSA (Rode et al., 2014). The ABCDE technique is used in patient evaluation to identify and treat life-threatening injuries, starting with the most rapidly fatal ones, according to Broadis et al. (2017). As part of the first evaluation of paediatric burns, it is also critical to refer suitable patients-such as those who have inhaled- early and perform an escharotomy at the facility where the patient has presented. Areas of erythema are typically not included in the evaluation of paediatric burns because they are only superficial and typically recover in seven days.

Several charts are accessible to assist in estimating the %TBSA. Because it takes into consideration the variable contributions made by each body area at different ages, the Lund and Browder Chart is thought to be the most accurate way to determine burn size. Using the patient's hand's palmar surface (from wrist to fingers), which makes up around 1% of the body surface area, is an alternate strategy if this chart is not easily accessible (Lund and Browder, 1944). Smaller regions or sparing areas in larger burns can also benefit from this technique. However, it should be noted that there is debate regarding whether the entire hand or just the palm (excluding fingers) constitutes 1% (Rossieter et al., 1996). In contrast, Wallace's rule of nines, commonly used in adults, is not as accurate for children. This rule states that the head should make up 18% of the body surface area up until the age of one year, and each lower limb should make up 14%.

2.5.1.3 Acute Management of Paediatric Burns

The importance of airway management in the early treatment of heat injuries is emphasized in the International Society for Burn Injuries' guidelines (ISB, 2016). Due to their anatomical

susceptibility to airway obstruction, paediatric patients require immediate airway stabilization, including early intubation. A comprehensive study was carried out by Broadis et al. (2017), who also produced reference guidelines for the acute phase management of paediatric burn injuries. These guidelines were summarized under four main themes (Patient assessment, fluid management, pain management, nutritional management, toxic shock syndrome and tetanus) (Broadis et al. 2017).

An important objective in the initial treatment of burn injuries is to facilitate wound healing and prevent the development of chronic infections and sepsis, which used to be a leading cause of death following burn injuries (Cannon et al., 2006). Research has demonstrated that patients with sepsis experience greater muscle breakdown and increased metabolic rate compared to non-septic patients with similar burn injuries (Hart et al., 2000). The improved survival rates observed in severe burn cases can be partly attributed to the early removal of burn wounds and grafting procedures conducted within 24 to 48 hours of the injury. It has been demonstrated that early excision of burn wounds lowers death rates in children and young adults who have experienced burns, minimizes blood loss, lessens the body's inflammatory and breakdown reaction and shortens hospital stays (Barret & Herndon, 2003).

For patients with burn injuries, prompt assessment and treatment of any life-threatening disorders are crucial. In cases where children experience respiratory distress or airway compromise due to airway swelling, endotracheal intubation is necessary. The paediatric airway is narrower, thus it is critical to keep the threshold for intubation low (Mittal et al., 2024). A comprehensive medical history and physical examination should be conducted and burn sites should first be covered with

sterile. Patients should be kept warm by taking precautions such limiting exposure, keeping room temperatures high, and giving warm intravenous fluids (Cartotto et al., 2024).

2.5.1.4 Fluid Management and Resuscitation

Fluid resuscitation is a crucial component of initial burn care, especially in paediatric patients who are susceptible to rapid deterioration and burn shock (Cartotto et al., 2024). For paediatric burns exceeding 10% of the total body surface area (TBSA), intravenous fluid resuscitation is necessary, while adults typically require resuscitation for burns above 15% TBSA (Cartotto et al., 2024). When a child sustains a burn that covers less than 10% of their body surface, oral fluids including oral rehydrate solutions are typically sufficient (Broadis et al., 2017). A fluid formula that takes into account the patient's weight and the proportion of TBSA impacted by the burn is used to calculate how much fluid is required during the first 24 hours. The Parkland or Modified Brooke formula is normally used in Africa and it is calculated as $(\text{Total fluid in 24 hours} = 2\text{--}4 \text{ ml} \times \text{TBSA} (\%) \times \text{Weight (kg)})$ (Broadis et al., 2017).

To optimize resuscitation, half of the calculated fluid volume should be administered within the first 8 hours post-injury, with the remaining half delivered over the following 16 hours. This timing matches the pattern of edema formation, which peaks during the initial 24 hours. Additional fluids may be necessary for extensive burns or burns resulting from electrical or inhalation injuries (Gill & Falder, 2017). It is essential to consider maintenance fluids in paediatric patients, as they require ongoing hydration beyond initial resuscitation. Maintenance fluids typically continue during the acute phase until the child's oral intake is adequate, usually for 24-48 hours post-injury, and should contain at least 5% glucose to provide energy and prevent hypoglycemia by avoiding depletion of

liver glycogen stores (Gill & Falder, 2017). For children in hypovolemic shock or with signs of burn shock, fluid boluses of 10-20 ml/kg should be administered promptly. Losses from vomiting and diarrhea should be replaced as they occur (Hespe and Levi, 2022). Dark urine may indicate myoglobinuria from muscle fiber breakdown in deep burns, which requires a target urine output of at least 2 ml/kg/hour to minimize the risk of acute tubular necrosis (Hespe and Levi, 2022). A urine output goal of 1-2 ml/kg/hour indicates effective resuscitation. Excessive fluid administration, known as “fluid creep,” can lead to complications like abdominal compartment syndrome (Lyall and Bhadauria, 2023). If urine output is below the target range, resuscitation fluids should be increased by 50- 100% for the next hour before reassessing the patient. Conversely, if urine output is excessively high, fluid rates should be reduced accordingly. Oral intake should also be considered and subtracted from the total maintenance fluids to avoid overhydration (Gill & Falder, 2017; Lyall and Bhadauria, 2023).

2.5.1.5 Pain Management

Paediatric patients may experience three types of pain such as background pain (constant pain at rest), procedural pain (acute pain during wound care or medical procedures), and psychological pain (emotional distress such as anxiety or fear related to the burn or its treatment) (Admassie et al., 2022). These different types of pain can be effectively managed using both pharmacological and non-pharmacological approaches (Broadis et al., 2017).

Pharmacological methods involve the use of intravenous (IV) opioids such as morphine, methadone, and ketamine (Madadi et al., 2012). In many African healthcare centres, Paracetamol and Ibuprofen are commonly used and are generally suitable for managing most minor burns in

children. However, children younger than three months should not be given Ibuprofen (Madadi et al., 2012). In patients with minor burns, morphine can be administered to relieve procedural pain; in patients with more extensive burns, it can be given to treat background discomfort. Morphine has a systematic distribution throughout the body and is frequently used to treat severe burn pain. It can be constantly given by infusion or through a patient-controlled pain pump, which enables children older than eight to take the drug on their own (Madadi et al., 2012). Methadone is effective for managing background pain as it produces less euphoric effects. However, it should be tapered gradually to prevent withdrawal symptoms (Abrar et al., 2024).

In addition to pharmacological interventions, non-pharmacological methods are also effective in relieving pain in burn patients. Simple measures like covering the wound to protect it from air can significantly enhance the patient's comfort, considering the sensitivity of exposed nerve endings. Even a gentle breeze can cause pain for the patient. Non-pharmacological techniques such as breathing exercises, preparedness, relaxation techniques, and therapeutic medical play have shown positive outcomes in pain relief (Hollywood & O'Neill 2013; Moore et al. 2015). Physiotherapists play a central role in delivering many of these techniques. They guide patients through structured breathing exercises to reduce anxiety and pain perception, and help prepare children physically and emotionally for procedures through play-based simulations and movement preparation (Ciornei et al., 2023). Relaxation strategies, including guided imagery and gentle stretching, are often facilitated by physiotherapists to ease muscle tension and improve comfort (Ciornei et al., 2023).

Therapeutic medical play involves healthcare providers role in playing with the child using real medical equipment to simulate upcoming procedures, helping the child feel more prepared and less anxious (Gomez-Torres et al., 2014). At Red Cross War Memorial Children's Hospital in Cape Town, South Africa, portable DVD players have been used during dressing changes to distract children and reduce pain perception. Additionally, aromatherapy massage has shown promise as a complementary pain relief strategy (O'Flaherty et al., 2012). Emerging technologies like virtual reality systems, including devices like the Nintendo Wii Fit, have also been explored as tools to encourage movement, improve circulation, and reduce pain through interactive, engaging activities (Bai et al., 2025). Studies by Lozano and Potterton (2018) highlight the potential of virtual reality-based interventions in paediatric burn rehabilitation

2.5.1.6 Nutritional management

It is impossible to overestimate the importance of healthy eating for burn injuries. Burn injuries trigger a hypermetabolic response in the body, necessitating a higher calorie intake to promote optimal healing (Broadis et al., 2017). Additionally, there is a greater demand for protein. Early initiation and promotion of enteral feeding is recommended since it has been demonstrated to protect the gastrointestinal system, reducing the risk of bacterial translocation and stress ulcers (Pilkington et al., 2012). Severe burns can lead to complications such as gastric ulceration and bacterial translocation (Van Hasselt, 2008; Prelack et al., 2007).

For individuals with burns affecting more than 20% of their total body surface area (TBSA), it is recommended to insert a nasogastric tube and initiate enteral feeding within 8 hours (Bul, 2020). Various formulas are available to calculate calorie requirements based on weight and TBSA. Three

weeks following the injury, patients with severe burns that cover more than 40% of the TBSA may lose up to 25% of their body weight, according to studies. Therefore, vigorous nutritional assistance through enteral or parenteral feeding is crucial, particularly when burn injuries limit the patients' ability to consume food freely.

For calorie and protein requirements, recommendations vary, but guidelines typically propose energy intake of 65 kcal/kg/day or 150% of the Resting Energy Expenditure (REE) and protein intake of 2.5–4 g/kg/day to support anabolism, immune function, and healing (Jeschke et al., 2011; Rousseau et al., 2013; Kraft et al., 2012). Higher protein intakes (up to 4 g/kg/day) may be needed for extensive burns (above 50% TBSA). Micronutrient supplementation with selenium, zinc, copper, and vitamins B1, C, D, and E is crucial not only for supporting antioxidant defenses but also for preventing or correcting malnutrition, which can occur rapidly in severely burned children (Rousseau et al., 2013; Wasiak et al., 2013). Supplements can help prevent infections, modulate inflammation, and improve wound healing. The Curreri formula, widely used to estimate energy requirements in burn patients, calculates daily caloric needs as follows:

Calories/day=(1800 kcal/m² BSA)+(2200 kcal/m² BSA burned) (van Hasselt et al., 1994; Curreri et al., 1974).

2.5.1.7 Burn Wound Management

Research indicates that wound care should only begin once the patient's condition has been stabilized, which refers to achieving physiological stability, particularly restoration of adequate circulation, oxygenation, and fluid balance to prevent or treat burn shock (Herndon et al., 2017). The type of wound care provided depends on the severity and depth of the burn injury. Full

thickness burns, for example, often require more frequent dressing changes or surgical excision compared to superficial burns, underscoring the importance of accurately reporting burn depth in your findings, as it directly impacts treatment costs, healing time, and hospital stay duration (Jeschke et al., 2011).

Blisters can form when the epidermis separates from the dermis, and there are three main management options: (1) leaving the blister intact, (2) draining the fluid while keeping the skin in place, or (3) removing the blister roof entirely. Burn wounds should be cleansed using antibacterial solutions or mild soap and water, and debridement, the removal of dead or damaged tissue, should be performed regularly. Guidelines suggest that dressing changes for partial and full thickness burns may range from once daily to once every three days in high income countries, while in low and middle income countries they are often done more frequently, daily or twice daily, depending on wound exudate, infection risk, and resource availability (Rowan et al., 2015; Wasiak et al., 2013).

The choice of dressings depends not only on their properties and intended purpose but also on what is practically available at the hospital or clinic. For example, silver sulfadiazine dressings are frequently used for their bactericidal properties, although Sharp et al. (2014) reported difficulties with their use due to their messy consistency. Another study in India found that silver sulfadiazine cannot penetrate eschar effectively, leading to gel formation that complicates dressing changes (Kumar et al., 2022), prompting nurses to favor collagenase ointments combined with antibacterial creams.

The “wet dressing” technique, as described by Rahman et al. (2024), involves applying mesh gauze and burn dressings over the wound, with perforated catheters placed between dressing layers to allow periodic irrigation with antimicrobial solutions, which keeps the dressings moist and promotes healing (Beam, 2024). This approach is particularly useful during excisions, skin grafts, and applications of cultured skin substitutes, where maintaining a moist wound environment reduces infection risk and supports tissue regeneration (Rahman et al., 2024; Beam, 2024). Nurses are central to this process, as they manage regular dressing changes, catheter irrigation with antibiotic solutions, and debridement as needed.

2.5.1.8 Physiotherapy Management

Early and aggressive implementation of physical therapy has been demonstrated to play a central role in the holistic rehabilitation of paediatric burn patients, addressing physical, respiratory, functional, and psychosocial domains.

1) Pain Management and Psychosocial Support

Burn rehabilitation is inherently painful, and physiotherapists play a critical role in managing procedural and background pain through both active and passive strategies. These include transcutaneous electrical nerve stimulation (TENS), manual therapy, massage, positioning, hydrotherapy, and guided relaxation techniques. Pain control not only improves tolerance for therapeutic activities but also enhances overall participation and motivation. Evidence shows that alongside physical gains, exercise and therapy interventions also improve psychosocial functioning and perceived quality of life in paediatric patients (Rosenberg et al., 2013; Dodd et al.,

2017). The physiotherapist's empathetic engagement during painful procedures is instrumental in reducing fear, anxiety, and psychological distress, especially in younger children.

2. Breathing Exercises and Pulmonary Rehabilitation

Burn injuries affecting the thorax or requiring prolonged bed rest may compromise lung function and respiratory mechanics. Breathing exercises, including deep diaphragmatic breathing and incentive spirometry, help expand lung capacity, clear secretions, and prevent complications such as pneumonia and atelectasis. These exercises complement thoracic mobility routines and contribute significantly to improved pulmonary outcomes, as highlighted in studies where structured rehabilitation led to notable gains in lung function following burn injuries (Disseldorp et al., 2013; Rosenberg et al., 2013). When implemented in a hospital setting, these strategies support both immediate respiratory needs and long-term pulmonary recovery (Paratz et al., 2012).

3. Range of Motion Exercises and Thoracic Mobility

Early and aggressive implementation of physical therapy has been shown to be effective in preventing the development of contractures in burn patients (Melissa, 2017). Range of motion (ROM) exercises are vital in maintaining joint flexibility, reducing stiffness, and preventing muscle shortening, particularly in the acute and post-operative phases. These exercises also enhance thoracic mobility, which is essential for proper respiratory mechanics and overall functional independence. For children with extensive burns involving the trunk, thoracic mobility exercises help counteract restrictive scarring and improve posture and breathing capacity. The importance of structured rehabilitation, including these interventions, is underscored by findings

that exercise programs initiated at discharge significantly improve pulmonary function and reduce the need for surgical scar releases (Disseldorp et al., 2013).

4. Cardiovascular Endurance and Functional Recovery

Paediatric burn patients often suffer from reduced cardiovascular fitness due to prolonged immobilization and metabolic stress. Physiotherapy interventions aimed at enhancing cardiovascular endurance—such as graded aerobic training, walking, and cycling—are essential in rebuilding stamina and restoring independence in daily activities (Hultgren, 2016; Palackic et al., 2021). These interventions are particularly important for school-aged children engaged in physical and recreational activities. Compared to children who only received standard care, those who underwent resistance training programs showed significantly improved muscle strength and physical performance (Toma et al., 2024). Improvements in lean body mass and skeletal muscle function were also observed, promoting better physical outcomes and reintegration into school and community life (Alloju et al., 2008; Ebid et al., 2012).

Considering the evidence supporting the positive effects of exercise, implementing a hospital-based exercise program should be strongly recommended as a standard component of burn injury rehabilitation to enhance the physical and social functioning of individuals affected by burns.

2.5.2 Barriers and Facilitators in Paediatric Burn Management

An analysis of paediatric burn injuries in sub-Saharan Africa revealed barriers to delivering quality burn care. High fatality rates during the early stages of paediatric burn therapy were found to be significantly influenced by insufficient airway control and inadequate fluid resuscitation

(Arbuthnot & Garcia, 2019). In low- and middle-income countries (LMIC), airway burns are strongly associated with poor outcomes, and mortality rates related to smoke inhalation injuries have been reported as high as 68.7% (Olawoye et al., 2014). Furthermore, the equipment required for paediatric intubation which is crucial for appropriate airway management is usually lacking in hospitals in low-and-middle -income countries (LMIC) (Den Hollander et al., 2014).

Additionally, access to supplementary oxygen, a crucial component of burn care, was inconsistent among the facilities examined, particularly in low-income countries (LICs). A study focusing on referrals to a tertiary burn centre in Durban, South Africa, underscored the inadequate initial burn management in LMIC, often due to resource limitations (Den Hollander et al., 2014). Thomson et al. (2019) further noted that many facilities in LMIC do not have the capability to consistently provide basic intravenous fluids. In addition to limited resources, the timely administration of fluid resuscitation in LMIC faces practical barriers, including unclear or inconsistent guidelines, as highlighted in a recent review (Rode et al., 2014). Regarding inadequate burn patient rehabilitation, a survey involving 103 physical and occupational therapists found that 81% reported the absence of a hospital-based exercise program for paediatric burn patients (Diego et al., 2013). These factors, combined, are likely to have a detrimental impact on the quality of care provided to paediatric burn patients in LMIC and may contribute to higher mortality rates.

2.6 Conclusion

Given that burn injuries are more prevalent and have higher death rates in low-and middle-income countries (LMIC), it is evident from the reviewed studies that paediatric burns represent a significant public health concern. Children under the age of five are the most affected, with scald

burns being the leading cause. Poverty, illiteracy and urban migration are social and environmental factors that contribute to the high rate of burns in many parts of the world, especially Africa. In addition to causing physical suffering, burn injuries can have long-term emotional and psychological effects on children and their families. Many children face prolonged hospital stays, physical disabilities, and mental health challenges after burn injuries. Parents and caregivers also experience emotional distress due to the traumatic nature of the injury and the uncertainty of their child's recovery.

The management of paediatric burns requires a specialised, multidisciplinary approach that includes first aid, wound care, pain management, fluid resuscitation, airway protection, and psychological support. High-income countries have made significant progress in burn care, leading to improved survival rates even for children with large burns. However, LMIC continue to face challenges in providing effective treatment due to limited resources, inadequate healthcare infrastructure, and harmful traditional first-aid practices and cultural beliefs. The literature therefore reveals an urgent need for improved prevention strategies, public education on proper first aid, and research focused on developing context-specific burn management and rehabilitation protocols tailored to the needs and challenges of LMIC.

CHAPTER THREE

METHODOLOGY

3.1 Study Overview

The methodology utilised to develop a protocol for the comprehensive management of paediatric burns at Korle Bu Teaching Hospital in Ghana is described in this chapter. This study employed a mixed method study using both quantitative and qualitative approaches to collect both primary and secondary data among children with paediatric burns injury and their caregivers, and the health workers at the National Reconstructive Plastic Surgery and Burns Centre (NRPS & BC) of the KBTH. The mixed-method approach was justified by the need for a holistic understanding of the paediatric burns landscape in Ghana epidemiologically, experientially, and clinically. Quantitative approaches were employed through a retrospective review of hospital records to determine the prevalence and characteristics of paediatric burn injuries. Qualitative approaches were used to explore the experiences of patients, caregivers, and clinicians regarding burn management and post-discharge needs. Additionally, focus group discussions (FGDs) were conducted with expert panels to gather insights for the development of a context-specific paediatric burns management protocol. The mixed-methods design thus enabled triangulation of data, strengthening the validity and depth of the findings, and ensuring that the resulting protocol reflects both clinical realities and patient-centred needs within the Ghanaian context. The entire study was carried out in 4 phases as illustrated in Table 3.1 below. This section highlights the research design, population, sample size, sampling technique and procedures for data collection used in carrying out each of the phases of the study.

Table 3.1: Summary of study methodology

Study	Aim	Design	Population	Analysis
Study 1	To determine the prevalence and types of paediatric burn injuries in Ghana	Retrospective study	Patient records	Descriptive data analysis using SPSS version 26
Study 2	To explore the experiences of burns, management, and post-hospitalisation needs	Qualitative explorative study	Paediatric burn patients and their caregivers	Thematic content analysis using NVivo software
Study 3	To explore the perceptions of health care practitioners on the hospital's paediatric burns management practices	Focus group discussion	Health care practitioners	Thematic content analysis using NVivo software
Study 4	To develop a contextual protocol for holistic paediatric burns management in Ghana	Modified Delphi study	Panel of experts	Quantitative and Qualitative data analysis

3.2 Study 1: Prevalence and Characteristics of Paediatric Burns

Study one aimed to determine the prevalence and characteristics of paediatric burns among patients treated at Korle Bu Teaching Hospital in Accra, Ghana. This included establishing the period prevalence and describing the characteristics of the burns, such as their type, depth, and the body parts involved.

3.2.1 Study Design

For this investigation, a retrospective record review design was used. This type of study involves looking back at existing records and data to analyse events or conditions that have already occurred

(Talari & Goyal, 2020). The medical records of paediatric burn patients who were admitted to Korle Bu Teaching Hospital for a given period were examined for this study. Retrospective studies are particularly useful for identifying patterns and trends in past events and are often used in healthcare research when the data needed is already available in hospital records (Talari & Goyal, 2020). This method is appropriate for investigating the frequency and features of paediatric burns in this context since it is economical and time -efficient (Talari & Goyal, 2020).

3.2.2 Study Setting

The study was conducted in the Greater Accra Region of Ghana. Ghana is a West African country situated along the Gulf of Guinea, bordered by Côte d'Ivoire to the west, Burkina Faso to the north, and Togo to the east (Figure 3.1). Ghana is classified as a lower-middle-income country by the World Bank, with an estimated population of over 34 million people, of which approximately 35.3% are children under the age of 15 (Ghana Statistical Service, 2021).



Figure 3.1: Map of Ghana, showing study area (Greater Accra Region)

The study utilised data from the National Reconstructive Plastic Surgery and Burns Centre (NRPS&BC) at Korle Bu Teaching Hospital (KBTH) located in Greater Accra. KBTH is Ghana's premier tertiary healthcare facility and the largest referral hospital in the country. Established in 1923, the hospital serves not only Accra and the Greater Accra Region but also referrals from across all regions of Ghana and parts of West Africa (Quao et al., 2025). The National Reconstructive Plastic Surgery and Burns Centre (NRPS&BC) at KBTH was selected because it is known to be one of Ghana's biggest burn treatment facilities. The Burns unit has 12 adult beds

and 6 paediatric beds. Services rendered at the unit include burn management, reconstructive surgeries (hand injuries and repairs, soft tissue reconstruction and congenital deformities), chronic wound management and lymphoedema management. A picture showing the NRPS & BC of KBTH is shown in Figure 3.2 below.



Figure 3.2: The building of the NRPS & BC of KBTH

3.2.3 Cases

The study included all paper based medical records of paediatric burn (0 – 14 years) admitted to the NRPS & BC of the Korle Bu Teaching Hospital over a period of 3 years, from January 2020 – December 2022. This three-year period was chosen because it represents the most recent and complete set of records available at the time of the study, providing current insights into the prevalence and characteristics of burns during this timeframe.

3.2.3.1 Inclusion Criteria

Paediatric burn cases between the ages of zero-14 years within the period of January 2020 to December 2022.

3.2.3.2 Exclusion Criteria

1. Cases with 20% missing data in medical records were not included in the study. This decision was supported by prior literature on acceptable thresholds for missing data exclusion from 10% (Bennett, 2001) to 20% (Peng et al. 2006). The exclusion threshold at 20% in this study aligns with Peng et al.'s recommendation and strikes a balance between retaining a sufficient sample size and ensuring data quality.
2. Cases seen at OPD or emergency and not admitted.

3.2.4 Sampling Technique and Sample Size Calculation

Based on the inclusion criteria, cases were chosen from patient records using the purposive sampling technique. To calculate sample size, data from a previous retrospective study of infant burns in Uganda was used. According Tusiime et al., (2022) the prevalence of burns in children under 5 years was 32% in Kampala City, Uganda. This setting was considered a closely comparable setting where local prevalence data in one town of Kampala City was used and not a national prevalence data. Furthermore, there is currently no published national or hospital-based prevalence data on paediatric burns in Ghana that could be used for sample size estimation. Based on a statistical analysis with a 95% power and a 5% significance level, at least 335 records had to be assessed (Naing et al, 2006).

3.2.5 Data Collection Tool

A data capture tool (Appendix A), developed by the researcher in consultation with clinical specialists and informed by relevant literature (Fadeyibi et al., 2011; Banga et al., 2022; Nduagubam et al., 2021) was used to extract data from the medical files. Patient information extracted included age, sex, hospitalisation duration, cause of burn injury, type of burn, body part involved in the injury, and the percentage of total body surface area (TBSA).

3.2.6 Data collection Procedures

After permission was granted, a pilot study was conducted. The purpose of the pilot study was to evaluate whether the proposed methodology is workable and to establish an initial assessment of the validity and reliability of the measurement. The pilot study was conducted with 10% of the total sample size of medical records to be reviewed by the researcher. Following the pilot, sections concerning the cost and length of stay were removed from the data capture sheet, as they were not included in the study's objectives. This refinement ensured that the tool accurately reflected the focus of the study. Data collected from the patients' records were entered into SPSS version 28 for descriptive statistical analysis.

3.2.7 Data analysis

Using the Statistical Package for the Social Sciences (SPSS) version 28, descriptive and inferential statistics were used to analyse the data. Prior to analysis, the distribution of continuous variables such as age and total body surface area (TBSA) was assessed for normality using the Shapiro–Wilk test and supported by inspection of histograms and Q–Q plots. As the data were found to be normally distributed, descriptive statistics including means and standard deviations were used to summarize continuous variables, while categorical variables were summarized with frequencies

and percentages. Inferential statistics specifically the univariate logistic regression analysis was used to determine the predictors of burn outcomes. These statistics provided a clear overview of the data, highlighting key patterns and trends. The data were summarised using tables, charts and graphs. Level of statistical significance was set at $p \text{ value} \leq 0.05$.

Table 3.2: Statistical test for each research objective.

Research objective	Outcome	Type of data	Statistical test
To determine prevalence and burn characteristics	Demographic Data	Numerical Categorical	Mean Standard deviation Frequencies Percentages
a.	Prevalence of burns	Numerical	Frequencies Percentages
b.	Characteristics of burns 1. Type of burn 2. Depth of burn 3. Body parts involved 4.Total Body Surface Area (TBSA)	Categorical Numerical	Frequencies Percentages Mean Regression Analysis

3.3 Study 2: Experiences of Paediatric Patients with Burns and Caregivers

Study 2 sought to investigate post-hospitalisation requirements, management and burn experiences. Its specific objectives were to investigate the experiences of paediatric burn patients, look at the experiences of caregivers with regard to the management of the burns, and determine the post-hospitalisation requirements of both paediatric burn patients and their caregivers.

3.3.1 Study Design

To investigate the experiences of patients between the ages of 6-14 years and caregivers, a qualitative exploratory study design was used. Lima and Newell-McLymont (2021) explained qualitative exploratory research design as one that enables a researcher to explore how people understand and describe human phenomenon and life experiences. This design enabled children and caregivers to give in-depth and detailed descriptions of their individual experiences with burns management and its outcomes.

3.3.2 Study Population

The study population comprised all paediatric burn patients with their caregivers who were undergoing treatment or had been treated and discharged from the National Reconstructive Plastic Surgery and Burns Centre (NRPS&BC), KBTH, from 2020 to the present 2024. In this study, the term caregivers refer to parents, guardians, or other family members who are primarily responsible for the daily care of the child.

1. Inclusion Criteria

- a) Children between the ages of 6-14 years who sustained burn injuries from 2020 to date (2024).
Including children aged 6–14 ensures that participants are developmentally capable of understanding questions and articulating their feelings, perceptions, and experiences regarding burn management and recovery.
- b) The child should be able to speak English, Akan, Ga or Ewe.
- c) Caregivers of paediatric burn patients between the ages of 0-14 years and are proficient in English or the local languages in Ghana (Akan, Ga, or Ewe).

3.3.2.2 Exclusion Criteria

- a) Children with speech disabilities such as severe stuttering and aphasia were excluded as the study relied on direct verbal feedback from children.
- b) Children who are unable to express themselves effectively after the burns, whether due to cognitive impairments, emotional trauma resulting or severe withdrawal were excluded.

3.3.3 Sample Size and Sampling Technique

The study used purposive sampling, a non-probability sampling technique to select participants for the study. This approach enables the intentional selection of participants who fulfilled the study's inclusion criteria and had pertinent experiences with the phenomenal being studied (Martín-Sanz et al., 2022). The research team first obtained contact details of eligible caregivers of burn patients from the burn centre. Participants were invited to participate via telephone. Interested caregivers received further details regarding their interview schedule.

The planned sample size used for the study was based on common recommendations for qualitative interviews, which suggest that 10 to 15 participants are generally sufficient to reach data saturation in homogenous groups (Guest et al., 2006). Data saturation, the point at which no new themes or information emerge, was reached after conducting 12 in depth interviews with children and 12 with caregivers. This indicated the sample size was adequate to comprehensively explore the experiences of paediatric burn patients and their caregivers

3.3.4 Data Collection Tool

The study employed a semi-structured interview guide to gather primary data from caregivers and paediatric burn patients (Appendices F and G). The interview guide consisted of open-ended questions designed to facilitate in-depth discussions during the interviews. It included sections on demographic data as well as questions that assessed the experiences, management, and post-hospitalisation needs of paediatric burn patients and their caregivers. This approach allowed for a comprehensive exploration of the participants' perspectives while providing flexibility to probe deeper into specific issues as they arose during the interviews. Open-ended questions designed to elicit detailed responses regarding the experiences of caregivers and paediatric burn victims were thoughtfully incorporated into the interview guide. The interview questions were developed based on a review of relevant literature, including studies on paediatric burn patients and caregivers' experiences (McGarry et al., 2014; Santos et al., 2024). Additionally, expert input was sought from three senior clinicians at the NRPS&BC of KBTH. These clinicians reviewed and provided feedback on the draft interview guide to establish content validity. A pilot test of the interview guide was further conducted with two caregivers and one paediatric patient (not included in the final sample). Feedback from the pilot study indicated that some questions were too broad or contained technical language; for example, a question about “burn severity management” was rephrased to “how was your child’s burn treated?” to make it easier for caregivers to understand. Based on this feedback, the questions were refined to ensure the interview process was effective, participant-friendly, and closely aligned with the study’s objectives.

3.3.5 Data Collection Procedure

The data collection procedure began with obtaining the necessary approval from the ethics review board of Korle Bu Teaching Hospital (7/09/23, KBTH-IRB 000166/2023) and the University of

Witwatersrand (26/05/23, M230512 MED23-05-033) (Appendices N, O, P). Permission was granted by the Burns unit of KBTH on 25th July 2023 to conduct the study. The researcher first obtained contact details of eligible caregivers of burn patients from the burn centre. Participants were invited to participate via telephone. Interested caregivers received further details regarding their interview schedule. Assent and informed consent were also obtained from paediatric burn patients and their caregivers respectively (Appendices E, F). The researcher conducted semi-structured interviews with the participants using the interview guide in the language the participants were comfortable in (English, Akan, Ewe or Ga). Audio recordings of the interviews were made for further examination. The interviews took place in person in a quiet, private consultation room within the burn unit to ensure confidentiality and a comfortable environment for participants. Each patient and caregiver had their own interview separately. This was to ensure that the voices of both the child and the caregiver were heard equally. On average, each interview lasted for approximately 30 minutes. The data collection process took a total of three weeks to complete, during which all participants were interviewed. The African Online Scientific Information Systems (AOSIS) qualitative research checklist was used to guarantee a methodical and exacting approach to doing and reporting this qualitative research in order to assure the study's credibility (<https://journals.abcjournal.aosis.co.za>).

3.3.6 Data analysis

Data analysis was done alongside data collection to ensure data saturation. The analysis followed Braun and Clarke's (2022) six-step approach, including familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing a final report. The audio recordings were first transcribed verbatim as Microsoft Word documents,

then imported and organized in NVivo 11 software for easier management. The interview transcripts were reviewed multiple times by both the principal researcher and one supervisor to become familiar with the data. Thematic content analysis with the help of the NVivo software was then used to generate initial codes by highlighting relevant text segments. The codes were organized into potential themes independently by the researcher and one supervisor. Researcher and supervisor met regularly to resolve discrepancies to reach consensus on coding and themes development. Reflective notes and peer debriefing were used throughout the process to enhance credibility and dependability of findings.

3.4 Study 3: Perceptions of Health Care Practitioners on Paediatric Burns Management

Study 3 aimed to explore the perceptions of healthcare practitioners on the hospital's paediatric burns management practices. Specifically, it sought to examine the contextual factors (personal and environmental) influencing these practices and identify both the barriers and facilitators that impact effective burn care.

3.4.1 Study Design

Focus group discussion (FGD) as a form of qualitative study design was used for this study. Focus group discussion is a research technique where a small group of individuals assemble to engage in conversation about a particular topic or subject matter, with the purpose of producing relevant data (Fayeh, 2021). The main characteristic of a focus group is the interaction between the moderator and the group, as well as the interaction between group members (Fayeh, 2021).

3.4.2 Study Setting

The focus group discussion was held in the Plastic and Burns Centre conference room at Korle Bu Teaching Hospital. This setting was chosen for the study because it was geographically convenient for most participants. Also, the setting is free from outside distractions and healthcare services provided in the centre. Participants were arranged to sit around a table to enable them to see and hear one another and a tape recorder was placed on the table for recording with consent.

3.4.3 Study population

The management of burns requires an MDT approach hence healthcare providers from various disciplines working at the Burns and Plastics Unit of the KBTH were recruited for the study. The focus group discussion included at least one representative from each of the following disciplines: Plastic Surgery, Medicine, Anaesthetist, Physiotherapy, Occupational Therapy, Dietetics, Nursing, Pharmacy, Clinical Psychology, Public Health Nursing and Laboratory Scientist reflecting the MDT approach required for effective burns management. All participants had at least three years of work experience, ensuring they had valuable knowledge and expertise to share.

3.4.3.1 Inclusion criteria

1. Participants must have at least three years of burn care clinical experience ensuring they had valuable knowledge and expertise to share.

3.4.3.1: Exclusion Criteria

1. Healthcare professionals at the unit involved exclusively in administrative, research-only, or non-clinical roles related to burn care.

2. Professionals whose clinical work at the burns unit is unrelated to paediatric or burn care (e.g., dermatologist, lymphoedema management specialist).

3.4.4 Sample size and Sampling technique

Snowballing recruitment technique was used to recruit initial health practitioners who were requested to suggest other health care providers who would make relevant contributions to the discussion. There were 15 participants in the focus group: 6 men and 9 women. The focus group included one participant from each MDT discipline, except for plastic surgeons, physicians, and nurses, each of whom were represented by two participants. For a focus group, this size was thought to be ideal because it provided a variety of viewpoints and made sure that every person had enough time to add to the conversation (Nyumba et al., 2018).

3.4.5 Data collection tool

A FGD discussion guide (Appendix H) with questions generated from the review of literature on clinical practice guidelines for paediatric burns (Broadis et al., 2017; Wall et al., 2019) was used to facilitate the discussion. The guide included open-ended questions and probes. Demographic data such as age, sex and profession were also collected from all the participants. The guide was piloted with a small group of healthcare professionals (n=5) prior to the full study to ensure clarity, relevance, and comprehensiveness of the questions. Feedback from the pilot indicated that some questions were too technical, ambiguous and repeating. The guide was revised to simplify language, group related questions together, and add prompts to encourage elaboration. Additionally, the order of some questions was rearranged to improve the logical flow of discussion.

3.4.6 Data collection procedure

The focus group discussion took place in a single session lasting approximately 90-minute session. A round table was used to encourage face-to-face interaction during the discussion, which was held in the Plastics and Burns Centre conference room at Korle Bu Teaching Hospital. The entire session was audio recorded. The discussion was moderated by two trained research assistants and a note taker. Prior to data collection, all research assistants underwent a two-day training workshop facilitated by the principal investigator and supervised by senior burns clinicians. This training covered ethical considerations, qualitative interviewing skills, and use of the discussion guide. Two research assistants transcribed the audio recording following the focus group discussion, and the correctness of the transcription was checked by principal researcher against the handwritten notes.

3.4.7 Data analysis

Data obtained were transcribed verbatim, coded, and analysed thematically to identify patterns and recurring themes. NVivo 11 software was used to organize and manage the data effectively. Using Braun and Clarke's (2022) six-phase framework for thematic analysis, the data were analysed in a step-by-step process. First, initial codes were generated independently by two members of the research team (principal researcher and one research assistant). These codes were then collated and compared, and any discrepancies were discussed and resolved through consensus. In the next phase, the researchers identified themes by grouping related coded. These themes were subsequently reviewed and refined to ensure they accurately reflected the data. Throughout the process, NVivo 11 software was used to assist in organizing and managing the coded data

3.5 Study 4: A Protocol for Holistic Paediatric Burns Management.

Creating a comprehensive paediatric burns management protocol for Korle Bu Teaching Hospital was the goal of the study's final phase.

3.5.1 Study Design

A three-round modified Delphi study technique was employed to develop a consensus among a group of rehabilitation experts on a model for paediatric burn management applicable to the Ghanaian context. This technique uses questionnaires administered in multiple rounds to gather information continually until a consensus is reached (Drumm et al., 2021). The consensus level is the degree to which the experts recruited agree on an answer. It is determined by measuring the extent of agreement among participants during various rounds of questioning (Barrios et al., 2021). For this study, 80% was the threshold consensus level (Görgec et al., 2023). This means that for any item in the protocol to be considered relevant, it should have been considered important by at least 80% of the expert panelist.

3.5.2 Study Population

The population of this study comprised rehabilitation experts with at least eight years of experience in paediatric burns management in LMIC. These experts were not included in the FGD in study three. Experts participated from various healthcare institutions, burn treatment centers, and rehabilitation facilities across Africa. Eight years was considered sufficient to reflect long-term professional engagement, the ability to recognize patterns and trends in patient outcomes, and the capacity to contribute informed and contextually grounded perspectives.

1. Inclusion criteria

1. Rehabilitation experts must have worked in the field of burn management for at least eight years.
2. Participants must be licensed Physiotherapists (PTs) or Occupational Therapists (OTs) actively involved in burn rehabilitation.
3. Rehabilitation experts must have actively contributed to burn care in LMIC through clinical practice, research, or program development.

3.5.2.2 Exclusion Criteria

1. Participants who are not willing to commit to participating in multiple rounds of the Delphi study.

3.5.3. Sample Size and Sample Technique

Seven rehabilitation experts with at least eight years of experience in burns management in LMIC were selected to participate in the process. These experts were rehabilitation specialists from physiotherapy and occupational therapy backgrounds with expertise from clinical practice from elected from various fields. Purposive sampling was used to select experts who have substantial experience in paediatric burns management, particularly in resource-limited settings. Purposive sampling enables the researcher to pinpoint and choose participants who possess significant expertise and familiarity regarding the subject matter being investigated (Palinkas et al., 2015). The selected experts demonstrated expertise through years of clinical practice or active involvement in research, such as authorship of peer-reviewed publications or participation in burns-related research projects. In addition, the experts must possess an understanding of the challenges faced in LMIC.

3.5.4 Procedure, Instruments and Data Analysis

The Modified Delphi study was conducted in 3 rounds. According to Drumm et al. (2021), one of the fundamental blocks of the Delphi techniques is to have as many rounds as needed to achieve convergence for consensus. A Modified Delphi questionnaire (Appendix L) was developed by the principal researcher through reviews of relevant literature for data collection (Marvin et al., 1991; Yirdaw et al., 2022). The questionnaires design also took into consideration the results from the qualitative study involving the perceptions of the paediatric patient, caregivers and health workers. The chosen experts were emailed an electronic questionnaire with an information sheet explaining the purpose and requirements of the study. The questionnaire consisted of 70 carefully designed items, structured as a five-point Likert scale, where respondents rated each item from 1 (least important) to 5 (most important). It addressed eight critical areas of paediatric burns management, including infection control and wound care, pain management, physical and occupational therapy, scar management, psychological or psychosocial support, education, discharge planning, and follow-up. The breakdown of the modified Delphi study was as follows:

- **Round 1:** A questionnaire was sent to the expert panel, presenting the 70-item questionnaire item along with any additional information. The questionnaire was distributed electronically using online Google Forms. The experts were tasked with rating each item on a five-point ordinal scale to determine its importance, with one being least important and five being most important. Consensus for retaining an item was predefined as achieving at least 80% of respondents rating it as 4 (important) or 5 (very important).

- **Round 2:** Round two focused on integrating feedback and comments from Round one to streamline the questionnaire. Experts were to further refine, validate, or revise their opinions and decide which items should be incorporated into the protocol.
- **Round 3:** Round three marked the final phase of the Delphi process and involved a focus group discussion among the experts. The discussion was conducted via a secure online video-conferencing platform (Zoom) and lasted approximately 90 minutes. The session was audio-recorded with consent and transcribed verbatim for analysis. This interactive session provided an opportunity for the panel to collectively review areas where consensus had been achieved and address the remaining unresolved sections of the protocol.
- Descriptive statistical analysis done by the SPSS version 28 was used to summarize the ratings from experts. The experts' opinions and contributions were analysed for themes, patterns and concepts using qualitative content analysis, which entails methodically coding and classifying the qualitative data. The principal researcher conducted thematic analysis.
- **Reflexivity:** Reflexivity is essential in ensuring transparency and minimizing bias in research. As a deputy chief physiotherapist with extensive experience in burn rehabilitation, professional expertise informed the study's approach to assessing paediatric burn management. This background provided valuable insight into the challenges and best practices in burn care, shaping the research process while maintaining objectivity and researcher bias. To mitigate potential bias, a structured methodology was followed, incorporating perspectives from various stakeholders, including experts, patients, caregivers, and healthcare professionals.

3.6 Ethical Considerations

The research obtained ethical approval from the University of The Witwatersrand, (26/05/23, M230512 MED23-05-033) (Appendix N) and Institutional Review Board of KBTH, (7/09/23, KBTH-IRB 000166/2023) (Appendix O) and an extended ethics clearance from KBTH (18/06/24, KBTH-IRB / 000166/2023) (Appendix P).

In line with the fundamental ethical principles of research, this study adhered to the Declaration of Helsinki and the Belmont Principles of autonomy, beneficence, and justice (World Medical association, 2025).

- **Autonomy:** The principal researcher explained in detail the purpose of the study and the processes involved to all participants (paediatric patients, caregivers, healthcare practitioners, and the panel of experts) (Appendices B, C, D, E). Written informed consent was obtained from adult participants, while parental consent and child assent (where appropriate) were secured for paediatric patients (Appendices F, G, H). Participation was voluntary, with the right to withdraw at any stage without consequence.
- **Beneficence:** The study was designed to minimise any potential risk to participants while maximising the potential benefits of improved knowledge and practices in paediatric burn management. Sensitive handling of children and families ensured that no harm, distress, or burden was caused during data collection.
- **Justice:** Fair participant selection procedures were observed, ensuring that no group was unfairly excluded or overburdened. The inclusion of multiple stakeholders (patients, caregivers, clinicians, and experts) guaranteed that diverse perspectives were respected in the development of the protocol.

The researcher alone had access to a password-protected laptop that contained the study's confidential and securely stored data. Hard copies of any documents were kept in a locked cabinet

within a restricted-access office. Additionally, the anonymity of all participants was ensured by removing personal identifiers such as names and any other information that could be used to trace responses back to individual participants.

3.7 Trustworthiness of the Study

The widely accepted criteria, namely credibility, transferability, dependability, and confirmability (Haq et al., 2023) were employed to ensure the rigour and trustworthiness of the qualitative components of this research (Study 2 and Study 3).

In relation to study 2, credibility was enhanced through the use of prolonged engagement with participants during the interview process and triangulation of sources, by comparing perspectives of both children and their caregivers. Transferability was achieved by providing rich descriptions of the participants' demographic backgrounds, the setting of the burns unit, and the cultural context in which care was delivered. Dependability was ensured by maintaining a comprehensive audit trail, which documented methodological decisions, code development, and changes in the analytic process. Data analysis was also conducted collaboratively by the researcher and one supervisor, using independent coding and consensus discussions to promote reliability. Confirmability was reinforced through researcher reflexivity, where the researcher maintained reflective notes throughout the process of data collection.

For study 3, credibility was strengthened by using trained FGD moderators and note-takers, as well as through triangulation among different perspectives of health professionals. Dependability was maintained through a clearly documented methodology and analytic process and inter-coder

agreement procedures to reconcile any discrepancies. An audit trail was kept to document procedural steps and decisions. Confirmability was ensured through reflexive journaling by the principal investigator and verification of transcriptions with audio and handwritten notes to reduce potential bias.

CHAPTER FOUR

PREVALENCE AND CHARACTERISTICS OF PAEDIATRIC BURNS

4.1 Introduction to Manuscript One

Chapter 4 presents the manuscript that investigates the prevalence and characteristics of paediatric burns at the National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana. The findings revealed significant insights into paediatric burns, highlighting the period prevalence, demographic distribution, burn mechanisms, and associated outcomes. The aim of this manuscript was to determine the prevalence and describe the characteristics of paediatric burns at the Burns Centre, Korle Bu Teaching Hospital. Thus, the manuscript addressed the objective one of this research. This manuscript was published in the Burns Open Journal.

4.2 Manuscript Details

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CRedit Author Statement

Contributor	Role(s)	Details of Contribution
Alberta Amissah Nyarko	Conceptualization, Data Collection, Data Analysis, Interpretation, Writing – Original Draft, Corresponding Author	Led the study design, collected and analysed the data, interpreted findings, and drafted the manuscript. Acts as the corresponding author.
Natalie Benjamin- Damons	Conceptualization, Supervision, Writing – Review & Editing	Contributed to study conceptualization, supervised analysis, and critically revised the manuscript.
Sonti Pilusa	Conceptualization, Supervision, Writing – Review & Editing	Contributed to study conceptualization, supervised data processes, and reviewed the manuscript for accuracy and quality.

BURNS JOURNAL

Prevalence and Characteristics of Paediatric Burns at The National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana

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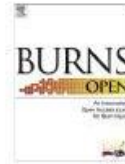
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Highlights

- There is a concerning prevalence of paediatric burns in Ghana, particularly among children aged 0 to 5 years.
- Scald burns from hot water and hot foods were the primary causes of paediatric burns.
- Multiple body parts injuries were the commonest with the lower limb being the most frequently involved.
- Higher total body surface area (TBSA) scores were associated with lower chances of survival.



Prevalence and characteristics of paediatric burns at the National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana

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ABSTRACT

Introduction: Burn injuries among children have emerged as a significant global public health concern, accounting for substantial morbidity and mortality worldwide. Low and Middle-Income Countries bear a significant burden of paediatric burn injuries. In Ghana, limited data exists on the prevalence, characteristics and outcomes of paediatric burns. This study provides vital data on the local burden and epidemiology of paediatric burns at Ghana's main burns treatment center. The findings have significant value in informing prevention strategies, allocating resources, and improving quality of paediatric burn care.

Study objective: To establish the prevalence and characteristics of paediatric burns injuries in Ghana's leading burn center.

Methodology: A retrospective cohort study analyzed data from 662 adult and paediatric patients who presented with burns from all over Ghana between 2020 and 2022. The study encompassed medical records of paediatric burn cases (aged 0–14 years) admitted to the center from January 2020 to December 2022. A purposive sampling technique was used to select cases based on the inclusion criteria and elimination of cases with 20 % missing data. A total of 335 paediatric records were reviewed.

Data analytical methods: Descriptive statistics, such as frequencies, mean, percentages were used to establish period prevalence and demographic characteristics of paediatric burns. Chi-square analysis and univariate logistic regression was utilized to explore associations between categorical variables, and predictors of burn outcome.

Results: The period prevalence of paediatric burns was found to be 50.6 %. Paediatric burn cases predominantly affected males (57.6 %). Majority of cases fell within the age range of 1 to 5 years (70.1 %). Hot water emerged as the leading cause (58.4 %), whereas superficial partial thickness burns (51.9 %) was the predominant type of burn. Most cases involved burns affecting less than 20 % Total Body Surface Area (59.0 %). Multi-part body injuries were common (87.2 %), with the lower limb being the most affected (25.36 %). The mortality rate was calculated to be 21.0 %. Higher TBSA was a significant predictor of mortality ($p < 0.001$).

Conclusion: This study found a high prevalence of paediatric burns with hot water and foods being the predominant causes. Higher TBSA predicted lower chances of survival. The findings have scientific value in informing prevention strategies, allocating resources, and improving the quality of care.

1. Introduction

Globally, burns injury has been identified as a leading cause of morbidity and death among children [1]. Burns injury rank as the third most frequent cause of mortality among children aged 1–9 years [2]. The majority of burn cases, which make up an estimated 90 %, are found in

low- and middle-income countries (LMICs), with Africa and South East Asia bearing the majority of this disease burden [3,4]. Children under the age ten bear the brunt of the burden of burn injury, reflecting the urgent need for tailored interventions and effective prevention strategies [1,5].

Each year, around 300,000 new cases of burns are reported among

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Table 1
Demographic characteristics of paediatric burns cases.

Variables	N (%)	M ± SD
Sex		
Male	193 (57.6 %)	
Female	142 (42.4 %)	
Age range		
Less than 1 year	14 (4.1 %)	3.61 ± 3.124
1–<5 years	234 (70.1 %)	
5–<10 years	64 (19.1 %)	
10–14 years	23 (6.7 %)	

children under the age of five in sub-Saharan Africa [6]. It is estimated that annually, between 18,000 and 30,000 children under the age of 18 lose their lives due to burn-related injuries in sub-Saharan Africa [7]. The concerning annual occurrence of roughly 300,000 fresh cases of burns among children below the age of five in Sub-Saharan Africa emphasizes the significant public health challenge being faced [6]. This highlights the urgent requirement for comprehensive research initiatives and intervention strategies in the African region [4,8].

To address this pressing issue, a comprehensive understanding of the epidemiology of paediatric burns in Africa is essential. In Ghana, a weighted annual incidence rate of 63 per 1000 children (equivalent to 6.4 % of children per year) has been documented [4]. Data from other regions in Africa, including Zimbabwe, Nigeria, Cote D'Ivoire, and Angola, highlight the substantial scale of paediatric burn injuries [9]. However, research concerning the prevalence of paediatric burns injuries and predictors of burn outcomes in Ghana is limited, highlighting an area of insufficient understanding that requires attention. Consequently, this study seeks to address the existing gaps in the understanding of the prevalence and characteristics of paediatric burn injuries, focusing specifically on the context of Ghana, while offering insights that can contribute to global efforts in paediatric burn injury prevention and management.

The aim of this study is to investigate prevalence of paediatric burns in Ghana by providing a detailed description of burn characteristics, encompassing types, depth, body parts affected, and outcomes utilizing data from Ghana's premier burns center.

2. Methods

A retrospective cohort study design was employed, utilizing data from the National Reconstructive Plastic Surgery and Burns Centre (NRPS & BC) at Korle Bu Teaching Hospital in the Greater Accra Region, Ghana. The study encompassed medical records of paediatric burn cases (aged 0–14 years) admitted to the center over a 3-year period, from January 2020 to December 2022. A statistical power calculation [10] using a precision of 0.05 and a prevalence rate of 32 % based on a study in Uganda [11] and a 95 % confidence level was used to estimate a minimum sample of 330.12 cases to be reviewed. A purposive sampling technique was used to select 335 cases based on the inclusion criteria and eliminating 5 cases with ≥20 % missing data. Experts differ on the threshold for missing data exclusion. While Schafer [12] proposed 5 %, Bennett [13] suggested over 10 %, and Peng et al. [14] proposed 20 %. Data was collected using a structured data collection tool that captured the age, sex, type, cause and depth of burn, TBSA, body part(s) involved and outcome of burn. Ethical approval was obtained first from the

University of Witwatersrand (26/05/23, M230512 MED23-05-033) and Institutional Review Board of KBTH (7/09/23, KBTH-IRB 000166/2023). Patients records were stored securely using data encryption, restricting access to authorized personnel only.

Data was analyzed with the Statistical Package for Social Sciences (SPSS) software, version 23. Descriptive statistics, such as frequencies, mean, percentages were used to establish period prevalence and demographic characteristics of paediatric burns. Inferential statistics such as Chi-square analysis and univariate logistic regression was utilized to explore associations between categorical variables, and predictors of burn outcome. The calculation of prevalence was done by dividing the number of paediatric cases reviewed for the study period over the total number of burn cases admitted including adults and expressing it as a percentage.

$$\text{Prevalence rate} = \frac{\text{Number of Paediatric cases reviewed}}{\text{Total number of admitted cases}} \times 100$$

$$\text{Prevalence rate} = \frac{335}{662} \times 100$$

$$\text{Prevalence rate} = 50.6 \%$$

3. Results

A total of 335 paediatric patients' records out of 662 of the cases admitted at the burn center from 2020 to 2022 were reviewed for analysis. Records of patients above the age of 14 years and those with 20 % missing data were excluded.

3.1. Demographic characteristics of paediatric burn cases

Majority of the cases (n = 193, 57.6 %) were males, while 142 (42.4 %) were females. The ages of paediatric cases ranged from 15 days to 14 years, with a mean age of approximately 3.61 ± 3.12 years. Table 1 below shows the demographic characteristics of cases reviewed in this study.

3.2. Prevalence of burns

The period prevalence of paediatric burn injuries calculated for 2020 to 2022 at the NRPS & BC of the KBTH was estimated to be 50.6 %. The majority of paediatric burn cases occurred in children aged between the ages of 1 and 5 years (n = 234, 70.1 %) (Table 2).

3.3. Causes and types of paediatric burns

Hot water was the most common cause, accounting for 188 (58.4 %) of cases. Hot foods, including soup, stew, oil, tea and oats, was responsible for 74 (23.0 %) of burns, while flames caused 39 (12.1 %) of burns. Other causes of paediatric burns recorded which were relatively rare, included gas explosions (n = 19, 5.9 %) and electrical burns (n = 2, 0.6 %). Fig. 1 below shows the various causes of burn injury (Table 3).

Superficial partial thickness burns were the most prevalent, accounting for 167 (51.9 %) of the total cases, followed by mixed thickness burns (n = 115, 35.7 %). Fig. 2 illustrates the type of burn recorded from cases review.

3.4. Distribution of body parts involved in paediatric burns

There were 43 cases where burn injuries affected a single body part, representing approximately 12.83 % of the total cases. In contrast, majority of cases (n = 292, 87.17 %) involved burns affecting multiple body parts. The most involved body part recorded was lower limb (n = 225, 25.36 %) followed by the trunk (n = 207, 23.33 %) and upper limb (n = 174, 19.61 %). Head injuries accounted for 82 (9.24 %) of the total

Table 2
Body parts involvement in paediatric burn injuries.

Variables	P (%)
Distribution of body part	
Single body part	43 (12.8)
Multiple body parts	292 (87.2)

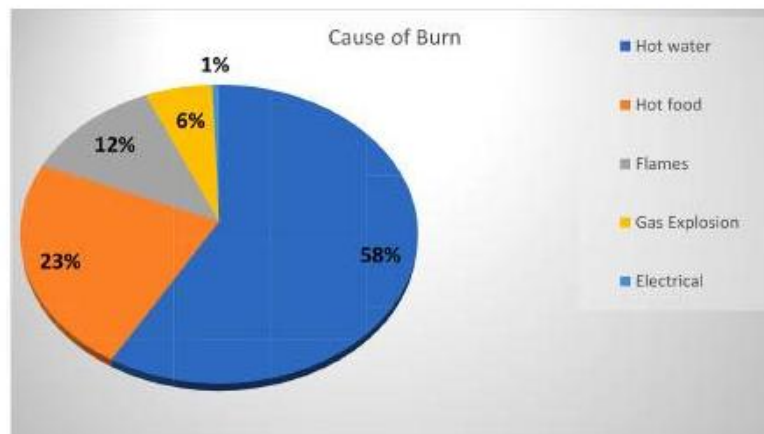


Fig. 1. Cause of paediatric burn injury.

Table 3
TBSA and Outcome of Paediatric Burns.

Variables	Frequency (N = 335)	M ± SD
% TBSA		
Less than 20	197 (60.0)	20.16 ± 14.05
20-40	95 (29.0)	
40-60	31 (9.5)	
Above 60	5 (1.5)	
Burn Outcome		
Died	67 (21.0)	
Discharged	252 (79.0)	

number of cases, while neck injuries constituted 25 (2.82 %) cases. Buttock injuries also comprised 86 (10.82 %) of cases, while perineal injuries accounted for 78 (8.79 %) cases (Fig. 3).

3.5. TBSA and outcome of paediatric burns

The TBSA, representing Total Body Surface Area of paediatric cases ranged from 1 % to 100 %, with a mean value of 20.16 ± 14.05 . The distribution of the TBSA of paediatric burn injuries, the majority of cases ($n = 197$, 60.0 %), fell into the category of burns affecting less than 20 % TBSA, followed by 20 %–40 % TBSA ($n = 95$, 29.0 %). Burn cases above

60 % TBSA were relatively rare, representing only 5 (1.5 %) of paediatric cases. In relation to the outcome of paediatric burn injuries, 67 cases did not survive their burn injuries, representing a mortality rate of 21.0 %. A significant majority of burn cases ($n = 306$) were discharged after treatment, accounting for a recovery rate of 79.0 %. The distribution of TBSA and burn outcome are presented in Table 5. Furthermore, results from Fig. 4 shows that higher TBSA was associated with increased mortality with the highest mortality rate (100 %) observed in patients with burns covering more than 61 % of their body.

3.6. TBSA as a predictor of paediatric burn outcomes

The univariate regression analysis revealed that higher TBSA scores were significantly associated with lower odds of survival ($p < 0.01$) as illustrated in Table 4. The cross-tabulation of TBSA level and treatment outcome highlighted that almost all patients with minor burns survived (100 %), as did the majority of moderate burns patients (94.1 %). However, 26.0 % of patients with major burns died to their injuries as illustrated in Table 5.

4. Discussion

The period prevalence of paediatric burn injuries at the NRPS & BC of the KBTH was estimated to be 50.6 % for the years 2020 to 2022. This

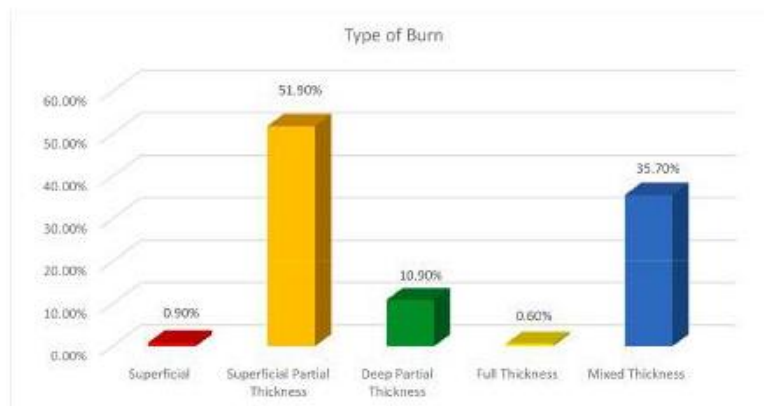


Fig. 2. Type of paediatric burns.

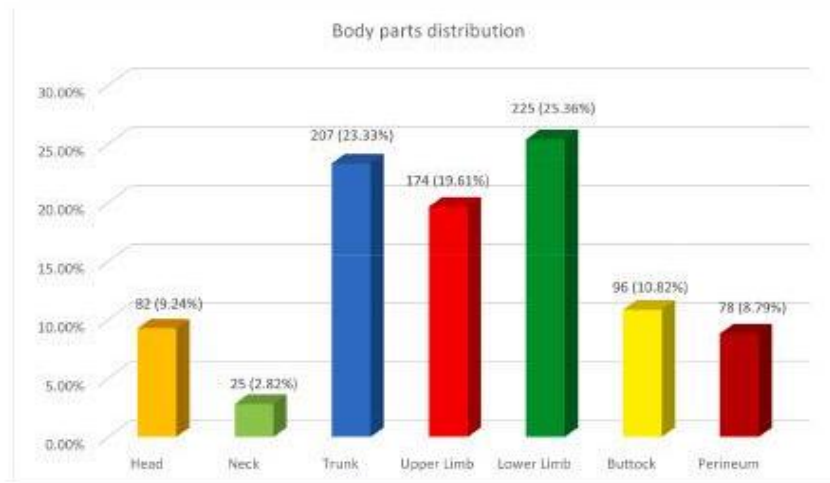


Fig. 3. Distribution of anatomical sites involved in paediatric burn injury.

Table 4
Univariate Logistic Regression Analysis of Predictors on Treatment Outcome.

Predictors	AOR	S.E.	(df)	95 % C.I. Lower-Upper	P-value
TBSA Score	0.90	0.01	48.9(1)	0.87–0.92	0.00
AGE	1.11	0.06	3.1(1)	0.99–1.24	0.07
Gender	0.81	0.30	3.3(1)	0.47–1.39	0.44

Confidence Interval = CI, Degrees of Freedom = df, Adjusted Odds Ratio = AOR, Significance = P-value, Standard Error of AOR = S.E.

highlights the significant burden of paediatric burn injuries in Ghana and is consistent with global reports especially in the Sub-Saharan African Region [3–6]. Similar findings of striking burden of paediatric burns have also been reported elsewhere. Davies et al., [15] reported more than 50 % of paediatric cases among burn cases in European hospitals. Findings from the Western Regional Hospital of Nepal reported a prevalence rate of 61 % [16]. In contrast, a study conducted in China, revealed a prevalence of 28.6 %, which is lower than that reported in the current study [17]. A comparatively lower prevalence rate between 17 and 25 % has also been reported in India [18]. On the other hand, a similar study in Uganda reported a relatively lower prevalence rate of 32.0 % of all hospital admissions [11]. The findings suggest that Ghana records a relatively higher prevalence of paediatric burn injuries compared to other countries such as China, Nepal and Uganda [17,18,11]. This highlights the pressing need for focused efforts from government, public and private stakeholders and advocacy groups to address this public health challenge within the country. Furthermore, the disparities in prevalence rates highlight the need for prevention strategies tailored to the specific contexts and challenges faced in different regions.

In line with previous research, this study found that gender and age

Table 5
TBSA Level and Treatment Outcome Cross-tabulation.

Independent Variable	Level	Treatment Outcome		Total	P-Value
		Alive	Died		
TBSA Level	Minor	9 (100)	0 (0)	9	0.00
	Moderate	64 (94.1)	4 (5.9)	68	
	Major	179 (74.0)	63 (26.0)	242	

Minor Burn (<5% TBSA) Moderate Burn (5–10 % TBSA) Major Burn (>10 % TBSA):

Source: American Burn Association Burn Injury Severity Grading.

distribution for paediatric burns was skewed towards males (56.7 %) and children below the age of five (70.1 %) respectively [11,19,16]. Stocken et al. [19] reported approximately 60.0 % male paediatric burn cases in Australia. Studies have similarly reported 66.4 % males in Nigeria [20], 52.4 % in Uganda [11] and 58 % in South Africa [21]. A possible explanation of this trend has been attributed to the fact that, boys tend to exhibit higher levels of physical activity and are aggressive in behavior compared girls [22]. Contrary findings have also been reported in few studies where females were dominant in paediatric burn cases in Asia [24]. In addition, the current study revealed a mean age of approximately 3.61 ± 3.124 years with the majority of cases occurring in children aged between the ages of 1 and 5 years. Similarly, previous epidemiological studies have established a high prevalence of burns among children less than 5 years [4,21]. This age group is widely recognized as particularly vulnerable to burn injuries due to their natural curiosity, lack of hazard awareness, and limited motor skills [20].

The most common cause of paediatric burns in the current study was hot water, accounting for 56.3 % of cases followed by hot foods (22.2 %). This finding is consistent with existing literature, which often identifies scald burns from hot liquids as a leading cause of burns in young children [19,22]. In the Ghanaian context, children may accidentally spill or come into contact with hot foods or liquids while around their parents in the kitchen. The kitchens are often open with hot foods left on the floor. Similarly, Başaran & Özer [23] mentioned that, traditional kitchens are typically positioned in areas where children play, families gather to eat, socialize and sometimes sleep, potentially

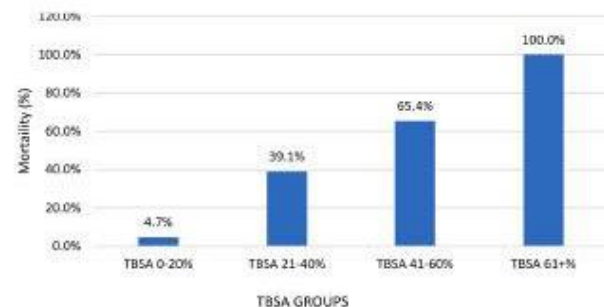


Fig. 4. Mortality distribution by TBSA Groups.

increasing the risk of scald of burns in children. Rode et al. [25] revealed a high prevalence scald injury of paediatric burns in the Ashanti Region of Ghana, accounting for 62 % of cases. Some studies have also reported contrary findings on the primary causes of burns among paediatric burn patients. For example, Mehta et al. [4] reported a high prevalence of flame-related incidents (53.0 %) while scalds accounted for 38 % of burn cases. Fadeyibi et al. [20] also reported 66.4 % of flame injuries as the primary cause of burns. These variations in the primary causes of paediatric burns may be attributed to age differences and differences in contexts [26]. Since hot water and hot foods were identified as the most common causes of paediatric burns, parents and caregivers need to be educated about the risks associated with these hazards and the importance of implementing safety measures in the kitchen and other areas where children may be exposed to hot substances.

The complexity and severity of burn injuries in paediatric patients is revealed in the multiple anatomical sites involved. We found multiple body part involvement in majority of the cases similar to the findings of other studies [21,22]. This finding may be attributed to the limited ability of children to recognize the initial source of injury and protect themselves from additional injuries. The lower limb was the most frequently involved body part, accounting for 25.36 % of cases followed by the trunk (23.33 %) and upper limb (19.61 %). This finding is in line with the fact that children, especially toddlers, often explore their surroundings and may unintentionally touch or step on hot surfaces, leading to burns on their lower and upper extremities. Contrary to these findings some studies have also reported more frequent upper limb involvement [20–22]. Buttock and perineal injuries although relatively small, can be vulnerable, especially in infants and young children who spend a significant amount of time sitting.

On a positive note, majority of burn cases (75.7 %) were discharged after treatment, indicating a high recovery rate. A mortality rate of 21.0 % suggests that paediatric burn injuries can be life-threatening, especially in cases of severe burns and associated complications. The mortality rate in the current study is relatively high compared with previous studies in Liberia (14.2 %) and Angola (9.1 %) [3]. The key predictor of burn outcome was TBSA. Higher TBSA scores were generally associated with more severe burns, prolonged recovery periods and a higher risk of complications, including sepsis and multi-organ failure, which can lead to increased mortality rates [20,22,26]. Therefore, while the high discharge rate following treatment is encouraging in this study, the relatively higher mortality rate cautions healthcare providers about timely and comprehensive medical interventions, particularly for cases involving larger total body surface area (TBSA) burns, to minimize the risk of complications and improve patient survival.

5. Conclusion and recommendations

The study highlights a concerning prevalence of paediatric burns in Ghana, particularly among children aged 0–5 years. Superficial partial thickness burns were the most prevalent, often affecting multiple body parts, with the lower limbs being the most frequently involved. Scald burns, especially from hot water, were identified as the primary cause, underscoring the need for targeted prevention strategies and educational programs for caregivers on their domestic environment. The mortality rate among severe cases was notable, emphasizing the potential life-threatening nature of these injuries. However, the majority of patients were discharged after treatment, indicating a promising recovery rate when proper treatment protocols are put in place. The major predictor of paediatric burn outcomes was TBSA score. Higher TBSA score was generally associated with lower chances of survival. Considering the mortality rate of 20.0 % among severe cases, there is a pressing need to ensure access to quality care, potentially through inclusion of paediatric burn care under full insurance cover. Furthermore, caregivers need to be educated about the risks associated with scald burns, particularly from hot water and foods, and provided with educational programs to create a safe domestic environment. Awareness should also

be raised about prioritizing kitchen safety in households with preschool-aged children. High prevalence of paediatric burns in Ghana calls for the collective effort of government engagement, stakeholder collaboration, policy formulation, and regional sub-committee initiatives to elevate awareness surrounding paediatric burn injuries across the nation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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CHAPTER FIVE

EXPERIENCES OF PAEDIATRIC BURN PATIENTS AND CAREGIVERS

5.1 Introduction to Manuscript Two

Chapter four presented findings on the prevalence and characteristics of paediatric burns, setting the foundation for understanding the clinical context of burn injuries in Ghana. Building on these findings, Chapter five moves further to explore the lived experiences of paediatric burn patients and their caregivers at the National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana. This Chapter presents the manuscript that addresses the second objective of this study by providing qualitative insights into the experiences of paediatric burn patients and their caregivers. This manuscript was submitted to the Burns Open Journal on April 12 and is currently under review.

5.2 Manuscript Details

Title: Experiences of Paediatric Burn Patients and their Caregivers on Burn Management at Ghana's Premier Burns Center: A Qualitative Study

Authors: Alberta Amissah Nyarko, Natalie Benjamin-Damons and Sonti Pilusa

Journal: Burns Open

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CRediT Author Statement

Contributor	Role(s)	Details of Contribution
Alberta Amissah Nyarko	Conceptualization, Data Collection, Data Analysis, Interpretation, Writing – Original Draft, Corresponding Author	Led the study design, collected and analysed the data, interpreted findings, and drafted the manuscript. Acts as the corresponding author.
Natalie Benjamin-Damons	Conceptualization, Supervision, Writing – Review & Editing	Contributed to study conceptualization, supervised analysis, and critically revised the manuscript.
Sonti Pilusa	Conceptualization, Supervision, Writing – Review & Editing	Contributed to study conceptualization, supervised data processes, and reviewed the manuscript for accuracy and quality.

Status: Under Round 2 Review

Experiences of Paediatric Burn Patients and their Caregivers on Burn Management at Ghana's Premier Burns Center: A Qualitative Study

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ABSTRACT

Background: Children and their families are greatly impacted by paediatric burn injuries, which call for specialized treatment and management. Understanding the unique experiences of paediatric burn patients and their caregivers is crucial for improving burn management strategies and enhancing patient outcomes.

Objectives: This study explored the experiences of paediatric burn patients and their caregivers with regard to in -hospital management and post-hospitalization needs at Ghana's Premier Burn Center.

Methods: This exploratory qualitative study included patients and their caregivers treated at a Burns Center in Ghana from 2020 to the present. Twelve paediatric burn patients and their caregivers participated in the interviews. Data were collected using semi-structured interview guidelines, and salient themes were identified through the use of inductive content analysis .

Results: Six themes emerged from the data analysis: (1) causes of burns, (2) burns care pathway, (3) experiences following burn injury, (4) perceptions of burn management, (5) outcome and post-hospitalisation needs, and (6) suggestions for improving burn care.

Conclusion: The study revealed varied causes and care pathways for paediatric burns, with generally positive perceptions of multidisciplinary management and professional competence at Ghana's Premier Burn Centre. The study revealed varied causes and care pathways for paediatric

burns, with generally positive perceptions of multidisciplinary management and professional competence at Ghana's Premier Burn Centre. Challenges included procedural pain, scarring, itchiness, and difficulties with school reintegration. Emotional distress, coping strategies, and systemic barriers were noted. Suggested improvements included transparent costs, better communication, enhanced infrastructure, and faster emergency response.

Clinical implications: Implement procedural pain management protocols and address ongoing issues such as itchiness and scarring, as well as advocate for better insurance coverage for burn treatments.

Keywords: Paediatric burn survivors, caregiver support, burn management, burn experience, burn injuries

Introduction

Paediatric burn injuries can have far-reaching consequences for children as well as their families (Rencken et al. 2021). Children may experience difficulties in their daily activities and social interactions, leading to a negative impact on their overall well-being. Furthermore, families are often burdened by the emotional and financial stress associated with burn injuries (Santos et al. 2024). Caregivers play a critical role in supporting the child through the recovery process and providing the necessary physical and emotional care (Wickens et al. 2024). In order to give burn patients the best treatment possible, it is essential to comprehend the particular difficulties that impacted children and their caregivers experience.

Burn patients endure various physical and psychological consequences, including hypertrophic scars, contractures, functional limitations (Santos et al. 2024), stigma, and mental health issues due to their traumatic experiences (Woolard et al., 2021). Caregivers also face significant challenges in managing children's injuries, as they are responsible for daily care tasks such as wound dressing, administering medications, and ensuring comfort (Wickens et al. 2024). Additionally, financial constraints can increase caregiver stress because effective burn management often involves expensive medical procedures, medications, and therapies that may not be covered by insurance as in the case of Ghana (Wickens et al., 2024).

Research has highlighted the substantial challenges encountered by burn patients and their caregivers when reintegrating into society (Rencken et al. 2021). Children who survive burns are at a higher risk of facing bullying, stigmatisation, issues related to body image, low self-esteem and challenges in social interactions (Snider et al. 2021). Furthermore, adherence to burn care procedures greatly depends on how burn patients and their caregivers view burn management (Willebrand et al. 2018). These perceptions encompass various aspects, including satisfaction with the quality of care received, concerns about resource availability, the effectiveness of treatment modalities, and the overall experience of navigating the healthcare system (Andrews et al. 2018).

Rencken et al. (2021) identified a considerable gap in qualitative research concerning the post-discharge experiences and societal reintegration of patients and caregivers of paediatric burn patients in Sub-Saharan Africa, particularly in light of the high rate of burns in this area (Broadis

et al. 2017; Gessesse & Yitayew, 2020). Previous studies investigating the experiences of burn survivors in Ghana did not focus exclusively on paediatric patients or their caregivers (Yarney et al., 2019; Bayuo et al., 2024). As a result, there is a dearth of literature in Ghana regarding the experiences, viewpoints, and post-hospitalization requirements of paediatric burn victims and their caregivers. Therefore, the current study attempted to address this vacuum by studying these experiences and views.

Methods

Study Design

This study employed an exploratory qualitative approach to explore the lived experiences of paediatric burn patients and their caregivers.

Study Setting

This study was conducted at the National Reconstructive Plastic Surgery and Burns Centre (NRPS & BC) at the Korle Bu Teaching Hospital in Ghana. This facility is notable for being the biggest teaching hospital in the country and the third largest in Africa, with a bed capacity of 2,000 (Addae-Nuku, 2022). KBTH hospital was chosen for its National Reconstructive Plastic Surgery and Burns Centre (NRPS & BC), which has become one of the largest burn treatment facilities in Ghana. The Burns unit has 12 adult beds and 6 paediatric beds. Services rendered at the unit include burn management, reconstructive surgeries (hand injuries and repairs, soft tissue reconstruction and congenital deformities), chronic wound management and lymphoedema management. While Ghana has a few other burn units in regional or teaching hospitals such as Komfo Anokye Teaching Hospital (KATH) and Cape Coast Teaching Hospital, these are typically operated within general emergency and acute care services, without a dedicated multidisciplinary team (MDT) structure. Limited resources, staffing constraints, and the absence of centralised, specialised facilities often prevent MDT integration in these settings. The NRPS & BC stands out by providing a fully resourced, specialised burns service with active MDT involvement, ensuring coordinated, comprehensive care for patients from initial management to rehabilitation.

Study Population and Sample Size

The study population comprised all paediatric burn patients with their caregivers who were undergoing treatment or had been treated and discharged from the National Reconstructive Plastic Surgery and Burns Centre (NRPS&BC), KBTH, from 2020 to the 2024. Caregivers in the context of this study refers to parents, guardian and other family members who take care of the child. Participants (both caregivers and patients) were recruited using purposive sampling, ensuring that they were proficient in English or the local languages (Akan, Ga, or Ewe). Purposive sampling technique was employed because it allows for the deliberate selection of participants who met the study's inclusion criteria and had relevant experiences of the phenomenon under study (Martín-Sanz et al., 2022). The sample size was determined based on the concept of data saturation which is the point at which no new information or themes emerge from the data (Guest et al., 2020). Twelve (n=12) burn patients and 12 (n=12) caregivers were recruited to participate in in-depth interviews. Data saturation was reached after conducting 12 in-depth interviews with children and 12 with caregivers, indicating that the sample size was adequate to comprehensively explore the experiences of paediatric burn patients and their caregivers. Children aged 6–14 years were eligible for inclusion in the study. Including children aged 6–14 years ensured that participants were developmentally capable of understanding questions and articulating their feelings, perceptions, and experiences regarding burn management and recovery. Exclusion criteria encompassed children with speech impairments or those unable to articulate themselves following burn injuries were excluded. Caregivers in this study primarily included parents, guardian and other family members who directly provided care for the child. Caregivers aged 18 years and above were eligible for inclusion in this study. Additionally, caregivers were required to have been actively involved in the care of the patient both during the in-patient stay and at home.

Procedures

The African Online Scientific Information Systems (AOSIS) checklist for qualitative research was employed in this study to ensure a systematic and rigorous approach to conducting and reporting this qualitative research. The research team first obtained contact details of eligible caregivers of burn patients from the burn centre. Participants were invited to participate via telephone. Interested caregivers received further details regarding their interview schedule. Twelve caregivers and twelve paediatric burn patients were enlisted and using an interview guide, semi-structured

interviews were carried out with them over the course of three weeks. The interviews were conducted face-to-face. Separate interviews were held for each caregiver and patient to ensure that the voices of both the child and the caregiver were heard equally. Interviews were conducted in the language the participants were comfortable in (English, Akan, Ewe, or Ga). On average, each interview lasted for approximately 30 minutes. Open-ended questions intended to elicit in-depth answers regarding the experiences of caregivers and paediatric burn victims were thoughtfully incorporated into the interview guide. The interview questions were developed based on a review of relevant literature, including studies on paediatric burn patients and caregivers' experiences (McGarry et al., 2014; Santos et al., 2024). Additionally, expert input was sought from three senior clinicians at the NRPS&BC of KBTH. These clinicians reviewed and provided feedback on the draft interview guide to establish content validity. A pilot test of the interview guide was further conducted with two caregivers and one paediatric patient (not included in the final sample). Feedback from the pilot study indicated that some questions were too broad or contained technical language. Based on this feedback, the questions were refined to ensure the interview process was effective, participant-friendly, and closely aligned with the study's objectives.

Statistical Analysis

Data analysis was done alongside data collection to ensure data saturation. The analysis followed Braun and Clarke's (2022) six-step approach, including familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing a final report. The audio recordings were first transcribed verbatim as Microsoft Word documents, then imported and organised in NVivo 11 software for easier management. The interview transcripts were reviewed multiple times by authors in order to become familiar with the data. Inductive content analysis with the help of the NVivo software was then used to generate initial codes by highlighting relevant text segments. These codes were reviewed and refined through discussions among authors to ensure consistency. The codes were organized into potential themes relating to participants' experiences with burn management. Two authors meticulously recorded reflective insights and elaborated on ideas regarding the final themes and critical quotes throughout the iterative data analysis process.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board of the University of Witwatersrand (26/05/23, M230512 MED23-05-033) as well as the Institutional Review Board of KBTH (7/09/23, KBTH-IRB 000166/2023). All methods employed in this study strictly adhered to the guidelines and regulations involved in human research. Before taking part in the trial, caregivers and paediatric patients gave their informed consent and assent. Participants were informed of their rights to decline uncomfortable questions, to redraw from the interview at any time without consequences and to engage willingly. Participants were de-identified with unique codes to ensure their anonymity throughout the study.

Results

Demographic Characteristics of Interview Participants

Table 1 outlines the demographic characteristics of the interview participants. Sex distribution of the burn patients (n=12) showed that 5 (41.7%) were male, while 7 (58.3%) were female. The median age of the paediatric patients was 8.5 years, with an interquartile range (IQR) of 7.0 to 10.0 years. Among caregivers (n=12), the sex distribution mirrored that of paediatric patients, with five (41.7%) male and seven (58.3%) female caregivers. Caregivers recorded a median age of 42.0 years, with an IQR of 34.25 to 46.5 years.

Table 1: Demographic Characteristics of Interview Participants

Variable	Paediatric Burn Patients (n=12)	Caregivers (n=12)
Sex		
Male	5 (41.7)	5 (41.7)
Female	7 (53.8)	7 (53.8)
Age (years)		
Median	8.5	42.0
IQR	[7.0, 10.0]	[34.25, 46.5]
Marital Status		
Married		9 (75.0%)

Single	3 (25.0%)
Employment Status	
Formal employment	6 (50.0%)
Self-employed	6 (50.0%)

Clinical Characteristics of Paediatric Patients

Most burn injuries were due to a scald from hot water or food (n=8, 66.7%). Regarding the TBSA as recorded with the Lund Browder chart, majority of patients (n=9, 75.0%) had major burns (>10% TBSA). The median TBSA among the patients was 12 [IQR =7, 15] indicating that most patients sustained moderate to severe burns. Table 1 outlines the clinical characteristics of the patients interviewed in the study.

Table 2: Clinical Characteristics of Paediatric Patients

Variable	Freq (%)	Median [IQR]
Mechanism of Burn		
Flame	3 (25.0)	
Scald (Hot water/food)	8 (66.7)	
Electrical	1 (8.3)	
TBSA level		
Minor	2 (16.7)	12 [7, 15]
Moderate	1 (8.3)	
Major	9 (75.0)	

Minor Burn (<5% TBSA) Moderate Burn (5-10% TBSA) Major Burn (>10% TBSA)
Source: American Burn Association (ABA) Burn Injury Severity Grading

Themes

Analysis of the data revealed, six overarching themes. The main themes that emerged were (1) causes of burns, (2) burns care pathway, (3) experiences following burn injury, (4) perceptions of burn management, (5) outcome and post-hospitalisation needs, and (6) suggestions for improving burn care. Within the themes, sub-themes were generated to provide detailed understanding of caregiver and patient experiences. The themes and subthemes that arose from this investigation are summarized in Table 2.

Table 3: Themes, sub-themes from reflexive thematic analysis from the participants' interviews

Major Themes	Sub-Themes
Theme 1: Causes of paediatric burns	1.1 Activity leading to burns
	1.2 Mechanism of burn injury
	1.3 People around during the injury.
Theme 2: Burns Care pathways	2.1 Self-care approaches (first aid)
	2.2 Accessibility of peripheral clinics and challenges encountered
	2.3 Referral to Burn Center
Theme 3: Experiences following burn injury	3.1 Emotional and psychological experiences
	3.2 Coping Mechanisms
Theme 4: Perceptions of burns management	4.1 Multidisciplinary approach to burn management
	4.2 Facilitators to effective burn management
	4.3 Barriers to effective burn management
Theme 5: Outcome and post-hospitalization needs	5.1 Impairment related to burn
	5.2 Functional and Participation level
	5.3 Scarring and physical appearance
	5.4 Societal Integration (e.g. School, work)

Theme 6: Suggestions for improving burn care	6.1 Transparency of cost of burn management
	6.2 Paediatric ward with recreation center
	6.3 Good communication
	6.4 Improving response time for treatment and First aid
	6.5 Purchasing new equipment

Theme 1: Causes of Paediatric Burns

Sub-Theme 1.1: Activity Leading to Burns

This sub-theme describes what the child was doing immediately before the burn injury occurred. It focuses on the context, setting, and type of activity rather than the physical process that caused the burn. In many cases, children were engaged in unsupervised play, with kitchens being the most common setting for such incidents. Caregiver negligence, whether due to absence or momentary distraction, was a recurring factor. Two participants shared their experiences, highlighting these issues.

“When I decided to go back and take the kettle, I made a mistake. I rather went to the bathhouse while the water was in the kettle in the kitchen. My kid went closer to it and the time I came she had poured the water on herself” No one was at home too. Her dad was on shift” (Participant 1, Caregiver)

“I was burning a paper and it got hold of my dress. I was playing with it as well” (Participant 2, Patient)

Sub-Theme 1.2: Mechanism of the Injury

This sub-theme focuses on how the burn physically occurred, referring to the direct process or cause of injury. Some participants provided details on the circumstances surrounding the burn injury and shed light on the mechanisms through which burns occurred. Incidents involving hot water and hot food spillage were commonly reported by participants.

"I wanted to heat water to bath so I can go to church I was turning it off from the plug since it was closer to bed and unfortunately, I jumped on the bed and the water poured on my thighs" (Participant 3, Patient)

In addition to scald burns, accidental exposure to flames and electrical plugs were reported as an event leading to burn injuries.

"I mistakenly touched an electric with my wet hands. I was a kid and did not know anything so I got electrocuted" (Participant 1, Patient)

"I was burning a paper and it got hold of my dress" (Participant 2, Patient)

Sub-Theme 1.3: People Around During the Injury

Individuals present at the time of burn incidents provided insights into the social context and supervision surrounding paediatric burn injuries, as well as the immediate help offered by those individuals. Some participants (n=3, 25.0%) who were caregivers mentioned family members, friends, and caregivers who were present during the incident. One caregiver specifically mentioned the absence of adult supervision, leading to injury.

"No one was at home too. Her dad was on shift." (Participant 4, Caregiver)

"Everyone left and my daughter was remained with another girl in the room. I was at home and I was not around where they were playing" (Participant 2, Caregiver)

Theme 2: Burns Care Pathways

Care pathways in the context of this study, refers to the journey that paediatric burn patients and take from the moment of injury to receiving specialised care. This pathway involves several key stages, each with a set of actions, challenges, and outcomes. Three main sub-themes emerged: self-care approaches (first aid), accessibility of primary clinics and challenges encountered and referral to the premier burn centre.

Sub-theme 2.1: Self-care Approaches (first aid)

Immediately following a burn incident, some patients (n=8, 66.7%) and caregivers (n=7, 58.3%) reported using self-care measures as a first response to alleviate pain and minimize further damage. These included cooling under running water, withdrawal from source of injury and removal of clothes. Other traditional approaches reported were application of mixtures of salt and water, and

mixture of sand and water to affected areas. Patients and caregivers shared various approaches that were used as follows:

"I rushed her to the washroom and put her under the shower." (Participant 7, Caregiver)

"The first aid I had was a mixture of salt of water, poured over the affected areas." (Participant 3, Patient)

"I rinsed the sand off her body with water." (Participant 5, Caregiver)

Sub-theme 2.2: Accessibility of Primary Clinics and Challenges Encountered

Accessing community clinics for further medical attention was identified as a critical step in the care pathway for burn survivors. Primary health clinics served as facilities where caregivers sought immediate medical management, advice, and recommendations for referral to specialized burn centres. Some caregivers (n=5, 41.7%) disclosed difficulties such as limited beds they encountered at these primary facilities. One caregiver and patient shared their experiences at the peripheral clinics as follows:

We roamed a couple of hospitals at night without getting help. We went to Amasaman Hospital they gave her some few medications and we moved to Mahama hospital as well. We went there we could not be catered for so we went to 37 Military Hospital and there was no bed. We changed our location to Ridge Hospital and there was no bed as well." (Participant 7, Caregiver)

"We went to about two hospitals before coming here" Nothing could be done at those hospitals we went to." (Participant 7, Patient)

Sub-theme 2.3: Referral to the Burn Center.

Referral processes serve as a means of directing paediatric burn patients to specialized medical facilities equipped with expertise, resources, and infrastructure tailored specifically for the treatment and management of burn injuries. This referral was mostly done by the primary health clinics after assessing the severity of the injuries and concluding that it demanded specialized care. One participant explained her entire process of referral to the burn center as follows:

"We finally came to Korle Bu polyclinic and we were transferred to Accident and Emergency Centre. At the A&E center, her wounds were dressed, she slept over and we were transferred to the burns unit the following morning." (Participant 7, Caregiver)

Theme 3: Experiences Following Burn Injury

Participants shared diverse emotional and psychological experiences regarding the aftermath of burn injuries. involving. Thus, beyond the physical trauma, burn patients and their caregivers navigate a complex journey of coping with the aftermath, adjusting to life-altering changes, and seeking ways to heal physically, emotionally and psychologically. The participants' experiences were categorised under two sub-themes: 1) emotional and psychological experiences, and 2) coping strategies.

Sub-theme 3.1: Emotional and Psychological Experiences

Caregivers reported experiencing confusion, shock, emotional trauma, depression, and sleeplessness immediately after the burn incident and during the management journey. The emotional toll of seeing their child in pain is profound for caregivers, eliciting feelings of sadness and depression. Two caregivers (n=2, 16.7%%) reported sleeplessness, as they constantly monitored and cared for their child, ensuring their well-being.

"When it happened, I was confused. When we were in the car, I noticed his body started peeling off and it got me so frustrated. I have never seen such a severe burn before." (Participant 10, Caregiver)

"I barely sleep just for her to get better, I always made sure she is okay." (Participant 8, Caregiver)

Similarly, some paediatric burn patients (n=3, 25.0%) shared their experiences of pain and fear in their responses. One participant shared her experience as follows:

"I did not want to go near hot water and I was scared as well. I promised myself I would never go near hot materials and stuff like that" (Participant 3, Patient)

I was in pain. I cried. I was scared." (Participant 11, Patient)

Sub-theme 3.2: Coping Strategies of Patients and Caregivers

In dealing with the emotional and psychological challenges associated with burn injuries, participants employed various strategies. These included, adjustment of life, acceptance, reliance on faith. Three caregivers revealed their coping strategies a follow:

"It is all part of life." (Participant 2, Caregiver)

"It was God since day one." (Participant 10, Caregiver)

"I am not shy in showing my scars out. I'm okay with all these." (Participant 10, Patient)

Theme 4: Perceptions of Burns Management

Sub-theme 4.1: Multidisciplinary Approach to Burn Management

The burn centre's comprehensive approach to burn management was valued by both patients and caregivers. They emphasized how numerous medical specialists, such as surgeons, physiotherapists, occupational therapists, dietitians, psychiatrists and nurses worked together to provide complete care. One participant shared the following thoughts about the various healthcare professionals' roles in helping patients manage their burn injuries:

"Clinical procedures such as wound dressing, medications, physiotherapy, occupational therapy and diet services were all good" (Participant 12, Caregiver)

Wound dressing which is mostly handled by nurses was vital in the management of paediatric burns at the centre. Some patients (n=4, 33.3%) recounted experiences of having their wounds dressed and bandaged, with variations in the techniques used, such as applying warm water baths, ointments, and cotton dressing. Most patients (n=6, 50.0%) expressed heightened levels of pain and discomfort during dressing sessions while caregivers expressed concerns with cost associated with frequent wound dressing.

"She's has been dressing wounds every three days. We buy medications to clean wounds (Participant 9, Caregiver)

"I was having dressing so I was crying. I did not want them to remove the Vaseline gauze on me because I will feel much pain for every three days" (Participant 3, Patient)

Surgical interventions were often mentioned by participants, reflecting their significance in addressing various aspects of burn injuries, including wound closure, skin grafting, and scar management.

"They had a skin grafting on him. Some flesh was taken off his thighs to proceed with the surgery." (Participant 5, Caregiver)

In addition, physiotherapy and rehabilitation interventions was highlighted by most patients (n=4, 33.3%) and caregivers (n=6, 50.0%). These interventions aimed to restore function and mobility of affected children. One patient and one caregiver echoed their experiences with physiotherapy as follows:

"I had physiotherapy treatment as well. They taught me how to walk. When I started with the exercise. It was difficult for me because it was painful but within the process I got healed." (Participant 3, Patient)

Physiotherapists came every morning because she could not walk. Those from the physio were very instrumental. They helped her walk because she was not able to walk when the incident happened” (Participant 7, Caregiver)

Participants also mentioned the instrumental role dieticians played in providing tailored nutritional support to aid in the recovery and healing process. Their expertise ensured that patients received adequate nourishment to support tissue repair, boost immunity, and prevent complications associated with malnutrition. One caregiver and one patient shared their observations as follows:

“Dieticians were around and made food menu for the child. If he will be given egg it was through an NG tube. The NG tube helped a lot in his feeding because he was not able to feed. All treatment were effective.” (Participant 10, Caregiver)

“Dieticians also made sure I was on proper diets.” (Participant 2, Patient)

Sub-theme 4.2: Facilitators to Effective Burn Management

Participants mentioned several factors that contributed to effective burn management at the centre. These were themed as facilitators of burn management included the dedication of healthcare providers, fast wound healing, repair, and access to early funding to pay for surgical procedures. Ghana’s healthcare system comprises both public and private providers. Most specialist burn care is offered in public tertiary hospitals. Ghana’s healthcare system includes public and private providers, with most burn care delivered in public tertiary hospitals. The NHIS does not fully cover burn treatment, but most private insurance schemes do, enabling timely surgical care and reducing financial burden. Three caregivers (25.0%) highlighted facilitating factors as follows:

“She was on a private insurance so it covered most of her bills especially the surgery. (Participant 4, Caregiver)

“Her wound was not deep, it was just the flesh that peeled off and the wounds were not infected so the treatment made her heal very fast.” (Participant 13, Caregiver)

“Our treatment here was really excellent. Following your medical services, I really liked it. I am really grateful to Dr.XXX because he really gets times for us. Even when I do not tell him he renders good support and medical care to my ward. Nevertheless when busy, he still comes and made sure my daughter is okay.” (Participant 12, Caregiver)

Sub-theme 4.3: Barriers to Effective Burn Management

According to some caregivers, they encountered obstacles or challenges that hindered effective burn management. Financial constraints emerged as a significant barrier with one participant (8.3%) expressing concerns about postponing treatment due to lack of funds. Caregivers bore all the costs associated with treatment, including hospital fees, medications, dressing materials, and surgical procedures. Another caregiver highlighted limited access to wards which hindered her from being actively involved in their child's care.

“I spent a lot of money treating it. When we came to the Emergency ward, around 12 am before we came here the following day. Just within that short period we were charged GHC1,200.00. I was not having much on me that time. Here at the burns center I was buying dressing materials every 3 days which was not going well with me.” (Participant 5, Caregiver)

“So I was always outside until it was time for visiting and that is when I am allowed in. I really felt bad. He would need help and stuff such as dressings, toiletries that he could not get” (Participant 5, Caregiver)

Theme 5: Burns Outcome and Post-Hospitalization Needs

The main theme of burn outcomes and post-hospitalisation needs highlights the journey and experiences of paediatric burn patients and their caregivers beyond their hospitalisation period. It explores varied experiences and requirements for recovery across several dimensions. Burn outcomes included pain level, functional and participation levels, scarring and physical appearance, societal integration, and overall impact of injury on health related quality of life.

Sub-theme 5.1: Impairments related to burns

Patients and caregivers provided varied accounts of their pain experiences after burn treatment at the centre. Five caregivers (41.7%) specifically mentioned significant reduction or absence of pain post-treatment. Few patients (n=3, 25.0%) however, reported a range of pain sensations, from complete relief to occasional discomfort. In addition to pain, some patients (n=3, 25.0%) reported dealing with persistent itchiness in the affected areas, which added to their discomfort.

“At first I was experiencing pains but after everything I feel okay now. No pains.” (Participant 1, Patient)

“She does not feel any pain.” (Participant 12, Participant 5, Caregivers)

“The scar itches me. It is just itching me.” (Participant 7, Patient)

Sub-theme 5.2: Functional and Participation Level

Both patients and caregivers highlighted improvements in functional abilities post-treatment, with many expressing satisfactions at the restoration of normal activities. Five caregivers (41.7%) noted the transition from a state of dependency to regained independence in daily tasks, while majority of the patients (n=8, 66.7%) highlighted their capacity to partake in exercise like walking, playing and doing everything by themselves. Two participants shared their experiences as follows:

“At first when he could not do anything and the arm was not worked on people feel pity for him. But now that his surgical procedures underwent well he is able to do everything well” (Participant 5, Caregiver)

“When I had the injury I could not do all these until I was fully healed. I still do my normal day to day activities” (Participant 3, Patient)

Sub-theme 5.3: Scarring and Physical Appearance

Scarring and its implications on physical appearance were key concerns voiced by both patients (n=6, 50.0%) and caregivers (n=4, 33.3%). While some expressed acceptance of scars and gradual healing progress, others remained dissatisfied or self-conscious about their appearance. Patients expressed desires for scar reduction or aesthetic improvement, reflecting ongoing challenges in coping with altered body image. Participants expressed themselves as follows:

“I feel bad when I see the scar on my body. I am able to go to school. My areas are my tummy, waist and some part of my body.” (Participant 9, Patient)

“I just want my color to come again and look so appealing” (Participant 12, Patient)

“She cannot wear certain dresses and foot wears” (Participant 4, Caregiver)

Sub-theme 5.4: Societal Integration (e.g., School, Work)

The impact of burn injuries on societal integration, particularly in educational and occupational settings, was evident in participants accounts. Most children (n=6, 50.0%) mentioned that they had successfully reintegrated into school. However, some of them encountered challenges such as stigma, and mockery from peers which disrupted schooling. This highlights the need for supportive environments to facilitate successful reintegration into social and academic spheres. Two

caregivers (n=2, 25.0%) also reported of disruptions to daily routines and social withdrawal. Participants expressed their thoughts as follows:

"I attend school and do normal day to day activities. I still play with my friends. I even go to mosque to pray despite having scars" (Participant 8, Patient)

"I am able to go to school. My friends always say one of my hands is more beautiful than the other (Participant 9, Patient)

"I can be there sometimes and I will receive calls to attend to emergencies concerning my ward. It affects my work as well. It makes me feel uncomfortable at work because all the time she was in my mind and I have to go see how she is doing." (Participant 5, Caregiver)

Theme 6: Suggestions for Improving Burn Care at the Centre

Patients and caregivers offered valuable recommendations for enhancing burn care at the center. One patient (8.3%) and one caregiver (8.3%) expressed their desire for a recreational area within the facility to provide space for relaxation and stress relief.

"There should be a recreational centre so that when the paediatric patients are depressed they can go there and release stress. Even when they are not sleeping, they can go there as well" (Participant 7, Caregiver)

"I want management to make a recreational area." (Ruby, Patient)

In addition, caregivers (n=3, 25.0%) highlighted the need for transparency in cost estimates and billing processes, suggesting clearer communication to avoid misunderstandings and financial strain on families. Additionally, one caregiver proposed subsidizing the cost of treatment items like silicone sheets and garments to alleviate financial burdens on patients.

"The estimate given was not the total amount to be used as the surgery so it made me get a problem with the school. They thought we wanted to steal them. We even delayed here when it was time for discharge because our helpers were not trusting us." (Participant 5, Caregiver)

"If they can subsidy the cost of the treatment especially silicon sheet and garments from the physio." (Participant 7, Caregiver)

Concerns were raised regarding burn patients' accommodation in the adult wards due to lack of space in paediatric wards. Two Participants (n=2, 16.7%) revealed that, the situation hindered caregivers from accessing the ward to check on their children. Thus, one caregiver (8.3%)

recommended the creation of a separate ward for paediatric burn patients. One participant reported the situation as follows:

In my case, at the males ward I was not able to cater for him well. I was a single parent too and I was a female. I cannot be there whiles they are bathing or doing such things. It was unfair.” (Participant 5, Caregiver)

Moreover, one caregiver (8.3%) highlighted how important it is for people and healthcare professionals to communicate effectively, particularly for those with limited literacy or language proficiency. Caregiver expressed his concerns as follows:

“Most people that visit the hospitals are illiterates, therefore management should improvise treatment plans centered toward them. Since most of them do not understand English Language, there should be changes to that for effective communication” (Participant 10, Caregiver)

Other suggestions included improving response times for treatment, updating outdated equipment, implementing a first aid system, and advocating for better coverage under the National Health Insurance Scheme. One participant shared his thought about improving response time to treatment as follows:

“When burn patients come nurses and management must attend to them quickly. Sometimes attention to that is being slowed. Seeing a patient in hurt does not need to answer whole lot of questions before they are catered for” (Participant 13, Caregiver)

Discussion

In the exploration of event surrounding burn injuries, the study identified play and engagements around kitchen spaces as primary activities leading to paediatric burns. Consistent with this finding previous studies have frequently cited that unsupervised play in home environments are significant risk factors for burn injuries in children. According to Puvanachandra et al., (2024), children are naturally curious and often explore their surroundings without understanding potential dangers, making them vulnerable to burns during play or when imitating adults in the kitchen. Alnababtah et al., (2016) Abedin et al., (2022) similarly noted that the kitchen is a common site for paediatric burns due to the accessibility of hot liquids and open flames. These are common risk factors for burns in low socio-economic and rural areas. These incidents in the kitchen highlight why children most frequently sustain burn injuries from scalds, from hot liquids and beverages (Broadis et al., 2020). The study discovered that children received little supervision at home or while playing,

underscoring the fact that this is a significant risk factor for burn injuries in children (Sanyang et al., 2017). The above findings highlight the challenges caregivers in the Ghanaian context face in ensuring child safety during daily household activities. These challenges are further exacerbated by the typical household layout in many communities in Ghana, where play areas and kitchen spaces are not clearly separated, increasing the risk of burn injuries for children.

The initial response involved first aid administered by caregivers before transporting patient to a nearby facility. These responses align with recommendations from burn care experts who advocate for immediate cooling of the burn with cool running water to reduce pain and limit tissue damage (Harish et al., 2019). However, inappropriate first aid measures such as applying salt water and sand mixture were also reported. The findings suggest that there is a gap in first aid knowledge among caregivers in Ghana. This further points to the need for proper education on first aid for burns, as incorrect practices can exacerbate injuries and lead to complications (Qing et al., 2020). Structured first aid education programmes hosted in schools at the community level, aimed at improving caregivers' knowledge will ensure that caregivers administer appropriate care as they prepare to seek medical assistance. As part of the care pathways for paediatric burn management, this study documents significant challenges in accessing adequate care at peripheral clinics due to the unavailability of beds and lack of appropriate care. The literature corroborates these findings, highlighting that many LMICs face significant barriers in providing timely and effective burn care owing to resource limitations, including inadequate facilities, lack of trained personnel, and insufficient medical supplies (Thomson et al., 2020). Although peripheral clinics may not be adequately equipped to manage all burn cases, it is expected that they will be able to enforce appropriate first aid mechanisms, educate caregivers, and refer patients to specialised burn centres. Thus, the effectiveness of specialised burn centres is partly dependent on timely and efficient referral of patients from primary and secondary healthcare facilities (Ehrl et al., 2018).

The emotional and psychological toll on caregivers of burn victims was significant. Previous studies have similarly revealed that caregivers of patients with burns often suffer from high levels of psychological distress, sleep disturbances, and depression which impact their daily activities and overall well-being (Rencken et al., 2021; Santos et al., 2024). Caregivers highlighted how the incident impacted their quality of life, particularly their work life. Intensive and prolonged care

required for burn patients can lead to significant economic and social burdens on families, affecting their ability to maintain employment and social relationships (Rencken et al., 2021).

Findings from both burn patients and their caregivers emphasized on the multidisciplinary approach to burn management at the burn center involving various disciplines such as surgical procedures, wound dressing, physiotherapy, nutrition support, and psychological support. According to Gerber et al. (2020), the management of paediatric burn patients encompasses acute, subacute, rehabilitation, and long-term planning, ideally coordinated within a multidisciplinary care framework. The caregivers expressed positive perceptions of the multidisciplinary approach to burn care. The importance of surgical interventions, including skin grafting, was emphasized. Although surgical procedures are costly, it is necessary in the recovery of burn patients, particularly for severe burns requiring skin grafts (Jeschke et al., 2020). Notably, physiotherapy and adequate nutrition support played a vital role in burn rehabilitation at the center. Consistent with this finding, Clinical Practice Guidelines (CPG) have recommended early nutrition support (Bul, 2020) and early intensive physiotherapy (Cartotto et al., 2023) for improving outcomes for paediatric burn patients. Physiotherapy interventions include respiratory care, joint mobility exercises, strengthening, functional training, pain relief, and scar management to prevent complications and improve recovery (Cartotto et al., 2023). One of the obstacles to prompt and efficient paediatric burn care is the significant financial cost associated with the treatment, as noted by caregivers. It is worth knowing, that at Ghana's premier burn center the National Health Insurance Scheme (NHIS) utilized in the country does not cover for most of the procedures done at the burn center making caregivers bear almost all the cost. According to Hulsebos et al., (2023) adequate insurance coverage can significantly affect the quality and accessibility of burn care services. This suggests that although paediatric burn injuries entail a considerable financial burden (Wickens et al., 2024), utilizing private or public insurance schemes can help alleviate these costs. In the current study, the majority of participants were on the public NHIS, which offers only limited coverage for burns, whereas private insurance generally provides full coverage, particularly for surgical procedures.

The current study revealed significant outcomes of burn management at the center was largely in dimensions of improved pain levels and functional abilities. However, concerns regarding scar

itchiness, physical appearance and societal and school reintegration persisted. Spronk et al., (2018) reported similar concerns that, parental concerns about the appearance of their children persisted for up to two years following the burn injury. Similarly, Pan et al., (2018) assert that, the ongoing alterations in appearance might result in social stigma, can pose obstacles to the child's reintegration into school. Limited access to advanced scar management options at the burns center in Ghana may explain these ongoing concerns, and points to the need for improved aesthetic interventions. The prolonged hospitalization period for serious burn cases, which can extend from several weeks to months, can interrupt school-related activities for the entire duration of admission. In some cases, it may even lead to a complete discontinuation of schooling (Pan et al., 2018), making school reintegration an important area of concern. This highlights the need for novel techniques and surgical revisions for scar management to enhance aesthetic outcomes of paediatric patients so that can be return to school happily.

In proposing a model to address the shared challenges of burn management identified in this study, an integrated community-based burn care model could be beneficial. This model would focus on education at the community level, early first aid intervention training, better communication between caregivers and health professionals, and improved insurance schemes. Suggestions from participants to improve burn management practices pointed to areas for improvement in cost transparency and effective communication. Similar to the concerns raised by caregivers on cost transparency, the literature supports the need for transparency in healthcare costs, particularly in LMICs, where out-of-pocket expenses can be a significant burden (Naher et al., 2020). Research has indicated that clear communication regarding costs can help families plan better and reduce stress related to financial uncertainties (Haverfield et al., 2020). It is worth noting that, Ghana's premier burn center did not have a separate ward that was exclusive for paediatric burns at the time of the study due to renovations. Children were mixed with adult cases which became a barrier for caregivers of the opposite sex to walk into the wards freely. It was therefore recommended that the burns centre should establish a dedicated paediatric ward to provide children with a more conducive recovery environment, complete with recreational spaces. This would address the concerns of caregivers about mixed wards and improve the overall experience for paediatric burn patients. Research shows that play and recreational activities are essential for the psychological well-being of hospitalized children. They provide a sense of normality and help in stress relief,

which can contribute to better recovery outcomes (Burns-Nader & Hernandez-Reif, 2016). Suggestions were also made to enhance effective communication at the burn center, especially when dealing with diverse populations. Enhancing communication channels at the burns centre, including the use of local languages and culturally appropriate methods, would ensure that caregivers fully understand treatment plans and can participate effectively in the care process, enhance compliance/adherence to home programmes and post-discharge care.

Conclusion

The study identified unsupervised play and kitchen activities as primary causes of paediatric burn injuries and highlighted proper first aid education and parental supervision importance to prevent such incidents. Significant challenges existed in accessing adequate burn care due to resource limitations, emphasizing the need for efficient referrals to specialized burn centers. Caregivers experienced profound emotional and psychological impacts, necessitating comprehensive support. Procedural pain and persistent itchiness were commonly reported by patients stressing the need for better pain management and interventions to address chronic itchiness and scarring. Overall satisfaction with burn management and healthcare professionals was good. A multidisciplinary approach, including surgical care, physiotherapy, and nutritional support were essential for effective paediatric burn management. However, financial burdens and the need for improved insurance coverage remain critical issues of paediatric burn management at the center. Post-hospitalization needs were significant, with emphasis on school reintegration, improving body aesthetics and managing itching scars.

Limitations and Recommendations

Future research must address a number of the study's weaknesses. Firstly, because different burn centers may have varied resources, protocols and patient characteristics, doing the study at a single site may restrict the data generalizability to other contexts. This restriction points to the necessity of additional multi-center research in the future to improve the findings' generalizability and offer a more thorough comprehension of paediatric burn care in various settings. Another limitation of this study is the underrepresentation of children's voices, as they had challenges in expressing their experiences. Some also found it challenging putting their feelings and thoughts into words while others were also shy. Future research can address this by using child-friendly methods like

drawing, storytelling, or play-based activities to help children express themselves better. Additionally, the study could not accurately report on the cost involvement in paediatric burn management and the length of stay which is a critical aspect of understanding the financial implications highlighted by caregivers. Future research should include detailed cost analysis to better inform healthcare policies and resource allocation. Furthermore, future studies exploring healthcare provider experiences in managing paediatric burn patients will provide a more holistic understanding of the challenges faced in care delivery. This will guide focused initiatives to raise patients satisfaction and care quality.

The findings of this study provide actionable insights for enhancing paediatric burn care within the hospital. Pain, itching, and scarring require a stronger integration of multidisciplinary rehabilitation into the standard care pathway, ensuring timely physiotherapy, occupational therapy, and psychological support. Caregiver distress highlights the need for structured emotional and educational support, while gaps in first aid knowledge point to an urgent need for targeted community outreach and hospital-based caregiver training. The reported financial strain underscores the importance of advocating for comprehensive NHIS coverage for paediatric burn management at KBTH.

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Competing interests

None of the authors have any conflict of interest to report.

Authors 'contributions

All authors contributed equally to this work. All authors read and approved the final article.

Ethical consideration

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Data availability statement

The corresponding author [A.A.R.] can provide the data supporting the study's conclusions upon request. Due to limitations, such as the fact that it contains information that can jeopardize research participants' privacy, the data are not publicly accessible.

Disclaimer

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CHAPTER SIX

HEALTHCARE PRACTITIONERS' PERSPECTIVES ON PAEDIATRIC BURN MANAGEMENT

6.1 Introduction to Manuscript Three

Chapter five highlighted the personal experiences of paediatric burn patients and their caregivers. Chapter six builds on these insights by exploring the perspectives of healthcare practitioners involved in the management of paediatric burns at the KBTH. Effective management of paediatric burns requires a multidisciplinary approach involving prevention, acute care, rehabilitation, and long-term follow-up. This chapter aligns with objective three of the study: to explore the perspectives of healthcare practitioners on paediatric burns management. The findings presented in this chapter have been published in the journal *Burn Open*, reflecting the study's contribution to the global discourse on burn management in resource-constrained settings.

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Contributor	Role(s)	Details of Contribution
Alberta Amissah Nyarko	Conceptualization, Data Collection, Data Analysis, Interpretation, Writing – Original Draft, Corresponding Author	Led the study design, collected and analysed the data, interpreted findings, and drafted the manuscript. Acts as the corresponding author.
Natalie Benjamin- Damons	Conceptualization, Supervision, Writing – Review & Editing	Contributed to study conceptualization, supervised analysis, and critically revised the manuscript.
Sonti Pilusa	Conceptualization, Supervision, Writing – Review & Editing	Contributed to study conceptualization, supervised data processes, and reviewed the manuscript for accuracy and quality.

BURNS JOURNAL

Healthcare Practitioners' Perspectives on Paediatric Burns Management at Korle Bu Teaching Hospital, Ghana

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Highlights

- The multidisciplinary approach enhances paediatric burn care outcomes.
- Lack of formal protocols, limited infrastructure and financial burden on families were major barriers identified.
- The impact of paediatric burn care on patients and families revealed psychological trauma and limited support.
- Burn management and recovery outcomes were influenced by socio-cultural beliefs and socioeconomic status.
- Enhancing social welfare services, upgrading burn facilities and improving training for staff were recommended.



Healthcare Practitioners' perspectives on paediatric burns management at Korle Bu Teaching Hospital, Ghana

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ABSTRACT

Background: Paediatric burns pose significant challenges in healthcare management. Paediatric burns require specialized care due to the distinct anatomical and physiological characteristics of children, which make them more vulnerable to complications. In resource-limited settings like Ghana, the absence of adequate supplies and standardized protocols can exacerbate these challenges, necessitating the need for a comprehensive understanding of the perspectives of healthcare practitioners involved in their care.

Study Objective.

To explore healthcare practitioners' perspectives on paediatric burns management at a tertiary hospital, Ghana, covering current practices, barriers, impacts on patients and families, and recommendations for improvement. **Methodology:** This study employed a qualitative research approach utilizing Focus Group Discussion (FGD) with 15 participants from various disciplines, including Plastic Surgery, Medicine, Anaesthetics, Physiotherapy, Occupational Therapy, Dietetics, Nursing, Pharmacy, Clinical Psychology, Public Health Nursing and Laboratory Scientist. Participants were recruited through a convenience sampling technique. The discussion lasting approximately 90 min, were audio recorded, and facilitated by a discussion guide based on existing literature. The audio recordings were transcribed verbatim, and the transcripts were compared with handwritten notes for accuracy. The final transcribed data were coded and analyzed using thematic content analysis to identify recurring themes and patterns.

Results: Findings revealed four primary themes: strengths of current practices (multidisciplinary approach, experienced practitioners), barriers (lack of formal protocols, infrastructure limitations, financial burdens), contextual factors influencing burn care (psychological trauma, inadequate support, socio-cultural beliefs and socioeconomic status), and recommendations for enhancing burns care (improved social welfare, facility upgrades, staff training and mental health support).

Conclusion: While burns care has improved in Ghana, there are clear opportunities for improvement. A move towards more integrated care, the development of locally adapted protocols, better financial support, and enhanced caregiver education are essential next steps in elevating the quality of paediatric burn management in Ghana.

1. Introduction

Paediatric burns represent a serious public health issue due to their high incidence rate and potential for long-term consequences [1]. Burns is reported to be the third common cause of death in children between 1 to 9 years of age [2]. In sub-Saharan Africa, approximately 300,000 new burn cases occur annually in children under five years of age [3].

Children who sustain burns face not only psychological, emotional, and physical challenges but also significant financial hardships for their families and strain on the healthcare system [4]. While the incidence of burn cases has been declining in high-income countries (HICs), where advanced treatment protocols have been developed, the opposite trend is observed in many LMICs [5,3,6].

The management of paediatric burn cases demands unique and

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specialized approaches compared to adult care [7]. This is largely due to the anatomical, physiological, and psychosocial differences between children and adults [8]. Children have different body proportions, thinner skin, smaller airways, reduced blood volume, and are more prone to distress [9]. These factors make them more vulnerable to severe outcomes following burn injuries, necessitating specialized care [10]. For instance, for children, burns involving more than 10 % of their total body surface area necessitate formal fluid resuscitation and careful maintenance to address these distinct needs [8]. Preston et al., [7] further noted that, distinct considerations for paediatric burn cases include specialized airway management, transfusion strategies, and carefully designed pain management protocols. These specific needs are further complicated in resource-limited settings, as illustrated by a study conducted among Ugandan anesthetists, which found that only 13 % had access to the essential supplies required to safely administer anesthesia to paediatric patients [11]. Healthcare practitioners are therefore expected to stay updated with the unique considerations required for paediatric burn management and to receive the necessary resources to provide effective care.

Moreover, effective management of burns requires a multidisciplinary approach involving various healthcare practitioners, including anaesthetists, surgeons, nurses, psychologists and physiotherapists [12]. Holistic management, which addresses not only the physical but also the emotional and social aspects of the injury, has been proven to be highly effective in reducing the physical and mental illness and death linked to such injuries. Effective burn management has significantly reduced morbidity and mortality in high-income countries (HICs), where survival rates for children with burns covering up to 60 % of their total body surface area (TBSA) are high [3]. However, in resource-limited countries, burns affecting as little as 20 % TBSA can be fatal, with survival rates for burns exceeding 45 % TBSA remaining very low. The mortality rate in these settings is still high at 6.9 per 100,000 among children under 15, compared to 0.2 to 0.6 per 100,000 in HICs [3]. The literature has revealed several challenges LMICs such as Ghana faces in the management of burn injuries, including limited resources, inadequate infrastructure, specialized health personnel and socio-cultural factors. A study conducted by Allorto et al., [6] in South Africa, reported similar constraints in infrastructure and staffing, such as limited access to isolation facilities and after-hours coverage highlighting the broader regional challenges in burn care.

In Ghana, and at Korle Bu Teaching Hospital in particular, the management of paediatric burns is often hindered by a lack of adequate resources, skilled healthcare practitioners, and accessible healthcare facilities Albertyn et al., [13]. This gap in care contributes to higher rates of complications and mortality compared to HICs [3,6]. Korle Bu Teaching Hospital, one of the largest tertiary hospitals in Ghana, plays a critical role in the management of burn patients. Healthcare practitioners at this institution face unique challenges in providing care, including limited resources, lack of specialized equipment, and cultural barriers. Understanding their perspectives on the current burn management practices, challenges, and areas for improvement is essential for enhancing the quality of care and improving patient outcomes. By addressing these issues, the hospital can move towards developing more effective and comprehensive care protocols that are better suited to the needs of paediatric burn patients in Ghana.

2. Methods

This study employed an explorative qualitative research approach, using focus Group Discussion (FGD) to gather opinions from healthcare providers working in the Burns and Plastics Unit of a tertiary Teaching Hospital in Ghana.

2.1. Study participants

Participants were recruited using a convenience sampling technique,

where they were invited to partake in the study through a formal letter from their respective departments, allowing for easier access and encouraging the sharing of valuable insights and experiences. The discussion included at least one representative from each of the following disciplines: Plastic Surgery, Medicine, Anaesthetics, Physiotherapy, Occupational Therapy, Dietetics, Nursing, Pharmacy, Clinical Psychology, Public Health Nursing and Laboratory Scientist reflecting the MDT approach required for effective burns management. All participants had at least eight years of work experience, ensuring they had valuable knowledge and expertise to share.

2.2. Data Collection and analysis

FGD is an effective method for exploring complex issues by facilitating in-depth discussion among participants with shared experiences or expertise [14]. The focus group consisted of 15 participants comprising 9 females and 6 males. This size was considered optimal for a focus group as it allowed for a wide range of perspectives while ensuring that each participant has ample opportunity to contribute to the discussion [14]. The focus group discussion was conducted in a single session lasting about 90 min. The discussion took place at the conference room of the Burns and Plastic Center at Korle Bu Teaching Hospital. Participants were seated in a round table to facilitate face-to-face interaction, and the entire session was audio recorded. A discussion guide with questions generated from the review of literature on paediatric burn management was used to facilitate the FGD. The guide was piloted with a small group of healthcare professionals prior to the full study to ensure clarity, relevance, and comprehensiveness of the questions. Feedback from the pilot was incorporated to refine the guide. After the focus group discussion, the audio recording was transcribed verbatim by two research assistants, and the transcript were compared with the handwritten notes to ensure accuracy. The final transcribed data was coded and analyzed using thematic content analysis. Themes were identified based on recurring patterns in the data, allowing for a comprehensive understanding of the perceptions and experiences of healthcare practitioners regarding paediatric burns management at Korle Bu Teaching Hospital.

2.3. Ethics

Ethical approval was obtained first from the University of Witwatersrand (26/05/23, M230512 MED23-05-033) and Institutional Review Board of KBTH (7/09/23, KBTH-IRB 000166/2023). Before the discussion, participants were informed of the study's purpose, and informed consent was obtained for recording the session. Participants were also informed that, due to the nature of focus group discussion, absolute confidentiality and anonymity cannot be guaranteed. However, all audio recordings and transcripts were stored in password-protected files, and any identifying information was anonymized during transcription. Only authorized personnel had access to the data.

3. Results

The results from the FGDs revealed four primary categories regarding the management of paediatric burns at the burn centre: (1) Strengths of Current Practices (2) Barriers of burns management, (3) Contextual Factors Influencing Burn Management, (4) Recommendations for Enhancing Burn Care.

3.1. Strengths of current burn practices

The participants felt that the strength of the current burns practices was due to the MDT approach in burns management, and the availability of experienced healthcare practitioners.

3.1.1. Multidisciplinary approach to burn management

Healthcare practitioners emphasized the strengths of the multidisciplinary approach in burn care at Korle Bu Teaching Hospital. The collaboration among various healthcare professionals ensures that paediatric burn patients receive comprehensive care that addresses their immediate medical needs and long-term recovery goals.

"I think our main strength for our department would be our multidisciplinary approach. And I think that's a strength you hardly find in other departments. And that's what has contributed to the success of our program." (Participant 2)

"When the patients come, the resuscitation here is so solid. Wound care is solid. Every discipline is called upon to do his or her part." (Participant 8)

In addition, participants emphasized the need to further improve synergy and collaboration among the various professionals involved in burn care. They recognized that enhancing these aspects could significantly contribute to better outcomes for paediatric burn patients.

"One of the things that we're looking for is to enhance or build on the synergy between the various professionals..." (Participant 14)

3.1.2. Experienced healthcare practitioners

Participants noted the strengths brought by experienced healthcare practitioners, particularly through experience, knowledge sharing, and the use of adapted protocols in managing burn cases at the center. Despite the lack of a formal, hospital-wide burn protocol, the expertise of some staff helped to develop internal protocols for burn care.

"With the experience of practice, everybody knows what to do. You don't sit and wait for something to happen before you step in." (Participant 15)

"The nurses have developed their own protocol that they use in management of patients who come. We use what we have to also train others so that we can all be on the same level." (Participant 5)

"As dieticians we also use the American Burn Association protocol. And based on experience, we've come up with a protocol for paediatrics and adults." (Participant 2)

3.2. Barriers to burn management

3.2.1. Lack of formalized protocol

Healthcare practitioners highlighted the absence of formalized protocols for paediatric burns management. This lack of standardized guidelines leads to variability in practices, with individual practitioners relying on their judgment or external guidelines such as the American Burns Association's criteria. The lack of a standardized protocol can impact patient outcomes due to the uncertainty in determining the appropriate course of treatment.

"I wouldn't say that there is a lay down protocol that anyone can look at and say, okay, this is a stage of treatment we are in... I'm not aware of any such document." (Participant 14)

"So, for 10 % of the cases, our management usually is based on the American Burns Association's criteria so far... But as to whether, for Korle Bu, the hospital itself has written or laid down protocols, that we don't have." (Participant 10)

3.2.2. Infrastructure and facility limitations

Inadequate facilities and infrastructure were cited by participants as significant challenges in providing optimal care. Healthcare practitioners highlighted the lack of specialized diagnostic equipment and inadequate physical environments for therapy and rehabilitation as critical weaknesses.

"At times, there are certain lab diagnostic investigations you have to do. The best center in this facility is not here." (Participant 15)

"Then looking at an adult opposite, I mean that one alone is scary. And it has a psychological impact." (Participant 6)

3.2.3. Financial burden of burn management

Financial limitations on the part of patient and caregivers were identified as a significant barrier to effective paediatric burns management. The lack of funding for essential medications and resources often forces healthcare providers to make compromises in patient care.

"In terms of finance, there's a lot of problem when it comes to financing the drug and things that you need for the care... So, it's a bit of a challenge." (Participant 6)

"Sometimes it's the finance that determines what you do. And that's not good enough. Because your hands are tied behind your back." (Participant 6)

3.3. Contextual factors influencing burn management

The management of paediatric burns was revealed to be profoundly influenced by various contextual factors, including socio-cultural and religious beliefs, socioeconomic status of patients and the attitudes and approach of caregivers to burn care.

3.3.1. Psychological and emotional trauma

Participants noted that the lack of dedicated space for paediatric patients within the hospital affects the emotional support that can be provided. When children are not grouped together, it can be difficult for them to find encouragement and solace from peers in similar situations.

"...When you go to any paediatric wards and you are passing, because they are all children there, they encourage themselves. But in this facility, I don't know who the child is going to encourage, the mother or the father. So, it becomes a weakness of our path." (Participant 5)

3.3.2. Family involvement and support

A key issue identified by participants was the lack of family involvement and support for burn patients during their hospital admission. Many participants expressed concern that families often do not provide financial assistance for necessary expenses, which adds to the challenges faced by patients and healthcare providers alike. Participants noted that while social welfare services may step in to assist with financial difficulties once a patient is discharged, there is generally a lack of ongoing support for patients during their stay in the hospital.

"The hospital doesn't have any support for them. Unless, maybe, a patient is discharged and can't afford to pay bills, then the social welfare come in to support." (Participant 1)

3.3.3. Socio-cultural and religious beliefs

Findings from the FGD revealed that, socio-cultural beliefs greatly affected how paediatric burns are managed at the Burn centre. Many parents strongly believed in alternative treatments, like herbal medicine, which can cause delays in getting standard medical care for their children. Participants voiced out their concerns as follows;

"A lot of people have this ideology here that herbal medication helps... they take their kids out to continue with the herbal treatment because they believe that herbal helps." (Participant 7)

Moreover, religious beliefs also play a crucial role in the treatment process. For instance, parents might refuse certain medical procedures or treatments based on their faith. This was evident in the experience shared by few participants.

"Most often when children are brought in, the decisions are taken by their parents... At times, parents taking their decision is based on their faith." (Participant 8)

"When you tell parents that we need to do physiotherapy because the child will get contracture, they tell you that they believe in God and nothing is going to happen." (Participant 13)

3.3.4. Socioeconomic factors

Participants mentioned that socio-economic factors play a significant role in the management of paediatric burns, often leading to inadequate care and poor outcomes. The financial burden on families was a recurring concern, as many are unable to afford essential medical supplies and treatments for their children.

"Most of the consumables, the medicine and medication that we use for these children have to be purchased by the parents." (Participant 1)

"It's disheartening to see a child we write medication for and the parents cannot buy... Sometimes, everything parents cannot buy, even dressing items, parents cannot buy." (Participant 10)

3.3.5. Caregivers' attitudes and approach to care

Participants noted that the attitudes and understanding of caregivers have a significant impact on the treatment process for paediatric burns. Some caregivers exhibit a lack of engagement in their child's care, which negatively affects treatment adherence and outcomes. One participant observed,

"There are some parents who come across as not being interested in the care being given to the child" (Participant 13).

Another participant expressed concern over the actions of some caregivers, stating,

"They don't buy the dressings, they don't buy medications, nothing. It seems like they are waiting for the child to pass away" (Participant 13)

3.4. Recommendations for enhancing paediatric burn care

3.4.1. Strengthening social welfare and post-discharge follow-up services

Participants emphasized the need to revive and enhance the role of social welfare in paediatric burns management, particularly for vulnerable children. They recommended involving social workers to assist with follow-up care and addressing social and financial challenges. Some participants recommended as follows;

"I want to add that some years back, I think quite long ago we had social welfare was very active care and it helped in following up some of the patients and helping us solve all these social and then some of the financial issues." (Participant 13)

I think in doing that, we should perhaps have an avenue where we can have a team following up post-discharge services. Because if you are doing a physical rehabilitation, it's supposed to go on until 18 months after they've been in for the survival. That's a long time, and we need to find ways to encourage people to continue their rehab today. (Participant 8)

3.4.2. Expanding and upgrading burn facilities and infrastructure

Participants stressed the need for facility improvement and adequate resources to enhance paediatric burn management. They advocated for the expansion or construction of a new unit, emphasizing the limitations of the current infrastructure and the need for more space and modern facilities. One participant had this to say;

"Looking into the future, are we going to expand or build a new unit? This was, those of you who don't know, the structure there was from a decommissioned hospital in Scotland. They brought the furniture, including wooden furniture, operating tables, instruments, all came from that decommissioned hospital. We need to improve on it. More space for the patients, more space for training people." (Kofi)

As part of the recommendations to upgrade facilities, some

participants also mentioned the importance of creating a child-friendly environment with tools like television, toys among others, that that will keep them active so they don't think much about their condition. One participant emphasized the therapeutic value of such an environment, stating,

"Then the playground. We cannot take play out of the growth of children. If we have a playground with colorful pictures, fun videos, and a television showing paediatric content, it would be therapeutic on its own. So, if we should get that setting for them alone. I think it will also help with that." (Participant 13)

3.4.3. Staff training and professional development

Participants identified significant gaps in training within the burns unit, particularly in managing paediatric emergencies and addressing child protection issues. They emphasized the need to reassess and restructure the unit's training programs to ensure that staff are adequately prepared to respond to emergencies and recognize cases of child abuse. Two participants were of this opinion;

"I think we as a unit have a goal for training, but I think we should have a second look at it. At times a child gets here and there's no emergency nurse here. As a center, you don't have. Then you tell the person to go back to the main emergency... And everything is slacking behind. Why? Because there was no one there who knew what to do, when to do at that moment. So if we as a unit can restructure our training needs again, it will go in a long way to help." (Participant 15)

"I think the unit should train a child protection person attached to the burn unit. Or to the old plastic surgery unit. So that. That person coordinates all these atrocities. Because at times you see a child that you know is purely abused. But you don't know what to do." (Participant 5)

3.4.4. Psychological support for staff

Some participants noted the importance of providing periodic psychological support to staff to maintain their sensitivity to patients' needs and prevent burnout. They recognized the emotional toll that working in such a demanding environment can take on healthcare professionals.

"So, I commend periodic psychological support for staff and them. Because I realize when you work about, I worked for, I've been for about seven, eight years on a row. At a point we became so insensitive to the pain the patient goes through, and the dying." (Participant 1)

"This kind of work is difficult comparing to other specialties so the staff also need periodic assessment health talk that will free their more psychologically free their minds." (Participant 10).

4. Discussion

This study sought to explore healthcare practitioners' perspectives on paediatric burns management at a tertiary hospital in Ghana. Four major themes emerged from the findings.

4.1. Strength of current practices

The emphasis on the strength of the multidisciplinary approach in burn care at Kofor Kofor Teaching Hospital by Healthcare practitioners is consistent with previous literature. Cambiaso-Daniel et al., [15] emphasizes the multidisciplinary approach as a cornerstone of effective burn management. According to Cambiaso-Daniel et al., [15], the integration of different specialties allows for a holistic treatment plan that can adapt to the complex and evolving needs of burn patients. Schlottmann & Lorbeer [16] similarly posited that, this collaborative approach addresses the complex needs of burn patients, ensuring that all aspects of their recovery, from acute care to long-term rehabilitation, are managed effectively. Although MDT has been well established in the literature, recent studies suggest a transition from a multidisciplinary to a

transdisciplinary approach in paediatric burn teams as it improves patient outcomes by fostering more integrated and cohesive care strategies [12]. The study also emphasized the importance of experienced and skilled professionals in the management of child burns. The complexity of paediatric burn care, due to factors such as the higher fluid losses, increased risk of hypothermia, and thinner skin in children compared to adults, requires specialized knowledge and expertise to improve chances of survival [9,10]. The above assertions therefore point to the need for continuous professional development for healthcare practitioners that supports the intricate needs of paediatric burn patients in order to maintain high standards in their ongoing care.

4.2. Barriers of burns management

One major barrier reported by healthcare practitioners in the management of paediatric burn injuries was the absence of formalized protocols. Practitioners often relied on their judgment or external guidelines, such as those from the American Burn Association (ABA). The lack of formalized protocols for burn management is not unique to the current study. A recent study by Patterson et al., [17] highlights the significant variability in paediatric burn care across the country, emphasizing the need for standardized quality measures and performance benchmarks to guide improvements in paediatric burn centers. Another study conducted by Holbert et al., [18] in Australia reported a lack of a formal protocol for integrating adjunctive Negative Pressure Wound Therapy (NPWT) into acute burn care. Despite these challenges McWilliams et al., [19] revealed that there were several ways practitioners could obtain guidelines or protocols for the initial assessment and treatment of paediatric burn patients, such as online sources if their context has not yet developed one. This was consistent with the practices of some healthcare practitioners in the current study who relied on guidelines developed by ABA. However, it is worth noting that, external guidelines may not be uniformly adopted in all healthcare settings, particularly in regions with limited resources such as Ghana [1]. The lack of local adaptations of external guidelines can lead to poor burn care because these guidelines are usually created in countries with better resources and advanced technology. In places with fewer resources, like Ghana, hospitals may not have the needed equipment, medicines, or enough trained workers to follow these guidelines properly.

Financial limitations being identified as another significant barrier to effective paediatric burns management in Ghana is a pressing issue. This finding aligns with previous research that has revealed that burn care requires a substantial allocation of hospital resources, with expenses being influenced by various factors such as patient demographics, the extent of the burn, and the length of hospitalization [20,21]. Contrasting findings, however, emerged from Latifi et al., [22] who found that the age of the patient, whether child or adult, did not significantly impact the costs of burn management. Instead, factors such as TBSA, duration of hospital stay, and male gender were more strongly associated with hospital charges. These findings suggest a need for improving National Health Insurance coverage for the management of burns as requested by burn patients in earlier studies in Ghana [23].

4.3. Contextual factors influencing burn management

Furthermore, healthcare practitioners in this study expressed their concerns regarding certain contextual factors such as socio-cultural and religious beliefs and practices, socioeconomic status, and the attitudes of caregivers that influences the care burn patients received at the center. Practices of caregivers such as poor first aid management was found to influence burn outcomes. Consistent with this finding Gete et al., [24] reported that majority of caregivers attending burn units demonstrated poor knowledge of burn first aid. In addition, the study found that positive attitudes of caregivers, such as the willingness to learn and improve first aid knowledge, are crucial for the immediate and long-term recovery of burn victims [24]. Many caregivers especially in the

African context, still hold strong beliefs in alternative treatments, such as herbal medicine, which can delay access to essential medical care for improving burn outcomes [25]. The study revealed that some caregivers exhibit a lack of engagement in their child's care, which can adversely affect treatment adherence. This observation reflects broader trends identified in research that link caregiver involvement with improved health outcomes for paediatric patients care [26].

4.4. Recommendations for enhancing burn care

Healthcare providers emphasized the need to revive social welfare roles in paediatric burn management. Similar to this recommendation, a study conducted by Curtis et al., [27] and Komhaber et al., [28] highlighted the importance of continuous support systems through social workers, that facilitate recovery beyond initial treatment. Social workers can address barriers such as financial constraints, access to rehabilitation, and the psychosocial needs of children and families, which are important for long-term recovery [27]. However, long-term rehabilitation and continuous support do not rely on social workers alone. Other members of the MDT such as physiotherapists, and psychologists still have a role to play to ensure that all aspects of a child's recovery, both physical, social and emotional, are addressed to achieve best outcomes. The suggestion to create child-friendly environments, including play areas, aligns with research showing that such spaces can aid healing by reducing stress and anxiety in young patients [28]. Studies in paediatric psychology emphasize the therapeutic value of play and colorful settings, highlighting their positive impact on children's emotional well-being [29,30]. This evidence supports the need for incorporating these elements into burn care facilities especially in low resourced settings to enhance the healing process for paediatric patients. Furthermore, healthcare providers advocated for regular psychological support to prevent burnout and maintain sensitivity towards patients' needs. This recommendation is supported by literature indicating that emotional exhaustion among staff can negatively impact patient care quality and staff retention rates [31]. A study by Murji et al., [32] indicates that healthcare workers in burn units are more likely to experience burnout compared to those in other specialties due to the long-term nature of care and the emotional burden of treating severely injured patients.

5. Conclusion and recommendations

The findings of this study demonstrates that there are clear opportunities for improvement in paediatric burn care at the Korle Bu Teaching Hospital. A move towards more integrated care, the development of locally adapted protocols, better financial support, and enhanced caregiver education are essential next steps in elevating the quality of paediatric burn management in Korle Bu Teaching Hospital. Healthcare practitioners at Ghana's premier burn center recommend enhancing paediatric burn care through several key initiatives. They emphasized the need to strengthen social welfare and post-discharge follow-up services by involving social workers to support vulnerable children and ensure continued rehabilitation. Healthcare practitioners also mentioned the urgent need to expand and upgrade burn facilities, including modern infrastructure and creating child-friendly environment. Furthermore, there is a need to improve staff training to ensure they are updated with current burn management practices. Lastly, healthcare practitioners highlighted the importance of providing periodic psychological support for staff to prevent burnout. Lastly, future studies could consider employing a mixed-methods approach, where perspectives of participants are resolved into scalar quantities for easier evaluation. To ensure that these recommendations lead to tangible improvements, the next steps will involve actively engaging with key stakeholders at Korle Bu Teaching Hospital, including hospital management, department heads, and relevant healthcare practitioners. A formal report summarizing the study's findings and recommendations

will be presented to these stakeholders to discuss how the suggestions can be integrated into the hospital's current burn care practices.

6. Limitation

The study is contextually limited to the Burns and Plastics Unit at Korle Bu Teaching Hospital, a single tertiary institution. Since the study is based on this specific setting, the findings may not fully reflect the experiences or challenges faced in other hospitals or healthcare settings in Ghana. For instance, hospitals in rural areas or those with fewer resources might deal with different issues in paediatric burns management. The resources, patient demographics, and available support at the burn centre at Korle Bu Teaching Hospital might not be the same elsewhere, making it harder to apply the study's results broadly across the country.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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DEVELOPMENT OF PROTOCOL FOR HOLISTIC PAEDIATRIC BURN MANAGEMENT

7.1 Introduction to Manuscript Four

Building upon the insights gathered in Chapters Five and Six from paediatric burn patients, their caregivers, and healthcare practitioners, this study advances the discourse by developing a protocol for holistic paediatric burn management tailored to low-resource settings. Chapters five and six explored the perspectives of patients, caregivers, and healthcare practitioners, highlighting the lived experiences, challenges, and strategies employed in paediatric burn care. While these perspectives offer invaluable context, the development of a practical and implementable protocol necessitates the synthesis of these insights with expert opinions. This chapter addresses the final objective of the study: to propose an evidence-based, and resource-adaptable protocol for managing paediatric burns in low-resource settings. The findings of this study were submitted for publication in *the Journal of Disability and Rehabilitation* on June 30th 2025.

7.2 Manuscript Details

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Authors: Alberta Amissah Nyarko, Natalie Benjamin-Damons and Sonti Pilusa

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Holistic Paediatric Burns Management Protocol For Low-Resource Settings: A Modified Delphi Study

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Abstract

Background: Paediatric burn injuries are a significant public health concern in Low- and Middle-Income Countries (LMIC), where limited healthcare resources and the absence of standardized protocols often lead to suboptimal patient outcomes. Although evidence-based paediatric burn management guidelines exist, they are primarily developed in High-Income Countries (HICs) and may not be suitable for low-resource settings due to differences in healthcare infrastructure, cultural practices, and resource availability. Developing a holistic and resource-adaptable paediatric burns management protocol is therefore essential to improving burn care in low-resource settings.

Aim: This study aimed to develop a protocol for holistic paediatric burns management in Korle Bu Teaching Hospital, Ghana

Methods: A modified Delphi study was conducted in three iterative rounds to refine and validate a 70-item paediatric burns management protocol questionnaire. Seven rehabilitation specialists with experience in Low- and Middle-Income Countries were purposively selected for the study. In the first and second round, the Delphi questionnaire covering eight key domains of burns management was administered, with experts rating each item on a five-point Likert scale. In Round 3, a focus group discussion was held to finalize the protocol based on expert consensus. Data were analysed with descriptive statistics to assess consensus and thematic analysis.

Results: The first round of the Delphi study achieved consensus (80% agreement) on 53 out of 70 items. Round 2 refined the protocol, emphasizing individualized, stage-specific multidisciplinary team (MDT) involvement, structured caregiver training, and enhanced scar management strategies where 43 items were retained. Experts also highlighted the need for technology-assisted education, clearer guidelines for school reintegration, and prioritization of feasible interventions in low-resource settings. The final round further streamlined the protocol to 40 items, integrating improved pain management, wound depth assessment, scar monitoring, and follow-up care strategies.

Conclusion: The study successfully developed a holistic, and resource-adaptable paediatric burns management protocol specifically developed for the Ghana but could be applicable to other LMIC settings. By incorporating expert consensus and context-specific considerations, this protocol has the potential to standardize paediatric burn care across Ghana and other LMIC, ultimately improving patient outcomes.

Keywords: Paediatric burns, low-resource settings, burn management protocol, modified Delphi, rehabilitation, LMIC.

Introduction

Burn injuries among children continue to be a major source of morbidity and mortality, especially in Low- and Middle-Income Countries (LMIC) like Ghana [1]. According to Albertyn et al. [2] paediatric burn injuries are the second most common cause of accidental death among children below the age of five in Africa. Alemayehu et al. [3] reveals that the rate of mortality from child burns is over seven times higher in LMIC than in High-Income Countries. Children in LMIC are particularly vulnerable because of unsafe home conditions and a lack of access to high-quality medical care [4]. This trend emphasises how urgent it is to develop a protocol for holistic paediatric burns management, especially in low-resource settings like Ghana.

Burn care delivery in sub-Saharan Africa is severely constrained by financial limitations, inadequate infrastructure, and a shortage of trained healthcare professionals [2, 5]. Burn treatment facilities in Africa are scarce, with specialised care limited to only few countries such as South Africa, Nigeria, Zimbabwe, Ghana, and Malawi [6]. According to Doku et al. [7] even if paediatric hospitals have resources to care for severely burned patients, they still lack standardized care guidelines for excellent outcomes. Tremblay et al. [8] emphasized that a systematic approach may help improve burn injury outcomes and provide practitioners with a step-by-step framework for managing patients with burns in resourced-limited settings.

Even though there are evidence-based paediatric burn management guidelines, they are frequently unsuitable for low-resource environments where there may not be enough medical equipment, trained personnel, or culturally relevant interventions available [2]. The majority of guidelines are not immediately applicable to areas with inadequate medical resources because they were created in high-income nations. For instance, Wall et al. [9] in their study investigating analgesia protocols of paediatric burn patients, reported that most published analgesia protocols are developed in High-Income Countries (HICs), making them less applicable in LMIC due to the limited availability of medications and monitoring equipment. Similarly, a study conducted by Doku et al. [7] revealed that implementing robust paediatric burn guidelines improves fluid resuscitation accuracy and timely nutritional support, leading to improved patient outcomes. Nonetheless, research on protocol development in managing paediatric burns in LMIC is scarce.

Research by Doku et al. [7] emphasizes the necessity of culturally sensitive care approaches, especially in areas with inadequate healthcare infrastructure and where caregivers frequently contribute significantly to the healing process. While some countries like Malawi and Zimbabwe have implemented standard protocols, others rely solely on the expertise of individual healthcare providers [10]. In the sub-Saharan Africa, where there is a high burden of paediatric burn injuries, there is no established protocol for burn care, highlighting a gap in healthcare provision [10]. Standardized protocols that address the unique challenges of low-resource settings, such as the use of the open method for wound treatment and enteral resuscitation practices, are necessary for improving outcomes [8].

The lack of standardized burn care protocols across sub-Saharan Africa poses a significant challenge. The absence of standardized context-specific guidelines results in inconsistencies in treatment approaches, further exacerbating health outcomes for affected children [9, 11]. Thus, the development of a holistic and resource-adaptable protocol for paediatric burns management in low-resource settings is crucial. This study therefore aimed to develop a protocol for holistic paediatric burns management in Korle Bu Teaching Hospital, Ghana.

Materials and Methods

Study Design

A modified Delphi study design was employed to develop a context-specific and resource-adaptable paediatric burns management protocol for the Ghanaian context. This modified approach incorporated focus group discussions to enhance the pragmatic development of the protocol. The Delphi method is a structured process for collecting and refining expert opinions through multiple rounds of questionnaires. It is particularly valuable for building consensus in areas with limited evidence [12] such as paediatric burns management in low-resource settings.

Study setting

This study was conducted among rehabilitation experts from different parts of Africa. Since the study used a modified Delphi technique, data collection was done remotely through online

questionnaires. Experts participated from various healthcare institutions, burn treatment centers, and rehabilitation facilities across Africa

Experts Recruitment

Seven rehabilitation experts with at least eight years of experience in burns management in LMICs were selected to participate in the process. Purposive sampling was used to select experts from the Interburns Organization who have substantial experience in paediatric burns management, particularly in resource-limited settings. The selected experts demonstrated expertise through years of practice or research and possess an understanding of the challenges faced in LMICs. Participants had experience from countries such as Ghana, Bangladesh, Malawi, Lebanon, Gaza and West Bank, Ukraine, India, Sierra Leone, Zimbabwe, South Africa, and Fiji. The selection of a relatively small number of experts is consistent with the significant shortage of specialists in burns management across Africa as highlighted by Wall et al. [9]. In Ghana, for instance, there are only two burn care specialists trained by Interburns, both of whom have experience working across multiple LMICs. One of these experts participated in this study. These challenges limited the pool of qualified experts available for this study. Table 1 below shows the experts' areas of experience in LMICs.

Table 1: Summary of experts' areas of experience in LMICs.

Expert Code	Area of Experience in LMICs
Expert 1	Ghana, Bangladesh
Expert 2	Ghana, Malawi, Lebanon, Gaza and West Bank, Ukraine
Expert 3	Bangladesh, Ghana, India
Expert 4	Ghana, Sierra Leone
Expert 5	Zimbabwe
Expert 6	Ghana, Sierra Leone
Expert 7	South Africa, Fiji

Data collection tool

A comprehensive 70-item questionnaire was used to collect data as shown in Table 2. This questionnaire was meticulously designed based on a thorough review of existing literature [13,14, 15] and qualitative data gathered from Ghanaian patients, caregivers, and healthcare professionals. It addressed eight critical areas of paediatric burns management, including infection control and wound care, pain management, physical and occupational therapy, scar management, psychological or psychosocial support, education, discharge planning, and follow-up.

Table 2: Modified Delphi 70-Item Questionnaire Sections

Category	Number of Items
Infection Control and Wound Care	10
Pain Management	9
Physical and Occupational Therapy	11
Scar Management	9
Psychological or Psychosocial Support	9
Education	7
Discharge Planning	9
Follow-up Care	6
Total	70

Modified Delphi Rounds and Data Collection

The Modified Delphi process employed in this study consisted of three rounds [16], designed to progressively refine and achieve consensus on the development of a resource-adaptable paediatric burns management protocol for the Ghanaian context. The modified Delphi was conducted between September 2024 and December 2024 (Figure 1). This structured and iterative approach allowed experts to evaluate, refine, and validate the protocol components while integrating their expertise and contextual insights in LMIC.

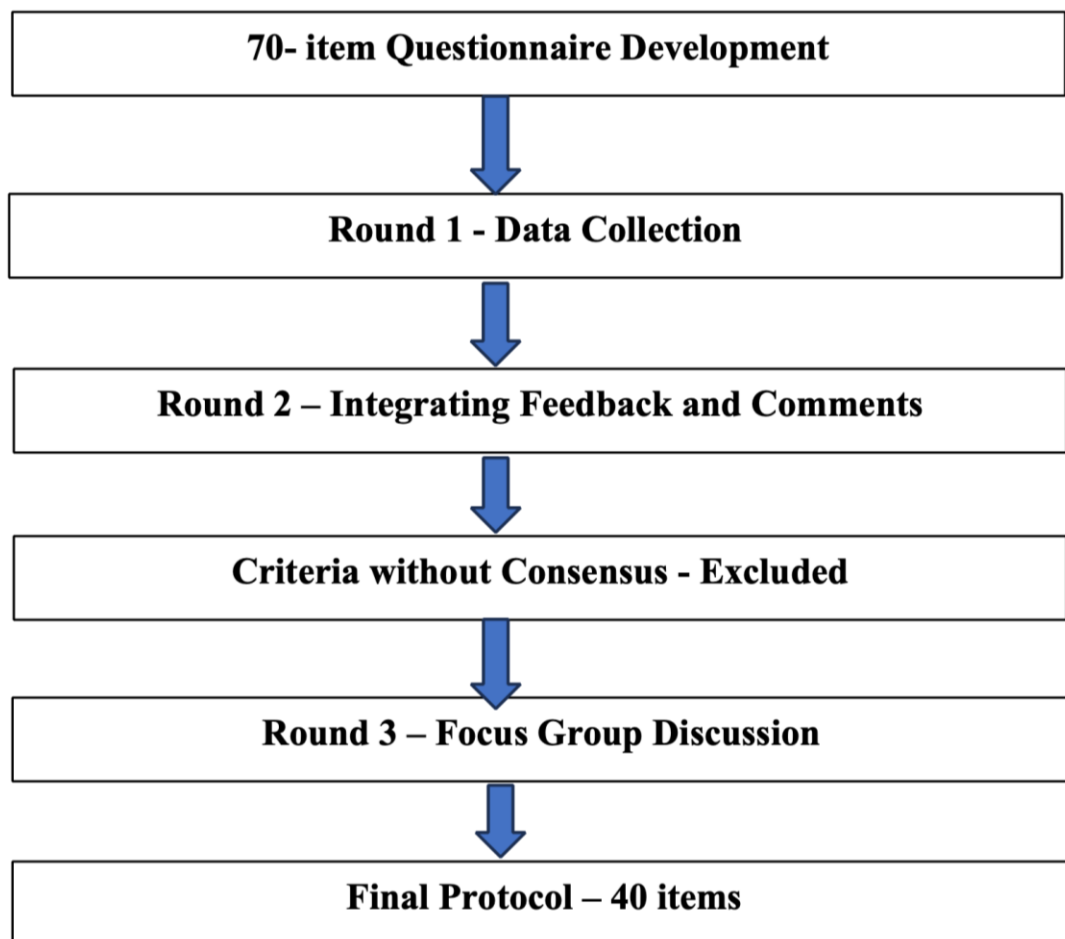


Figure 1: Overview of the three round Delphi process (September - December 2024)

Round one involved the administration of a comprehensive 70-item questionnaire to the selected panel of experts. The experts were tasked with rating each item on a five-point Likert scale to

determine its importance, with 1 being least important and 5 being most important. In the first round, all seven invited experts participated, yielding a 100% response rate. The responses were analysed using descriptive statistics to identify areas of agreement and divergence among the experts. This analysis provided clear indication of the items requiring further refinement or clarification in subsequent rounds.

Round two focused on integrating feedback and comments from Round one to streamline the questionnaire. By the second round, one expert dropped out due to related organizational responsibilities, resulting in six participants and an 85% response rate. Based on the responses, the questionnaire was refined, reducing the number of items from 70 to 43 by 80% consensus as well as written comments. This reduction was achieved by merging similar items, removing redundancies, and refining ambiguities as proposed by the experts.

Round three marked the final phase of the Delphi process and involved a focus group discussion among the experts. The discussion was conducted via a secure online video-conferencing platform (Zoom) and lasted approximately 90 minutes. The session was audio-recorded with consent and transcribed verbatim for analysis. This interactive session provided an opportunity for the panel to collectively review areas where consensus had been achieved and address the remaining unresolved sections of the protocol. The focus group discussion was instrumental in incorporating diverse perspectives, fostering collaboration, and ensuring that the final protocol was both practical and comprehensive. Participants confirmed final items and any outstanding disagreements were resolved through majority voting. Table 3 summarizes the extent of participation and response rate of participants per each round of the study.

Table 3: Delphi Study Rounds, Expert Participation, and Response Rates

Round	Number of Experts	Response Rate	Date of Delphi Round
Round 1	7	100%	25th Sept 2023
Round 2	6	85%	22nd July 2024

Data Analysis

Data were analysed combining quantitative and qualitative methods by the principal researcher. In Rounds one and two, descriptive statistics were used to calculate percentage consensus, with items reaching 80% agreement retained, while those with lower agreements were revised or removed based on expert feedback. In Round three, thematic analysis was applied to the focus group discussion (FGD) to identify key themes. Quality assurance procedures were applied throughout data collection, transcription, and analysis to ensure credibility and accuracy of the results. All questionnaire responses were reviewed for completeness and consistency. Transcription of focus group discussions was conducted verbatim and cross-checked by all authors to verify accuracy. Descriptive statistics and thematic analyses were independently reviewed by all authors to confirm reliability and reduce potential bias in data interpretation.

Ethical Considerations

Ethical considerations were rigorously addressed throughout the study to uphold the principles of respect, integrity, and accountability. The research received ethical approval from the Institutional Review Board of University of Witwatersrand (26/05/23, M230512 MED23-05-033) and Institutional Review Board of KBTH (7/09/23, KBTH-IRB 000166/2023) and an extended ethical clearance from KBTH (18/06/24, KBTH-IRB/ 000166/2023). Participation in the study was entirely voluntary, and written informed consent was obtained from all experts prior to their involvement. Experts were provided with detailed information about the study objectives, methodology, and their role in the process, ensuring informed decision-making. To protect the anonymity of participants and maintain objectivity, all responses and reporting were anonymized during the study. However, confidentiality was not fully upheld during the focus group discussion process, as the identities of participants were known to the researcher and other participants. Despite this limitation, participants responses were anonymized using coded identifiers to ensure

that the analysis and reporting of findings were conducted in a manner that safeguarded the privacy of participants and minimized any potential biases.

Results

Overview of Round 1

The first round of the modified Delphi study aimed to develop a holistic paediatric burn management protocol in Ghana and included 70 items across various domains: infection control and wound care, pain management, physical and occupational therapy, scar management, psychological support, education, discharge planning, and follow-up care. Out of these, 53 items met the 80% consensus threshold, indicating strong agreement among the expert panel. However, 17 items did not reach a consensus. Notably, key areas requiring further deliberation include aspects of infection control (e.g., the multidisciplinary team approach, antimicrobial use, and caregiver education on signs of infection), the role of distraction and non-pharmacological techniques in pain management, and the use of specialised paediatric splints and aquatic therapy in rehabilitation. Other unresolved items include the involvement of psychologists in scar management, nutritional support for tissue regeneration, education techniques (e.g., visual aids), and early discharge planning considerations like home modifications. These findings highlight areas needing refinement and additional expert input in subsequent Delphi rounds. Details of experts' responses from Round 1 are summarized in Table 4 below.

Table 4: Results from Round 1 (n=7)

Protocol variable	Delphi statements	% of Experts Rating 4 or 5	Consensus Reached (Y/N)
	1. Wound assessment and documentation to prevent wound infection.	85%	Y
	2. Involving caregivers in the education and training of wound care practices.	85%	Y
	3. Multidisciplinary team approach in paediatric burn wound management.	71%	N
	4. Antimicrobial agents (topical or systemic) in reducing infection rates in paediatric burn wounds.	71%	N
	5. Maintaining optimal nutrition on wound healing and infection prevention in paediatric burn rehabilitation.	71%	N

Infection control and wound care	6. Proper hand hygiene and personal protective equipment (PPE) use among healthcare providers in preventing infections during wound care.	71%	N
	7. Caregiver education on signs of infection and when to seek medical attention for paediatric burn wounds.	71%	N
	8. Continuous monitoring and surveillance of wound healing progress as a preventive measure against infections.	71%	N
	9. Easy access and availability of wound care products.	57%	N
Pain management	10. Using age-appropriate (paediatric) pain assessment tools for accurately evaluating procedural pain.	100%	Y
	11. Pharmacological interventions (e.g., analgesics, anesthetics) in managing procedural pain during wound care.	85%	Y
	12. Significance of distraction techniques (e.g., virtual reality, music therapy) in reducing procedural pain experienced by paediatric burn patients.	71%	N
	13. Involving caregivers in the pain management plan for paediatric burn patients.	71%	N
	14. Non-pharmacological interventions (e.g., breathing exercises, guided imagery) in managing background pain in paediatric.	85%	Y
	15. The role of play therapy in alleviating background pain and improving overall comfort in paediatric burns rehabilitation.	85%	Y
	16. Individualized pain management plans based on the patient's developmental stage and coping abilities in paediatric burn rehabilitation.	85%	Y
	17. Optimizing the physical environment (e.g., comfortable bedding, colourful rooms, temperature control) in reducing background pain for paediatric burn patients.	71%	N
Physical and Occupational Therapy	18. Minimizing pain-related barriers to physical therapy and rehabilitation progress in paediatric burns cases.	85%	Y
	19. Early and consistent range of motion exercises in preventing contractures in paediatric burn patients.	85%	Y
	20. Active exercises in promoting functional recovery in paediatric burns rehabilitation.	85%	Y
	21. Passive exercises in promoting functional recovery in paediatric burns rehabilitation.	85%	Y
	22. Effectiveness resistive exercises in promoting functional recovery in paediatric burns rehabilitation.	100%	y
	23. Using specialised paediatric splints in preventing contractures.	71%	N
	24. Role of play-based therapies (e.g., games, activities) in engaging paediatric burn patients during exercise therapy sessions.	85%	Y

	25. Incorporating activities of daily living (ADL) training into paediatric burns rehabilitation to enhance functional independence.	85%	Y
	26. Early mobilization and weight-bearing activities in preventing muscle atrophy and joint stiffness in paediatric burn rehabilitation.	100%	Y
	27. Dynamic splinting (serial casting, orthotic devices) in preventing and correcting contractures in paediatric burn patients.	100%	Y
	28. Role of caregiver education and training in carrying out home-based exercise therapy and proper positioning for paediatric burn patients.	85%	Y
	29. Aquatic therapy as a modality for promoting mobility, reducing pain, and preventing contractures in paediatric burns rehabilitation.	71%	N
Scar management	30. Early intervention and active scar management techniques in minimizing the long-term impact of scars on paediatric burn patients.	85%	Y
	31. Silicone-based products (sheets, gels) in reducing scar thickness, color, and overall appearance in paediatric burns.	85%	Y
	32. Massage therapy as a scar management approach in improving tissue flexibility and texture for paediatric burn patients.	85%	Y
	33. Patient and caregiver education on proper scar care techniques to promote scar healing and mitigate complications.	85%	Y
	34. Incorporating sunscreen use into scar management protocols to protect healing skin from hyperpigmentation.	85%	Y
	35. Pressure garments in preventing hypertrophic scarring and improving scar outcomes in paediatric burns rehabilitation.	85%	Y
	36. Involving psychologists or mental health professionals in scar management.	85%	Y
	37. Nutritional support (e.g., vitamins, minerals) on scar healing and overall tissue regeneration in paediatric burn patients.	71%	N
Psychological or Psychosocial support	38. Interdisciplinary collaboration (e.g., involving dermatologists, plastic surgeons, occupational therapists) in developing comprehensive scar management plans for paediatric burns.	85%	Y
	39. Individual counseling or therapy sessions in helping paediatric burn patients cope with emotional and psychological challenges.	85%	Y
	40. Involving caregivers in psychosocial support programs to enhance the overall well-being of paediatric burn patients.	85%	Y
	41. Play therapy and creative arts interventions in promoting emotional expression and psychological healing for paediatric burn patients.	85%	Y
	42. Impact of peer support groups or interactions with other paediatric burn survivors in facilitating social and emotional recovery.	85%	Y
	43. Cognitive-behavioral therapy (CBT) or similar approaches in managing anxiety, depression, and trauma-related symptoms in paediatric burn patients.	71%	N

	44. Involving school and teachers in supporting the reintegration of paediatric burn patients into their academic environment.	100%	Y
	45. Assessing and addressing body image concerns as part of the psychosocial support for paediatric burn patients.	85%	Y
	46. Mindfulness and relaxation techniques in helping paediatric burn patients manage pain and anxiety.	85%	Y
	47. The role of psychological support and play therapy in reducing stress and anxiety.	85%	Y
Education	48. Providing comprehensive education to paediatric burn patients and their caregivers about the nature and implications of paediatric burn injuries.	57%	N
	49. Using age-appropriate materials and visual aids in conveying essential information to paediatric burn patients and their families.	71%	N
	50. Educating caregivers about proper wound care and infection control practices to ensure optimal healing in paediatric burn patients.	85%	Y
	51. Practical skills training (e.g., mobilization, scar management) as part of patient and caregiver education.	85%	Y
	52. Facilitating peer support and knowledge sharing among paediatric burn patients and their families.	85%	Y
	53. Technology-based resources (mobile phones and tablets) in enhancing patient and caregiver education in paediatric burns rehabilitation.	85%	Y
	54. Role of school reintegration education in preparing paediatric burn patients for a successful return to their academic environments.	85%	Y
Discharge planning	55. Initiating discharge planning early in the paediatric burns rehabilitation process to ensure a smooth transition from hospital to home.	100%	Y
	56. Involving a multidisciplinary team in the development of individualized discharge plans for paediatric burn patient	85%	Y
	57. Assessing the home environment and making necessary modifications to ensure safety and accessibility for paediatric burn patients.	71%	N
	58. Involving paediatric burn patients and their caregivers in the decision-making process for discharge plans and goal	85%	Y
	59. Coordinating with schools and educational institutions to facilitate a seamless reintegration for paediatric burn patients post-discharge.	85%	Y
	60. Including long-term rehabilitation goals and recommendations in the discharge plan for paediatric burn patients.	85%	Y
	61. Utilizing technology (e.g., telehealth, remote monitoring) in post-discharge follow-up and support for paediatric burn patients.	100%	Y
	62. Regular communication and check-ins with paediatric burn patients and their families in the immediate weeks following discharge.	85%	Y

	63. Utilizing standardized tools or checklists to guide the development and implementation of paediatric burn discharge plans.	85%	Y
	64. Establishing a structured and individualized follow-up care plan for paediatric burn patients after their initial rehabilitation.	85%	Y
	65. Regular and scheduled follow-up appointments with a multidisciplinary team to monitor progress and address evolving needs.	85%	Y
	66. Providing ongoing scar management and wound assessment during the follow-up period for paediatric burn patients.	85%	Y
Follow up care	67. Incorporating psychosocial support and counseling as part of the follow-up care for paediatric burn patients and their families.	85%	Y
	68. Tracking functional outcomes and rehabilitation progress during the follow-up period for paediatric burn patients.	85%	Y
	69. Providing clear instructions and guidance for ongoing exercise therapy and home-based interventions during the follow-up period.	85%	Y
	70. Continuity of care between different healthcare providers and specialists involved in the follow-up care for paediatric burn patients.	85%	Y

Overview of Round 2

The second round of the Delphi study aimed to refine and further develop the proposed paediatric burn rehabilitation protocol based on expert feedback. A total of 43 items were retained on the protocol following careful consideration of comments and suggestions. Key insights emphasized the need for individualized treatment plans with clearer guidelines and stage-specific involvement of multidisciplinary teams. Experts underscored the necessity of involving team members flexibly based on the child's evolving needs rather than mandating the inclusion of every member for each case. However, the feedback pointed out that the protocol lacked clear directives on identifying which team members should be involved at different stages of the rehabilitation process. This observation prompted the refinement of MDT-related items to emphasize patient-centered and stage-specific team involvement.

Age-specific interventions required more explicit strategies for addressing physical, emotional, and psychological needs. Experts appreciated the recognition of varying needs across paediatric

age groups but noted that the protocol lacked clarity on how these needs should inform different interventions. The feedback called for more explicit age-specific strategies to ensure that care remains relevant and effective across developmental stages, especially in addressing the physical, emotional, and psychological aspects of rehabilitation.

Caregiver training and empowerment were highlighted as essential but underdeveloped components of the protocol. Feedback suggested the inclusion of structured caregiver training programs to prepare them for their roles in long-term care and rehabilitation. Experts recommended detailed guidance on scar management, including incorporating detailed strategies for scar massage, the use of pressure garments, and follow-up care to optimize outcomes over time. The feedback also emphasized the need for clearer guidelines on implementing age-appropriate psychosocial support and therapies.

Technology-based interventions, such as the use of mobile phones for education and tracking progress, were acknowledged as promising but underutilised components. Experts called for more practical suggestions on integrating technology into treatment while emphasizing that it should supplement, not replace, direct communication and education efforts. School and social reintegration needed more focus. Experts noted the absence of clear guidelines on engaging educators and preparing social environments. Feedback suggested incorporating activities that are both age-appropriate and meaningful, enabling children to resume social roles and interact with peers effectively.

Additional suggestions from experts also included merging overlapping items, clarifying ambiguous terms, and prioritizing feasible interventions suited to low-resource settings. These refinements aimed to make the protocol clearer, more adaptable, and practical across diverse contexts.

Round 2 of the Delphi study thus resulted in significant refinements to the protocol, addressing key areas such as individualized care, MDT coordination, age-specific interventions, caregiver empowerment, and school reintegration. The process also emphasized the importance of clarity, feasibility, and alignment with resource constraints. With these adjustments, 43 items were retained on the protocol as illustrated in Table 5.

Table 5: Refined protocol items retained after Round Two (43 items)

Protocol variable	Delphi statements
Infection control and wound care	1. Wound assessment, documentation and treatment plan to prevent wound infection.
	2. Education and training on early signs of infection and when to seek medical attention.
	3. A cohesive multidisciplinary approach to be incorporated in paediatric burn wound management.
	4. Monitoring wound healing process as a preventive measure against infections.
	5. Maintaining optimal nutrition on wound healing during rehab intervention.
	6. Proper hand hygiene and personal protective equipment (PPE) use among healthcare providers in preventing infections during wound care.
	7. Easy access and availability of wound care products.
Pain management	8. Age-appropriate (paediatric) pain assessment tools and pain management plans based on the patient's developmental stage and coping abilities in paediatric burn rehabilitation.
	9. Pharmacological interventions (e.g., analgesics, anesthetics) in managing procedural pain during wound care.
	10. Non-pharmacological, distraction techniques (e.g., virtual reality, music therapy) and play therapy in managing procedural pain experienced by paediatric burn patients.
	11. Involving caregivers in the pain management plan for paediatric burn patients.
	12. Optimizing the physical environment (e.g., comfortable bedding, colourful rooms, temperature control) in reducing background pain for paediatric burn patients.
	13. Minimizing pain-related barriers and optimizing the physical environment (e.g., comfortable bedding, colourful rooms, temperature control) in reducing pain.
Physical and Occupational Therapy	14. Early mobilization with consistent range of motion exercises in preventing contractures and weight bearing activities in preventing muscle atrophy.
	15. Individualized age-appropriate exercises, incorporating ADL training towards functional recovery using play therapy.
	16. Splints should be individualized requiring assessment and clinical reasoning in preventing contractures.

	17. Role of caregiver education and training in carrying out home-based exercise therapy and proper positioning for paediatric burn patients.
Scar management	18. Early intervention and active scar management techniques in minimizing the long-term impact of scars on paediatric burn patients. 19. Incorporating age-appropriate tools (Silicone-based products, Scar tissue massage, pressure garments, sunscreens) in promoting scar healing and management. 20. Patient and caregiver education on proper scar care techniques to promote scar healing and mitigate complications. 21. Interdisciplinary collaboration (e.g., involving dermatologists, occupational therapists, nutrition, psychologist) in developing comprehensive scar management plans for paediatric burns.
Psychological or Psychosocial support	22. Individual counseling or therapy sessions in helping paediatric burn patients cope with emotional and psychological challenges. 23. Counselling caregivers and school teachers on psychosocial support and reintegration programmes to enhance the overall well-being of paediatric burn patients. 24. Impact of peer support groups or interactions with other paediatric burn survivors in facilitating social and emotional recovery. 25. Cognitive-behavioral therapy (CBT) techniques such as age-appropriate play therapy, mindfulness and relaxation techniques in managing anxiety, depression, and trauma-related symptoms in paediatric burn patients. 26. Assessing and addressing body image concerns as part of the psychosocial support for paediatric burn patients.
Education	27. Providing comprehensive education to patients and their caregivers using, child friendly language, interpreters and illustrated information. 28. Technology-based resources (mobile phones and tablets) in enhancing patient and caregiver education in paediatric burns rehabilitation.
	29. Initiating discharge planning early in the paediatric burns rehabilitation process to ensure a smooth transition from hospital to home. 30. Involving a multidisciplinary team in the development of individualized discharge plans for paediatric burn patient 31. Assessing the home environment and making necessary modifications to ensure safety and accessibility for paediatric burn patients.

Discharge planning	32. Involving paediatric burn patients and their caregivers in the decision-making process for discharge plans and goals 33. Coordinating with schools and educational institutions to facilitate a seamless reintegration for paediatric burn patients post-discharge. 34. Including long-term rehabilitation goals and recommendations in the discharge plan for paediatric burn patients. 35. Utilizing standardized tools or checklists to guide the development and implementation of paediatric burn discharge plans.
Follow up care	36. Establishing a structured and individualized follow-up care plan for paediatric burn patients after their initial rehabilitation. 37. Regular and scheduled follow-up appointments with a multidisciplinary team to monitor progress and address evolving needs. 38. Providing ongoing scar management and wound assessment during the follow-up period for paediatric burn patients. 39. Incorporating psychosocial support and counseling as part of the follow-up care for paediatric burn patients and their families. 40. Tracking functional outcomes and rehabilitation progress during the follow-up period for paediatric burn patients. 41. Providing clear instructions and guidance for ongoing exercise therapy and home-based interventions during the follow-up period. 42. Continuity of care between different healthcare providers and specialists involved in the follow-up care for paediatric burn patients 43. Utilizing technology (e.g., telehealth, remote monitoring) in post-discharge follow-up and support for paediatric burn patients.

Overview of Round 3

The third and final round of the Delphi study aimed to refine and consolidate expert consensus on a Holistic Paediatric Burns Management Protocol for low-resource settings. Following previous rounds, this session focused on resolving ambiguities, ensuring clarity, and addressing gaps in treatment coordination, pain management, scar prevention, and follow-up care. The discussion was structured to incorporate feedback from previous iterations, ensuring that the protocol remains practical, patient-centered, and adaptable to varying levels of resource availability. Experts critically evaluated the wording of key recommendations, emphasized the need for individualized

care plans and multidisciplinary coordination, and worked towards eliminating redundancy while maintaining comprehensiveness and clarity. Notable themes that emerged from the FGD include:

Theme 1: Emphasis on Patient-Centered Care

A strong theme throughout the final Delphi round was the need for patient-centered care, ensuring that paediatric burn patients receive individualized treatment tailored to their specific needs. Experts emphasized the importance of holistic, patient-focused interventions that consider not just the medical aspects but also psychological and rehabilitative support. Two participants revealed as follows:

"Each child presents differently, and their care must be tailored to their specific needs, including their age, pain threshold, and psychosocial situation." (Participant 1)

"We cannot have a one-size-fits-all model; the protocol should allow flexibility in assessment and care planning." (Participant 2)

Participants thus reinforced the need for a structured, patient-driven approach in the management of paediatric burn injuries.

Theme 2: Proper Coordination among Multidisciplinary Team (MDT)

Experts agreed that burn care should involve a multidisciplinary team (MDT) but noted that the roles and coordination among team members needed clarification. There was a consensus on the necessity of individualized assessment and rehabilitation plans as revealed in the following quotes from participants.

"We need to clearly define the roles within the MDT so that there is no overlap or miscommunication in treatment delivery." (Participant 3)

"Timing and coordination between rehabilitation, wound care, and analgesia are critical—one should not compromise the other." (Participant 5)

Theme 3: Refinement of Pain Management Approaches

The panelists stressed the importance of age-appropriate pain management, incorporating both pharmacological and non-pharmacological strategies. There was also a consensus on merging similar statements regarding environmental optimization and pain minimization. Some panelists suggested as follows:

"We need to ensure that pharmacological interventions are explicitly labeled as 'age-appropriate' so that they are aligned with developmental needs." (Participant 4)

"Optimizing the physical environment and minimizing pain-related barriers should not be separate points; they go hand in hand and should be consolidated." (Participant 5)

Theme 4: Refinement of Scar Management Guidelines

Experts debated the clarity of the scar management guidelines, with some expressing concerns about listing specific techniques without clinical reasoning. The final consensus was to maintain basic scar management principles but ensure that recommendations were adaptable to low- and middle-income country settings.

"We should not just list tools like silicone-based products and pressure garments without explaining when and how they should be used." (Participant 3)

"The guidelines should not be overly technical; they must be simple yet effective for resource-limited settings." (Participant 2)

Theme 5. Strengthening Follow-up Care for Long-Term Recovery

Participants emphasized the need for structured follow-up care beyond the acute treatment phase, particularly in monitoring scar maturation and psychosocial support.

"The follow-up period must include ongoing scar assessment, as scars change over time, especially in growing children." (Participant 1)

There was also discussion on integrating telehealth and remote monitoring to improve follow-up care accessibility.

"Technology can bridge gaps in care, allowing families to receive guidance without needing frequent hospital visits." (Participant 5)

The feedback from the FGD resulted in a final protocol that is clearer, more concise, and tailored to the realities of low- and middle-income countries. The results of the focus group discussions and subsequent modifications are summarized in Table 6.

Table 6: Results Round 3 of Modified Delphi Technique

Theme	Experts' Comments	Changes Made
Physical and Occupational Therapy	- Suggested adding full range of motion and weight-bearing and strengthening activities.	- item 14 modified to include full range of motion exercises.
Nutrition and Wound Healing	- Emphasized that nutrition's role in wound healing should not be limited to rehabilitation.	- Revised item 5 to highlight nutrition's broader role in preventing complications and improving scar outcomes.
Pain Management	- Recommended including "age-appropriate" before pharmacological interventions. - Suggested merging "optimizing the physical environment" and "minimizing pain-related barriers" for clarity.	- Included "age-appropriate" pharmacological interventions for item 9. - Merged items 12 and 13 into one point to improve clarity.
Infection Control and Wound Care	- Highlighted the need for wound depth assessment and its impact on final scarring outcomes. - Recommended monitoring wound healing progress for scar formation tracking.	- A new item on wound depth assessment has been added to the infection control and wound care section as item 8. - Monitoring for scar formation has been included in item 4.

Scar Management and Psychosocial Support	- Stressed the importance of ongoing scar management during growth and recovery. - Cautioned against listing techniques without clinical reasoning. - Recommended highlighting low-resource practical techniques like cohesive bandages and massage therapy.	- Refined item 18 to include ongoing scar management techniques. - Added cohesive bandaging as a technique for scar management to item 19.
Follow-Up Care	- Recommended specifying follow-up periods to ensure proper monitoring. - Highlighted the importance of scar maturation and its effect on mobility and functionality.	- Items 37 has been modified to include specified intervals follow-ups. - Item 38 has been refined to include monitoring for scar maturation.
Other Comments	- Highlighted the need for caregiver preparedness for long-term rehabilitation. - Noted that roles and collaboration among MDT members were unclear. - Identified gaps in timing and coordination between rehabilitation, wound care, and analgesia. - Suggested removing redundant phrases and improving clarity.	- Merged Items 20 and 21 on scar management as both discuss interdisciplinary collaboration in scar care and patient education. - Merged Items 31 and 33 on discharge planning as both highlight multidisciplinary involvement in discharge planning and patient participation. - Merged Items 38 and 41 on follow-up care as both cover ongoing wound, scar, and rehabilitation progress assessment.

The final paediatric burns management protocol is presented in Table 7 below. It comprises eight key burn protocol variables with a total of 40 items, refined through expert consensus from the three round modified Delphi technique.

Table 7: Final Protocol by experts consensus

Protocol variable	Item	Delphi statements
Infection control and wound care	1.	Wound assessment, documentation and wound care to prevent wound infection.
	2.	Education and training on early signs of infection and when to seek medical attention.
	3.	A cohesive multidisciplinary approach to be incorporated in paediatric burn wound management.
	4.	Monitoring wound healing process as a preventive measure against infections and scar formation.
	5.	Optimizing nutrition to aid wound healing, rehabilitation and overall recovery.
	6.	Proper hand hygiene and personal protective equipment (PPE) use among healthcare providers in wound care.
	7.	Easy access and availability of wound care products.
	8.	Wound depth assessment to guide treatment decisions, monitor healing progression, and optimize scar outcomes.

Pain management	9.	Age-appropriate (paediatric) pain assessment tools and pain management plans based on the patient's developmental stage and coping abilities.
	10.	Age-appropriate pharmacological interventions (e.g., analgesics, anesthetics) in managing procedural pain during wound care.
	11.	Non-pharmacological, distraction techniques (e.g., virtual reality, music therapy) and play therapy in managing procedural pain.
	12.	Involving caregivers in the pain management plan for paediatric burn patients.
	13.	Minimizing pain-related barriers and optimizing the physical environment (e.g., comfortable bedding, colourful rooms, temperature control) in reducing pain.
Physical and Occupational Therapy	14.	Early mobilization with consistent full range of motion exercises in preventing contractures and weight bearing activities in preventing muscle atrophy.
	15.	Individualized age-appropriate exercises, incorporating ADL training towards functional recovery using play therapy.
	16.	Splints should be individualized requiring assessment and clinical reasoning in preventing contractures.
	17.	Role of caregiver education and training in carrying out home-based exercise therapy and proper positioning for paediatric burn patients.
Scar management	18.	Early intervention and active ongoing management techniques in minimizing the long-term impact of scars on paediatric burn patients.
	19.	Incorporating age-appropriate tools (Silicone-based products, Scar tissue massage, pressure garments, sunscreens, cohesive bandaging) in promoting scar healing and management.
	20.	Patient and caregiver education on proper scar care techniques with interdisciplinary collaboration (e.g., involving dermatologists, occupational therapists, nutrition, psychologist) to promote scar healing and mitigate complications.
	21.	Individual counseling or therapy sessions in helping paediatric burn patients cope with emotional and psychological challenges.

Psychological or Psychosocial support	22.	Counselling caregivers and school teachers on psychosocial support and reintegration programmes to enhance the overall well-being of paediatric burn patients.
	23.	Peer support groups or interactions with other paediatric burn survivors in facilitating social and emotional recovery.
	24.	Cognitive-behavioral therapy (CBT) techniques such as age-appropriate play therapy, mindfulness and relaxation techniques in managing anxiety, depression, and trauma-related symptoms.
	25.	Assessing and addressing body image concerns as part of the psychosocial support.
Education	26.	Providing comprehensive education to patients and their caregivers using, child friendly language, interpreters and illustrated information.
	27.	Technology-based resources (mobile phones and tablets) in enhancing patient and caregiver education in paediatric burns rehabilitation.
Discharge planning	28.	Initiating discharge planning early to ensure a smooth transition from hospital to home.
	29.	Multidisciplinary team to develop individualized discharge plans, involving patients and caregivers in decision-making.
	30.	Assessing the home environment and making necessary modifications to ensure safety and accessibility for paediatric burn patients.
	31.	Coordinating with schools to facilitate a seamless reintegration post-discharge.
	32.	Including long-term rehabilitation goals and recommendations in the discharge plan for paediatric burn patients.
	33.	Utilizing standardized tools or checklists to guide the development and implementation of paediatric burn discharge plans.
	34.	Establishing a structured and individualized follow-up care plan for paediatric burn patients after their initial rehabilitation.
	35.	Regular and scheduled follow-up appointments at specified intervals with a multidisciplinary team to monitor progress and address evolving needs.

Follow up care	36.	Providing ongoing wound assessment, scar management and monitoring for scar maturation during the follow-up period.
	37.	Incorporating psychosocial support and counseling as part of the follow-up care for paediatric burn patients and their families.
	38.	Providing clear guidance for ongoing home-based exercise therapy and interventions during the follow-up period.
	39.	Continuity of care between different healthcare providers and specialists involved in the follow-up care for patients
	40.	Utilizing technology (e.g., telehealth, remote monitoring) for post-discharge follow-up and support.

Discussion

The findings from the modified Delphi study provide a structured paediatric burn management protocol tailored to the Ghanaian healthcare context. The iterative consensus-building process ensured that key aspects of burn care, such as infection control, pain management, rehabilitation, and psychological support, were addressed comprehensively.

Infection control and wound care are fundamental components of the protocol, as preventing infections significantly reduces mortality and morbidity rates in paediatric burn patients [17]. Karaaslan et al. [18] in their study revealed the need for a multidisciplinary approach in infection control and wound care which was also emphasized in the expert consensus of this study. Infection control and wound care are important in the protocol because they help prevent serious infections that can slow healing, cause complications, and even lead to death in children with burns.

Experts in this study emphasized the importance of age-appropriate pain management interventions, as children's pain perception and coping mechanisms vary across developmental stages. Age-appropriate pain management strategies, including both pharmacological and non-pharmacological methods reflect clinical practice guidelines. In a Delphi study conducted in South Africa, experts reached a consensus on an analgesia protocol using pharmacological agents such as ketamine, midazolam, and ibuprofen for background procedural pain management [10]. On the

other hand, non-pharmacological interventions, such as distraction therapy, play therapy and relaxation have proven effective in mitigating pain perception among paediatric burn patients as demonstrated in a meta-analysis by Farzan et al. [19] involving multiple countries. This multimodal analgesia focus is supported appropriate guidelines for paediatric scald burn management for Sub-Saharan African countries reported by Broadis et al. [20] and the ABA guidelines referenced by Coppola et al. [21] which include both pharmacologic and psychosocial strategies for pain management. Therefore, non-pharmacological and pharmacological pain management interventions should be in the protocol to ensure thorough pain relief for paediatric burn patients.

The protocol's focus on individualized and age-appropriate exercise programs and the gradual reintegration of daily activities aligns with contemporary rehabilitation guidelines [22]. Atiyeh and Janom [23] emphasize that the care of paediatric burn patients should incorporate exercises and activities suited to their age, with well-defined timelines for introducing different forms of physical activity, including aerobic and resistance exercises. Physical and occupational therapy recommendations, including early mobilization, range of motion exercises, and the use of splints, are well-documented strategies in paediatric burn rehabilitation [24]. Additionally, exercise can play a crucial role in supporting the mental well-being of paediatric burn patients. Engaging in physical activities not only aids in physical recovery but also helps reduce anxiety, improve mood, and foster a sense of normalcy [24]. International clinical practice guidelines such as ABA, European Burn Association (EBA) and the International Society for Burn Injuries (ISBI) all emphasise on rehabilitation and early reintegration strategies are core components of paediatric burn care [21].

The psychological and psychosocial support aspects of the protocol, including cognitive-behavioural therapy (CBT), peer support, and caregiver education, align with existing evidence and the current American Burn Association (ABA) guidelines that highlight the importance of mental health support in paediatric burn survivors [25]. However, unlike the broad inclusion of structured psychological services as seen in high-resource settings [21], the Ghanaian context necessitates reliance on community-based support and caregiver training, given limited access to

psychologists. This divergence echoes observations by Patterson et al. [25] that even in some burn centers, structured psychological systems and professional staffing may be lacking.

Given the challenges of follow-up care in low-resource settings, the protocol's emphasis on structured home-care plans and scheduled follow-ups enhances its feasibility and sustainability. Establishing regular post-discharge check-ins helps monitor recovery progress and address emerging complications. Studies indicate that post-discharge follow-up improves health status, psychological status, and scar management in burn patients, however continued care is needed for pain, psychological health, and itching issues [26]. The protocol's incorporation of scheduled follow-up visits, telehealth options, and community-based support networks aligns with best practices for sustaining care beyond hospitalisation [26]. Nevertheless, as noted by Broadis et al. [20] and Vasileiadis et al. [27], follow-up systems must be adapted to the available resources, whether through community health workers, hybrid tele-consults, or mobile outreach, particularly in areas with poor digital infrastructure.

While many findings align with global best practices, some areas of contrast emerged due to the local context of Ghana and other LMIC. The role of technology in patient education and follow-up care was a debated topic among experts. While some studies suggest that telehealth and mobile health interventions are effective [28, 29], expert feedback in this study indicated concerns regarding accessibility and feasibility in low-resource settings. Limited internet connectivity, availability of smartphones and digital literacy may hinder widespread adoption, necessitating a more hybrid approach combining traditional and technological methods. Jordan et al. [30] similarly noted that several paediatric burn care facilities especially in low-resource settings lack readily available resources for burn care. Another area of divergence was the involvement of psychologists in scar management. While existing literature recommends psychological input for patients experiencing distress due to scarring [31], expert opinions in this study suggested that resource constraints might limit direct psychologist involvement. Moreover, unlike international guidelines that emphasize on fluid resuscitation strategies and surgical guidelines [27], the current protocol developed for the Ghanaian context places greater emphasis on rehabilitation, psychosocial support, and community reintegration, but does not provide specific guidance on acute medical interventions.

Conclusion and Recommendation

This study developed a structured paediatric burn management protocol tailored to the healthcare needs of Ghana. The findings highlight the importance of a multidisciplinary approach to infection control, emphasizing teamwork among healthcare providers to reduce complications. Age-appropriate pain management and rehabilitation interventions were a key focus. Rehabilitation services were also emphasized, with experts recommending early physiotherapy and structured exercise programs to help children regain mobility and reintegrate into daily activities. Psychological support emerged as a crucial element, with experts highlighting the need for mental health interventions for both patients and caregivers, although resource constraints may limit direct psychologist involvement. Follow-up care was another essential aspect, as structured home-care plans and scheduled visits were seen as vital for monitoring recovery and addressing complications, with telehealth and mobile health options suggested where feasible. The study found that while the protocol is well-grounded in existing literature, contextual adaptations remain necessary. This proposed paediatric burn management protocol demonstrates strong evidence base while incorporating the necessary contextual considerations for effective application in low-resource environment.

The study, however, recommends the need for a flexible approach that combines both traditional and modern healthcare strategies. While the protocol aligns with global best practices, it is opened to adaptations where necessary so that it can fit the realities of Ghana's healthcare system. Implementing these strategies can significantly improve paediatric burn care, enhance patient recovery, provide a sustainable framework for managing burn injuries in resourced-limited settings and inform future research.

Limitations

This study has some limitations that should be considered. One key limitation of this study is the limited number of experts consulted, and diversity of health professionals included, which may have influenced the breadth of professional perspectives obtained. Due to the significant shortage of burns management specialists in Africa, the pool of qualified experts available for this study was restricted. In Ghana for instance, there are only two burns specialists trained by the Interburns.

Additionally, cultural factors were not fully addressed in the protocol, even though they play an important role in healthcare decisions in an African setting like Ghana. Beliefs about traditional healing, family involvement in care, and attitudes toward scars and disability may affect how burn patients and their families follow medical advice. Future research should prioritize the integration of cultural beliefs and community values into burn care protocols. Lastly, while the protocol aligns with global best practices, its real-world effectiveness in low-resourced settings such as Ghana has not yet been tested, meaning further research and adjustments may be needed for successful implementation.

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Competing interests

None of the authors have any conflict of interest to report.

Authors' contributions

All authors contributed equally to this work. All authors read and approved the final article.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author [A.A.N]. The data are not publicly available due to restrictions, such as containing information that could compromise the privacy of research participant.

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CHAPTER EIGHT

INTEGRATIVE DISCUSSION

8.1 Introduction

The PhD work ‘Development of a holistic paediatric burns management protocol, Korle Bu Teaching Hospital, Ghana ’is integrated in this chapter . The integrative discussion was based on the findings from previous chapters and published manuscripts to provide a holistic understanding of paediatric burns management in KBTH. The discussion synthesizes the characteristics, prevalence, and causes of paediatric burns, experiences of patients and caregivers, healthcare practitioners' perceptions, and the development of a holistic burns management protocol. The results are interpreted in light of the body of research and international best practices for managing paediatric burns.

The study aimed to develop a protocol for holistic paediatric burns management at Korle Bu Teaching Hospital. The study findings were drawn from multiple perspectives: medical records, experiences of burn patients and caregivers, and healthcare practitioners' perceptions of existing management practices. These findings informed the development of a holistic protocol for paediatric burn care in Ghana. The results of the study were organized into different chapters as outlined in Figure 8.1 below.

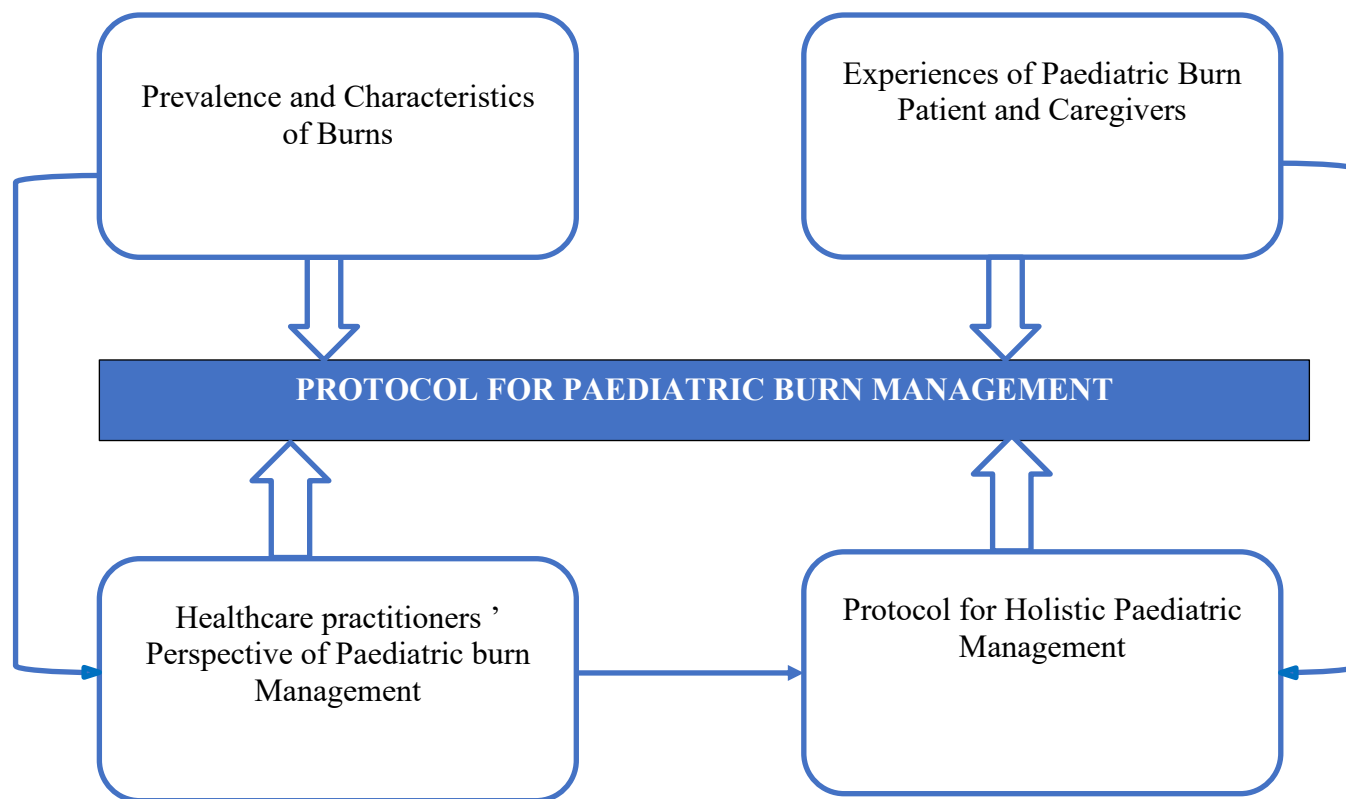


Figure 8.1: Schematic diagram of studies conducted.

8.2 Summary of Main Findings

The key findings of the study are that:

1. Paediatric burns are common, with a prevalence rate of 50.6% at the KBTH, affecting mostly children aged 1 to 5 years, with hot water burns being the most frequent cause. A higher risk of death was linked to the severity of burns, particularly those that covered a larger TBSA.

2. Paediatric burn children experienced severe pain during medical procedures and continued to suffer from persistent itching and discomfort, while some faced challenges reintegrating into school due to stigma, bullying, and self-esteem issues related to visible scars.
3. Caregivers, on the other hand, endured significant emotional distress, anxiety, and financial burdens due to the high cost of treatment, loss of income due to time off work, limited insurance coverage, and the challenges of reintegrating children into school.
4. Burn care services in Ghana have improved with a strong multidisciplinary team approach and experienced staff, but challenges remain, including the absence of clear treatment guidelines, limited medical infrastructure, financial burdens on the caregivers, and inadequate psychological support for healthcare providers, caregivers and children.
5. A structured paediatric burn rehabilitation protocol was developed through expert consensus. The protocol was refined to include 40 items and was found to be contextually relevant for low-resource settings like Ghana.

8.3 Prevalence Paediatric Burns in Ghana

Key Findings

- High prevalence of paediatric burns (50.6%) at KBTH, surpassing rates in other regions both within Africa and globally.
- Majority of cases occurred in children aged 1-5 years, emphasizing the need for early caregiver education
- Scald burns were very common, with hot water (56.3%) and hot food (22.2%) as leading causes, thus can be addressed through education and empowering communities
- High mortality rate (21.0%) was reported, with larger burns (TBSA >30%) significantly increasing the risk of death ($p < 0.001$)

The study confirms a high burden of paediatric burns at KBTH, with a period prevalence of 50.6% from 2020 to 2022. Out of a total of 335 paediatric admissions during this period, 67 deaths were recorded. The results highlight a chronic but little-studied public health issue and greatly contribute to the scant literature on paediatric burns in Ghana. Although burn units have been established and clinical management has improved over the years, the high prevalence among young children points to gaps in prevention, early intervention, and education at both community and institutional levels. This underscores the need for a paradigm shift from reactive clinical management to proactive public health approaches, including community-based health promotion, parental education, and safer home environments.

Comparing with findings from other regions, the prevalence of paediatric burns in this study (n=335, 50.6%) is significantly higher than that reported in Uganda (n=426, 32.0%) (Tusiime et al., 2022) and China (n=6741, 28.6%) (Chen et al., 2023) highlighting regional differences that necessitate targeted prevention strategies. These variations may be attributed to disparities in safety regulations, household environments, and healthcare access across different settings. The high prevalence in Ghana suggests that despite many years of burn management efforts, prevention has not been sufficiently emphasized. At Korle Bu Teaching Hospital (KBTH), current burn prevention strategies are largely limited to basic educational sessions provided to caregivers upon admission. However, these efforts are not sustained beyond the hospital setting and there is a notable absence of structured community-based education and outreach programs. This research emphasizes how urgently it is to improve public health initiatives and community education in order to lower the number of child burns.

Children under five years accounted for the majority (70.1%) of cases, a finding consistent with multiple studies across different regions (Fadeyibi et al., 2011; Nduagubam et al., 2021; Aikawa et al., 2022; Tusiime et al., 2022). The increased vulnerability of this age group can be linked to their impulsiveness, lack of awareness of environmental hazards, and dependence on caregivers for safety (Nduagubam et al., 2021). Additionally, research in Ghana found that toddlers aged one to five years had the highest burn incidence rate (Mehta et al., 2020), aligning with the current study's findings. This underscores the need to integrate comprehensive burn prevention strategies into public health interventions, including early education for parents and caregivers on child burn injuries, beginning as early as the antenatal care period and continuing through immunization visits. Given that the most burns occur in children aged 1 to 5 years, this stage presents a crucial window for targeted educational interventions. This could help caregivers adopt safer practices in their homes, reducing childhood burn incidents. Furthermore, caregiver education by public nurses, rehabilitation professionals and occupational health personnel should emphasize increased supervision at home to protect young children from burn injuries.

Scald burns were identified as the primary cause of injury, with hot water (56.3%) and hot food (22.2%) being the most common sources. In Ghana, like other LMIC, household environments often lack adequate safety measures, making children exposed to burns. Many homes rely on floor-level cooking, open fires, and boiling liquids within children's reach (Stocken et al., 2014; Rode et al., 2016; Nduagubam et al., 2021). Additionally, the frequent lack of electricity forces families to depend on alternative energy sources such as charcoal, firewood, and kerosene, further increasing the likelihood of burn injuries among young children. The problem is made worse by limited public awareness about burn risks, weak enforcement of home safety regulations, and cultural practices

that unintentionally increase children's exposure to danger. Examples of such practices include mothers carrying babies on their backs while working near fires or stoves and traditional healing methods that involves applying heated herbs or oils to children's skin. Similar findings were reported in Nigeria, where hot liquids were responsible for 56.7% of paediatric burns (Nduagubam et al., 2021), and in Ethiopia, where 71.1% of paediatric burn cases were attributed to hot water splashes (Huo et al., 2024). In South Africa, Mugwena et al. (2025) documented that 89.1% of paediatric burns resulted from scald injuries. Additionally, studies in Mozambique and Australia further reinforce this trend, reporting that hot liquids caused 66% and 44.4% of paediatric burns, respectively (Huo et al., 2024; Stocken et al., 2014). These findings highlight the heightened risk of childhood burn injuries during food preparation and cooking activities, underscoring the need for increased supervision from caregivers, social workers within the community, safer cooking practices and improved preventive measures. A multi-level response from health authorities, local government agencies, community leaders, non-governmental organizations (NGOs), and healthcare providers is required to address the problem, including community education on safe cooking practices, safer home designs and the enforcement of child safety standards. The health promotion campaigns can include radio talks and health education talks at the clinic. Beyond raising awareness, there is a need for policy makers and government to advocate for better housing. Without better housing strategies, we will continue seeing the impact of burns on children.

The study also made a valuable contribution to understanding paediatric burn patterns and outcomes in low-resource settings like Ghana. One of the most striking findings is that although the majority of paediatric burn cases involved less than 20% of the Total Body Surface Area (TBSA), the mortality rate remained high at 21.0%. This shows that even small or moderate burns

can be dangerous if not treated well or on time. This finding aligns with existing literature, which consistently identifies TBSA as a key determinant of burn-related mortality (Fadeyibi et al., 2011; Nduagubam et al., 2021). Similar correlations between higher TBSA and mortality outcomes have been found in studies conducted in Ethiopia and Nigeria (Huo et al., 2024). In Ghana, Mehta et al. (2020) documented that children with TBSA burns greater than 30% had significantly higher mortality rates which was also reported in this study. This finding emphasizes the urgent need to enhance paediatric burn care practices in Ghana and similar settings. The findings also point to possible delays in care, lack of skilled personnel, poor pain management, weak infection control, and limited monitoring. These factors can lead to complications and increase the risk of death in children, even in cases where the burn extent is not considered life-threatening by global standards. The study, therefore reinforces the importance of implementing a comprehensive, context-specific protocol that focuses not only on the severity (TBSA and depth) of the burn but also on improving the entire continuum of care, from pre-hospital response and triage to acute management, rehabilitation, and follow-up.

This study's high prevalence of paediatric burns goes beyond simple statistics. It has far-reaching consequences that extend beyond the immediate injury. Each case of burn injury affects the individual child physically, emotionally, and socially, while also placing a significant burden on caregivers who must provide long-term care and support. Therefore, caregivers' socio-economic context is important in addressing complications arising from paediatric burns effectively. These broader effects make it clear that burn injuries are not only a clinical concern but also a public health and socio-economic issue. The next section of the discussion explores in detail the multifaceted impact of paediatric burns on individuals, families, and community at large.

8.4 Impact of Paediatric Burns

Key Findings

- Children experienced persistent pain, itching, scarring, and altered body image, leading to emotional distress and low self-esteem.
- Caregivers reported emotional trauma, anxiety, and stress throughout the burn care and recovery process.
- Families faced a significant financial burden due to prolonged treatment, surgeries, and post-discharge care.
- Inadequate knowledge and reliance on harmful traditional remedies highlighted gaps in appropriate first aid and early care practices.
- School and social reintegration remains a significant challenge for paediatric burn survivors and their families.

This section discusses the multifaceted impact of paediatric burn injuries in Ghana, drawing on the findings of this study to highlight how such injuries affect children and their families across various domains of health and wellbeing including physical, psychological, and social wellbeing, as well as overall health-related quality of life (HRQoL). The results of this study provide valuable insights that help direct advancements in prevention, treatment and support networks for impacted children and their families, thereby contributing to a better understanding of the pervasive and complex impact of paediatric burn injuries in Ghana. The study adopts the International Classification of Functioning (ICF) framework (Leonardi et al., 2022) to holistically understand the broader impact of paediatric burns. The framework emphasizes the complex interplay between body impairments, activity and functional limitations and participation restrictions, environmental

and contextual factors, and personal circumstances of both the burn patient and the caregiver. Figure 8.2 below outlines the ICF framework as applied in this study, illustrating how each component namely impairments, activity limitations, environmental influences, personal factors and participation restrictions, interacts to explain the impact of paediatric burns.

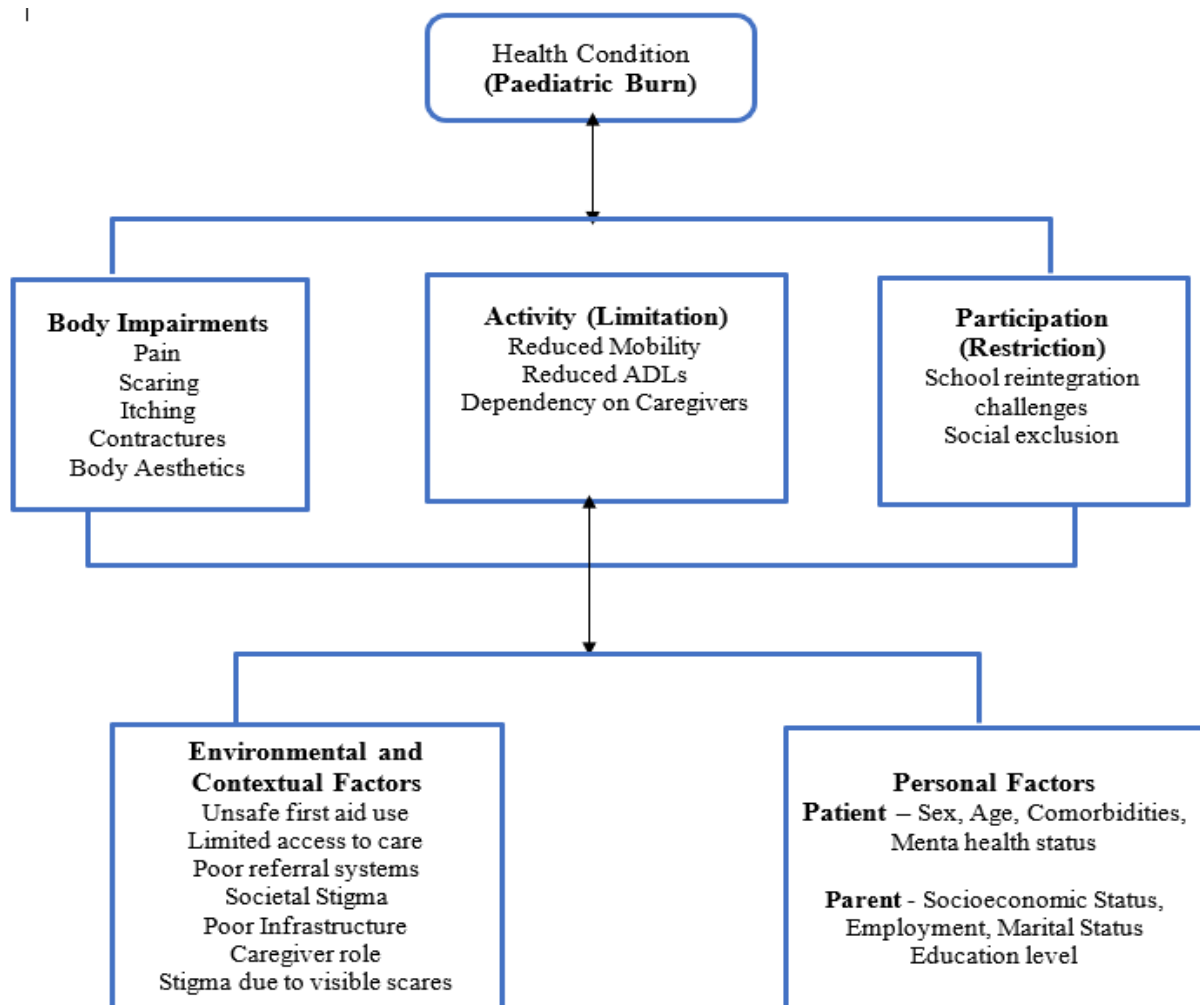


Figure 8.2: Understanding the impact of paediatric burns within the ICF framework (Leonardi et al., 2022)

At the impairment level, the findings revealed that many children sustain burns that lead to visible scarring, prolonged pain, and persistent itching. These impairments not only affect their physical health but also their psychological wellbeing and quality of life. For example, as noted by

Disseldorp (2015), post-burn itchiness and scarring can have a long-lasting impact on how children perceive themselves, often resulting in poor self-esteem and self-consciousness. In line with Wurzer et al. (2017), this study found that although some children may eventually adapt to their scars, they still struggle with body image concerns, which can limit social interactions and participation in everyday childhood activities such as play, ADLs, selfcare school activities, and social engagements. Burns injury limit functioning and participation in life events. The study identified significant limitations including difficulty returning to school, and social exclusion due to physical deformities and stigma. These findings are similar to research from high-income countries (Grice et al. 2014; Patel et al 2022). Both studies reported that burns negatively affected the child's development by restricting physical growth through scarring and contractures, hindering cognitive progress due to prolonged hospitalisation and school absence. Furthermore it impairs social interaction through stigma, reduced self-esteem, and limited participation in play and peer activities.

Social exclusion and the psychological impact of burn injuries extends beyond the acute phase. Palmu et al. (2016) and Tehranineshat et al. (2020) similarly emphasized that burn injuries result in significant psychosocial consequences for both patients and their families. Many survivors experience social stigma due to physical deformities (Hanna, 2023). The distress patients face is further exacerbated by the prolonged and intensive medical care required for burn recovery, as noted by Bakker (2013). Given these findings, it is imperative to adopt a holistic approach to paediatric burn management that not only addresses immediate physical medical needs but also provides long-term psychological and social needs. A multidisciplinary approach to care is imperative for burns management. Social workers, community workers and psychologists should

be included in burns management to address the trauma that comes with burns and burns management.

Major environmental factors that influenced burns outcomes are the caregiver's role in burns management practice and the impact of burns on the caregivers. Because burns injuries disrupt routine activities of daily living, affecting the child's independence, the caregivers provided constant support, especially in the early stages of recovery and rehabilitation. Secondly, unsafe first aid practices to manage burn injuries. Caregivers reported resorting to substances like salt water, sand mixture and others as first aid response. Similar practices have been recorded in other studies where eggs, salt, petroleum jelly, mashed cassava were used by caregivers as first aid responses to paediatric burns (Nduagubam et al. 2021; Banga et al. 2022, Rockson et al., 2024). These findings underscore a major gap in health education and the need for widespread caregiver training. Caregivers' wellbeing as a result of the burns is another important factor that needs attention. In this study, the caregivers experienced profound emotional and psychological distress. The stress could have been related to the financial burdens related to burns management, post-hospitalisation needs particularly in relation to school reintegration, body aesthetics, and managing itching scars.

Poor access to adequate burns management was another environmental factors that influenced health outcomes. Beyond first aid practices, challenges were reported by participants in accessing timely and adequate burn care in hospital facilities. Inadequate healthcare infrastructure, especially in LMIC, further complicates timely and effective treatment, especially for severe cases requiring emergency airway management, skin grafts, and long-term rehabilitation (Thomson et al. 2020).

In Ghana, these contextual factors are compounded by a lack of financial support from government, inadequate national burn policies, and poor integration of burn care into broader child health systems (Rockson et al., 2024). The financial constraints faced by many families in these regions exacerbate the challenges of accessing timely and adequate treatment. The need for improved insurance coverage and financial support mechanisms is crucial to alleviating the economic burden associated with burn management (Mehta et al., 2020). These systemic issues call for urgent policy attention, including the development of national burn prevention strategies, better enforcement of housing safety standards, and increased investment in specialised burn units and rehabilitation services. Strengthening peripheral healthcare facilities and improving referral systems are necessary policy interventions to address these gaps.

Personal factors also play a critical role in shaping the experience and outcomes of paediatric burn injuries for both the child and their caregivers. For children, age and sex have been shown to influence burn severity and recovery trajectories; younger children are at higher risk due to developmental immaturity and limited danger awareness (Fadeyibi et al., 2011), while male children are often more exposed due to higher activity levels (Fadeyibi et al., 2011; Nduagubam et al., 2021; Aikawa et al., 2022). Cognitive ability and emotional maturity also affect how children understand, cope with, and respond to burn trauma and subsequent care, influencing adherence to treatment and psychological resilience (Palmu et al., 2016). Children with pre-existing mental health issues or comorbidities may face prolonged recovery and greater functional impairment (Sheckter et al., 2020). On the caregiver side, socioeconomic status significantly impacts access to quality care, affordability of medications, and the ability to maintain consistent follow-up, particularly in low-resource settings such as Ghana (Rayner and Prentice, 2011; Mehta et al.,

2020). Parental education level affects health literacy, first aid responses, and engagement with rehabilitation processes (Nduagubam et al., 2021). Additionally, caregiver factors such as employment status, marital support, and psychological wellbeing influence both the quality of care provided and the caregiver's ability to cope with the demands of burn management (Miller et al., 2018). Single parents or unemployed caregivers, for instance, may experience heightened stress and difficulty balancing hospital visits with other responsibilities. These personal and interpersonal dynamics must be taken into consideration when designing family-centred burn care interventions.

Effective and context-specific management strategies are desperately needed, as evidenced by the high prevalence of paediatric burn injuries found in this study and their profound effects on children's and their caregivers' physical, psychological, social and functional well-being. The next section of this discussion delves into the management of paediatric burns, examining how burn injuries are currently handled both in the local context of the study and within the broader body of global literature.

8.5 Paediatric Burn Management Practices

Key Findings

- Healthcare practitioners at KBTH possess expertise in paediatric burn management, crucial for addressing children's unique needs.
- The absence of standardized burn management protocols in Ghana and LMICs results in inconsistent treatment approaches.
- Referral and infrastructure deficiencies hinder early interventions, delaying effective paediatric burn management.
- Caregiver involvement in the treatment process is inadequate, leading to missed opportunities for education and home care improvement.
- Burns unit healthcare workers experience emotional distress and burnout (self-reported), affecting care quality.
- Expanding the National Health Insurance Scheme (NHIS) to include comprehensive burn care could alleviate financial burdens for families.

Given the high prevalence and serious impact of burns on the physical, psychological, and functional wellbeing of children as well as caregivers, the quality and structure of burn care are central to patient survival and recovery. At the institutional level, one of the notable strengths identified in this study was the availability of a dedicated multidisciplinary team (MDT) at Korle Bu Teaching Hospital (KBTH), which plays a central role in paediatric burns care. Healthcare professionals in the study emphasized the importance of collaborative care involving surgeons, nurses, physiotherapists, nutritionists, and psychologists. This aligns with global literature that advocates for MDTs in managing complex burn injuries, ensuring that care is comprehensive and responsive to the child's evolving needs (Cambiaso-Daniel et al., 2018; Schlottmann & Lorbeer, 2020). The presence of such expertise, particularly among clinicians with specific training in

paediatric care, was seen as essential due to the unique physiological vulnerabilities of children, such as greater fluid loss, thinner skin, and higher risks of hypothermia (McWilliams et al., 2021). However, despite these strengths, the study also revealed several limitations in burn care delivery.

A major concern identified was the absence of standardized, locally adapted burn management protocols. While professionals often draw from external guidelines, such as those provided by the American Burn Association (ABA, 2023), there was a consensus that these are not always applicable within the Ghanaian healthcare context due to resource limitations. Holbert et al. (2021) similarly argued that the absence of structured protocols hinders the implementation of advanced therapies, leading to inconsistencies in treatment outcomes. Referral challenges also surfaced as a major barrier in paediatric burn management. Both caregivers and healthcare workers reported delays in referrals, poor coordination between referring facilities and the burn centre, and logistical difficulties during transportation. These issues are consistent with findings by Den Hollander et al. (2014), who documented similar delays in South Africa due to inadequate training and resources in lower-tier hospitals. Thomson et al. (2019) similarly found that many facilities cannot consistently provide intravenous fluids, further complicating early burn management. Given Ghana's resource constraints, external guidelines may not be fully applicable, further justifying the need for a locally adapted, evidence-based protocol that aligns with the country's healthcare infrastructure and patient needs.

The importance of patient and family-centered care (PFCC) cannot be overemphasized in the management of paediatric burn injuries. PFCC encourages the active involvement of the patients and caregivers in the management process (Furmenti et al., 2025). Literature supports that when

caregivers are empowered with knowledge and training, outcomes in paediatric burn care improve significantly (Koyro et al., 2021). Yet, in this study, caregivers felt sidelined during the treatment process, leading to missed opportunities for education, collaboration, and long-term support. The gap in caregiver education points to the need for structured caregiver training initiatives, which could equip them with essential burn care skills and facilitate better home care after discharge. Such training could be provided by multidisciplinary burn care teams, including nurses, physiotherapists, social workers, and clinical psychologists, either during admission, prior to discharge, or as part of scheduled follow-up visits.

In addition to systemic and structural issues, healthcare workers themselves highlighted personal challenges that affect the quality of care. Many staff reported emotional exhaustion, distress from managing severe paediatric cases, and the absence of support systems to help them cope. This is a critical finding as it directly impacts clinical performance and patient outcomes. The situation is further compounded by the shortage of healthcare workers in specialised care areas such as burns in Ghana, which increases the workload and stress on the limited available staff (Dartey et al., 2023). Wang et al. (2023) in an integrated review discussed the emotional toll and burnout of working in burns units and advocate for staff resilience training, access to mental health services, and debriefing sessions. These interventions can help reduce burnout, improve staff well-being, and enhance the overall care environment.

Building on the insights from the previous section on paediatric burn management, which highlighted both strengths and critical gaps in current practices at Korle Bu Teaching Hospital, the next section discusses the proposed protocol for holistic paediatric care management. This protocol

is based in the findings of the study and integrates perspectives from patients, caregivers, healthcare professionals, and burn care experts.

8.6 Protocol for Holistic Paediatric Burn Management

Key Findings

- The study developed a context-specific, expert-informed holistic paediatric burn management protocol tailored for Ghana's low-resource setting.
- The protocol integrates acute care with psychosocial support, rehabilitation, and follow-up, offering a comprehensive model unlike fragmented existing approaches.
- The protocol is examined through the lens of the WHO Health Systems Framework, revealing areas of strengths and gaps for improvement.
- School reintegration and long-term scar management are incorporated, addressing often-neglected post-discharge needs.

This protocol responds to the urgent need for structured and sustainable approaches to paediatric burn management in Ghana by incorporating the diverse and interconnected needs of children, their families, and the healthcare system. In doing so, the study offers a comprehensive, multi-faceted care model that aligns with global best practices and guidelines (ABA, ISBI and EBA) while being tailored to local capacity and resource availability.

The protocol consists of several key elements: infection control and wound care, structured pain management (including pharmacological and non-pharmacological approaches), age-specific rehabilitation, psychosocial support, and follow-up care. These components reflect best practices outlined in literature, such as the analgesic protocol for procedural pain used in South Africa (Allorto et al., 2021), and the importance of distraction therapy in paediatric pain relief as supported by Farzan et al. (2023). However, unlike many existing protocols that are fragmented

or disease-focused, the proposed protocol is holistic, integrating psychosocial and functional rehabilitation with acute medical care.

The developed burns protocol aligns with the American Burn Association (ABA) guidelines which recommend multi-disciplinary, patient-centered care (Patterson et al., 2023). A notable addition in this study's protocol is the explicit incorporation of caregiver training and community and social workers support as substitutes for professional mental health services, a practical adaptation to Ghana's shortage of trained psychologists in burn units, a gap also noted by Willemse et al. (2023) in a study conducted among burn survivors from Netherlands and Belgium. Given the shortage of healthcare workers, it is advisable to empower caregivers in burns management. Research suggests that involving caregivers in the care of burns through training, involvement in care plans, and the provision of support and resources can enhance care, help in treatment adherence, and increase overall satisfaction of both patients and caregivers (Sadeghi et al., 2022; Rockson et al., 2024).

The protocols also included telehealth interventions and advocacy for follow-up care. Expert opinions on the protocol raised concerns about the accessibility and feasibility of telehealth interventions due to limited internet connectivity and digital literacy in the study's setting, a challenge similarly noted in the literature (McWilliams, 2020; Leshner, 2023). A hybrid approach combining traditional and technological follow-up methods may be more practical in the Ghanaian context. The integration of advocacy and prevention in the protocol is particularly forward-thinking. By recognizing that most burns in young children result from domestic hazards like hot water, the protocol recommends early prevention strategies, including community education, caregiver sensitization, and collaboration with child welfare agencies. This reflects a shift towards injury prevention and family and patient-centered care (FPCC), consistent with modern health promotion paradigms (Furmenti et al., 2025). The protocol's attention to early prevention,

particularly through educational campaigns and environmental hazard assessments in homes, aligns with global child safety interventions and fills a major gap in traditional hospital-focused burn care models.

Examining the protocol through the lens of holistic health frameworks such as the WHO Health Systems Framework, several strengths and gaps were identified. The WHO Health Systems Framework consists of six building blocks: service delivery, health workforce, health information systems, access to essential medicines and equipment, financing, and leadership/governance (Blocks, 2022).

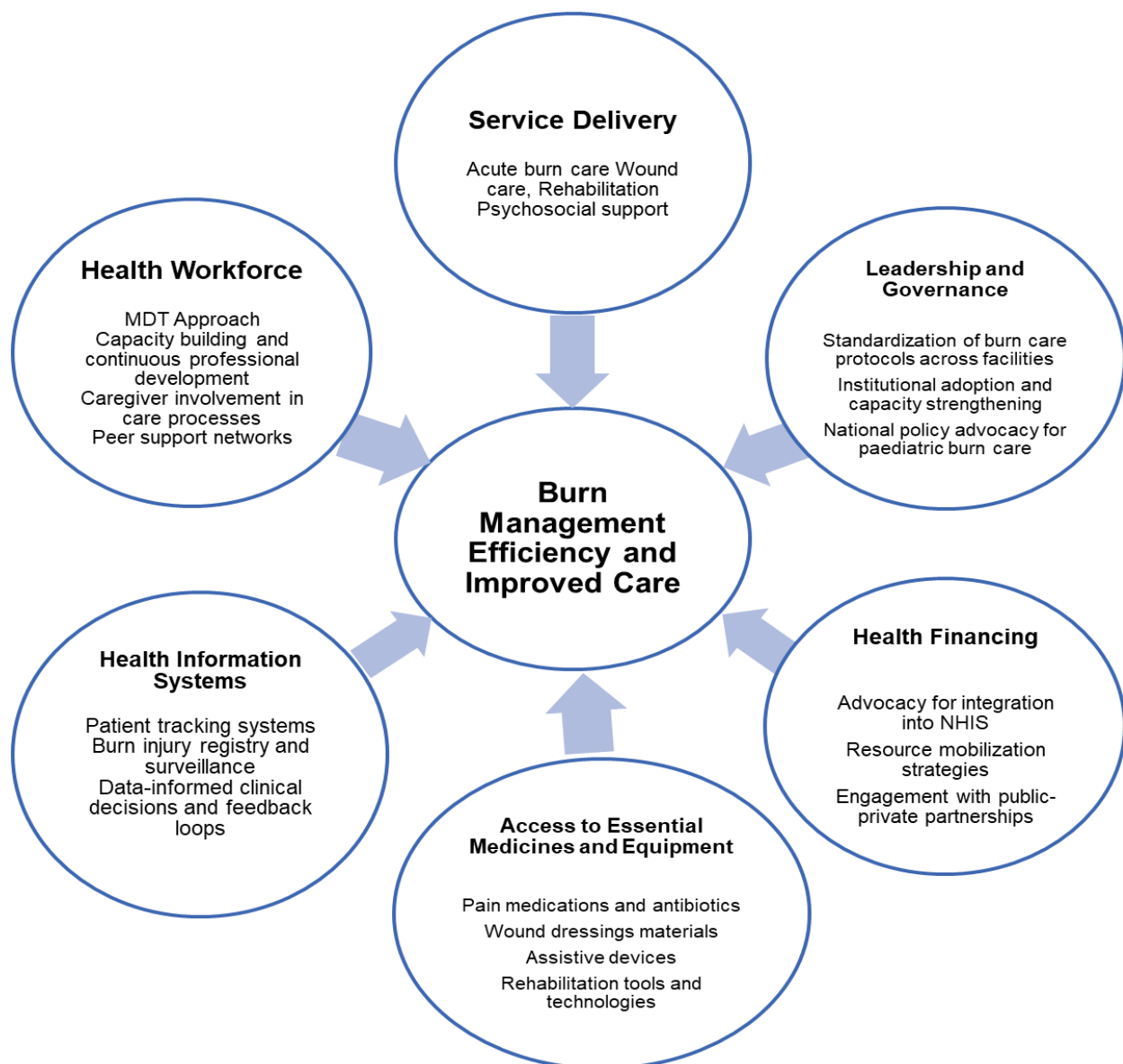


Figure 8.3: Analysis of the Protocol through the Lens of the WHO Health Systems Framework

In terms of service delivery, the protocol promotes comprehensive and continuous care from acute management to rehabilitation and follow-up. It addresses the health workforce pillar through capacity building, caregiver involvement, and recommendations for multidisciplinary collaboration. While it advocates for essential equipment (e.g., pain medication, dressing materials, assistive devices), challenges related to access and affordability remain, particularly for advanced wound care products and telehealth tools. Financing remains a critical gap; the protocol

does not detail how proposed interventions will be sustainably funded, which could hinder implementation. Health information systems are poorly addressed; there is limited integration of digital documentation, data tracking, or burn registries. Finally, governance and leadership are implicitly referenced through recommendations for protocol adoption, institutional training, and cross-sector collaboration, but more explicit strategies for policy enforcement and national-level leadership are needed. Future research on a systems approach to burns and burns management is recommended.

8.7 Researcher Reflexivity

The conduct of this study revealed critical insights into the current state of paediatric burn care in Ghana. The unexpectedly high prevalence of paediatric burns, juxtaposed with the limited implementation of structured prevention strategies and policies, underscores a significant public health gap. Despite the persistent burden of mortality and complications, there appears to be a paucity of research addressing sustainable, long-term solutions. It was observed in this study that many healthcare providers acknowledged their need for emotional, professional, and logistical support. Interestingly, they also emphasized that small, consistent improvements such as better communication, access to basic supplies, or interprofessional collaboration could substantially enhance care delivery. A noteworthy observation was the frequent exclusion of children and caregivers from clinical decision-making, despite their central role in recovery and the continuity of care. Additionally, the shortage of paediatric burn specialists with experience in low- and middle-income settings, such as Ghana, emerged as a critical limitation that hinders the planning and delivery of context-appropriate care.

This research highlighted the complex and interconnected nature of health system management, extending well beyond the provision of clinical care within tertiary hospitals. It reinforced the understanding that effective healthcare requires a continuum of interventions beginning with injury prevention and community health promotion. The findings further underscored that the process of recovery for a paediatric burn patient does not conclude at hospital discharge; rather, it continues through reintegration into school, family life, and broader society. A much responsive and equitable health system must adopt a holistic model of care that encompasses prevention, acute care, rehabilitation, psychosocial support, and long-term follow-up. Such an approach aligns with the core principles of the ICF, FPCC and universal health coverage. This full-circle approach to care is what true universal healthcare should look like.

8.8 Conclusion

The main conclusions from the entire study are compiled and examined in this chapter to demonstrate their relationships. The high prevalence of paediatric burns in Ghana, its effects on patients, caregivers, the healthcare system, and paediatric burns management were all highlighted by the integrative debate. The findings from this study make it clear that burn care is not just about treating wounds in hospitals. It is about prevention, proper first aid, emotional and social recovery, long-term follow-up, and giving both children and caregivers the help they need to return to normal life. As part of the study, a holistic paediatric burn care protocol was created with help from burn experts. It includes 40 key components to be considered for holistic paediatric burn management and it was designed to fit the Ghanaian setting, where resources are limited.

CHAPTER NINE

CONCLUSION

9.1 Introduction

The study aimed to develop a holistic paediatric burns management protocol tailored for low-resource settings, particularly in Ghana. Retrospective record reviews, in-depth interviews with paediatric burn patients and their caregivers, focus groups with medical professionals involved in paediatric burn care and an expert consensus process employing a modified Delphi methodology were all used to gather data. The study sought to understand the prevalence and patterns of paediatric burns, the experiences of caregivers and patients, the perceptions of healthcare providers on existing burn care practices, and to develop a standardized protocol for holistic paediatric burn management.

9.2 Recommendations of the Study

The findings of this study have far-reaching implications across multiple disciplines as outlined below.

1. Recommendations for Policy

1. Given the financial burden associated with burn treatment, the Ministry of Health (MoH) and the National Health Insurance Authority (NHIA) should integrate paediatric burn care into full insurance coverage to ensure affordability and accessibility of treatment, reducing mortality and complications due to delayed care.
2. Establishing regional sub-committees comprising government agencies, healthcare institutions, and community organizations will help in formulating policies, promoting injury surveillance, and implementing preventive strategies across Ghana.

3. The high prevalence of paediatric burns found in this study shows that urgent action is needed in Ghana. Burns should be treated as a serious public health issue and included in maternal and child health programmes. The Ministry of Health and Ghana Health Service should make sure burn prevention and care are part of national health plans. Child safety rules must be strengthened and enforced by community leaders, especially in homes, schools, and daycare centres.
4. The Ghana Health Service Health Information Department could implement national electronic surveillance system specifically to track and report burn cases is needed to help understand the problem better and plan solutions.

9.2.2 Recommendations for Healthcare Practitioners

1. There is a pressing need to improve paediatric burn care practices by adopting a more holistic and function-oriented approach that reflects the ICF framework. This entails understanding how bodily function and structure interact with activity restrictions, participation limitations and environmental and individual influences. Clinically, practitioners must go beyond treating the wound and provide psychosocial support, pain management, physiotherapy, and nutritional interventions. A multidisciplinary approach involving nurses, surgeons, physiotherapists, occupational therapist, speech therapist, nutritionists, psychologists, and social workers should be standard practice.
2. To improve treatment outcomes, healthcare facilities should upgrade burn units with modern infrastructure, including child-friendly treatment spaces, specialised burn wards, and advanced equipment for wound care and rehabilitation. Facility needs assessments

should be conducted by the hospital and burns infrastructure improvements should be incorporated into the hospital's annual performance improvement plans.

3. Regular workshops and training programs should be conducted by burns specialists or senior clinical staff to keep healthcare professionals updated on the latest paediatric burn management techniques, including pain management, scar treatment, and psychological support.

9.2.3 Recommendations for Future Research

1. Future research should include multiple healthcare facilities across different regions in Ghana to ensure that findings reflect paediatric burn management challenges and solutions applicable to diverse healthcare settings.
2. Since children struggled to express their experiences in this study, future research should employ storytelling, drawings, and play-based activities to capture their perspectives on burn care and rehabilitation effectively.
3. A detailed study on the financial burden of paediatric burn management, including treatment costs and hospital stays, should be conducted to inform healthcare policies and resource allocation strategies.
4. While the developed paediatric burn management protocol aligns with global best practices, future studies should assess its feasibility and effectiveness in clinical practice, allowing for cultural adaptations and refinements based on implementation outcomes.

4. Leadership

1. Effective leadership is critical to driving improvements in paediatric burn care and prevention. The Minister of Health, Directors of various health agencies in Ghana, hospital CEOs, and members Parliamentary Health Committee must advocate for child injury prevention as a national priority and mobilize resources for building specialised burn units and training healthcare teams.
2. At the community level, religious, political, and traditional leaders can play a vital role in promoting safe home environments and dispelling myths surrounding traditional burn remedies. Hospital administrators and healthcare leaders must prioritize the integration of structured debriefing sessions and mental health resources for burn unit staff to mitigate burnout. Advocacy for resource allocation and infrastructure improvements is necessary to address systemic barriers in paediatric burn management

5. Education

1. The study emphasizes the vital need for early burn prevention education, particularly aimed at parents and caregivers, since children aged 1 to 5 are the most impacted age group.
2. Education must begin at the community level and be embedded into routine healthcare services. Antenatal care visits, immunization clinics, maternal and child health outreach programs, and school health services are all viable platforms to educate families on safe home practices, burn first aid, and early healthcare-seeking behaviour. Moreover, health workers, especially community nurses and primary care providers, should receive training in burn prevention education, first aid, and early referral protocols.

3. Continuous professional development programs should focus on paediatric burn care, ensuring that healthcare workers remain updated on best practices. Importantly, physiotherapists should receive specialized training in paediatric burn rehabilitation to ensure evidence-based delivery of interventions such as range-of-motion exercises, splinting, scar modulation, and functional reintegration.
4. Educational curricula for medical, nursing, and allied health students should integrate child-centered care principles, the ICF model, and trauma-informed care to better prepare future professionals. For physiotherapy education in particular, modules on burn-specific assessment, psychosocial support, and interdisciplinary collaboration should be emphasized to enhance preparedness in managing paediatric burn survivors comprehensively.

6. Recommendations for Korle Bu Teaching Hospital (KBTH)

1. The newly developed paediatric burn rehabilitation protocol should be formally piloted in the Burns Unit of KBTH for 6 months to assess and evaluate its outcomes on paediatric burns. Clinical outcomes, staff feedback, and caregiver input should be used to assess its effectiveness for institutional adoption.
2. Given the high emotional toll on children, families, and healthcare staff, the hospital should embed monthly debriefing sessions, child counselling services, and caregiver support groups. The Clinical Psychology Unit, in collaboration with the Burns Unit and Social Welfare Department, should lead these interventions.
3. Weekly caregiver education sessions should be conducted by physiotherapists, nurses, and dietitians during ward rounds or scheduled group meetings. Topics should include wound

care, pain and itch management, scar prevention, return-to-school guidance, and home safety to promote education and awareness among caregivers.

4. In light of the financial burden reported by caregivers, the KBTH CEO and Finance Department should engage with the Ministry of Health and NHIS leadership to advocate for full coverage of paediatric burn care under the national insurance scheme. A policy brief highlighting mortality, costs, and treatment gaps can support this advocacy.
5. The Burns Unit at KBTH could upgrade its infrastructure to have a child-friendly rehabilitation space. The space should have age-appropriate equipment, toys, and visual aids. Physiotherapists will conduct therapy sessions here to enhance engagement, reduce anxiety and improve therapy participation.

9.3 Conclusion

This study has successfully developed a paediatric burns management protocol that is both appropriate and adaptable to low-resource settings like Ghana and other LMIC. By combining expert knowledge, patient and caregiver experiences, and real-life challenges in burn care, the protocol offers a clear and structured approach to treating and supporting children with burn injuries. The findings showed that paediatric burns are common, with young children being the most affected. Many injuries were caused by hot water and affected multiple body parts, often leading to long recovery periods. While burn care has improved in Ghana, challenges such as pain management, financial difficulties, psychological trauma, and a lack of clear treatment guidelines still exist. These issues highlight the need for a well-defined, standardized approach to care, which the newly developed protocol aims to address. The protocol provides a holistic solution that can

be adapted in other low-resource settings, improving the quality of life for burn survivors and their families.

This study has been a deeply insightful and transformative journey. In addition to exposing serious inadequacies in burn care, research on paediatric burns in low-resource environments like Ghana has reaffirmed the significance of a comprehensive, patient-centered approach to therapy. The voices of caregivers, patients, and healthcare providers and experts have provided invaluable perspectives, shaping a protocol that is both practical and contextually relevant. The research has deepened the researcher's understanding of the profound physical, emotional, and financial toll that burn injuries impose on children and their families. The researcher is confident that the protocol developed through this study will serve as a meaningful contribution to paediatric burn care, not just in Ghana but in similar low-resource settings. Going forward, this work will stimulate further research, policy changes, and resource allocation to ensure that paediatric burn patients receive the best possible care, minimizing long-term complications and improving overall quality of life. In the future, this protocol could also be scaled up or adapted to other hospitals and even outside Ghana, with adjustments made for different cultures and resources.

9.4 Limitations of the Study

When evaluating the results, it is important to take into account the limitations of this study. Initially, it was carried out at Korle Bu Teaching Hospital, a single burn facility . This may limit how well the results apply to other hospitals, especially those in rural or less-resourced settings. Different centres may have different patient needs, resources, and ways of working. Findings on predictors of burn mortality did not take into account burn depth and other comorbidities such as

Tuberculosis, HIV etc which can equally influence burn outcomes. Also, the protocol development employed a small number of experts due to the limited availability of burns specialists in Ghana and across Africa. Also there was limited diversity of health professionals included as the protocol development was facilitated by only rehabilitation professionals. This may have reduced the range of professional opinions included. Another limitation is that children's voices were underrepresented, as many found it difficult or shy to express their feelings. Future studies can use child-friendly methods like drawing or storytelling to better capture their experiences. The study also did not fully explore the costs involved in burn care or how long children stay in the hospital, which are important concerns for families. Cultural beliefs about healing, disability, and family roles were not deeply explored, even though they affect how care is received and followed in Ghana. Lastly, while the protocol developed aligns with international standards, it has not yet been tested in real-life settings in Ghana and may need adjustments to fit the local context better. Furthermore, the study did not propose specific implementation guidelines for the protocol, which may limit its practical uptake across healthcare settings. Future research could address this by developing operational frameworks for effective implementation and evaluation.

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APPENDIX A: PATIENT INFORMATION SHEET (ASSENT FORM)



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am studying how children with burns are taken care of at Korle Bu Teaching Hospital. I want to learn about their experiences and understand how the hospital manages their burns. This form I am reading to you will give you all the answers about this study I am doing.

Invitation to Participate

I am asking / inviting you to take part in this research study.

What is involved in the study.

The purpose of this study is to find out what you have gone through after your burn injury, how you were taken care of and your needs after discharge. This study will involve taking personal information details from your hospital folder and me asking you questions which you will kindly provide answers to it to the best that you can remember lasting about 45 minutes to 1 hour. I will be using a tape recorder to take all that you have said so that I can play it back. All that happened from the time you got burned until now will be asked.

Risks of being involved in the study

There are no direct risks associated with this study. However, if you are feeling any discomfort in the process of the question and answers, I have a distress protocol in place to help you.

Benefits of being in the study

All what you tell me will help other children who have also gone through what you have gone through in order to help them manage their burn. In addition, you will have access to the information on the study while involved in the project and after the results are available, you will be offered a free results summary, on request.

Participation is voluntary

You being involved in this study is not by force and can stop participating at any time without any consequences. You will not need to provide a reason for stopping to participate. Any data collected after you stop participating will be automatically destroyed.

Reimbursements for “out of pocket” expenses

I will cater for the cost of your transportation and refreshment the day you are called upon to take part in the study.

Confidentiality and Anonymity

Your personal information such as name, age etc will not be made known to anyone and every information you tell me will be kept secret. You will not be identified by your name in any report or publication that comes out of the study. All data collected in the course of the study will be protected for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Distress Protocol

You will be watched if you are showing any signs that is making you feel uncomfortable during the interview and I will help by giving you the necessary support or help you need.

Contact details of researcher

If you want to get more information about the study, please contact:

Principal Investigator: Mrs. Alberta Amissah Rockson, on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com / 2786206@students.wits.ac.za

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at

sonti.pilusa@wits.ac.za.

Assent

I _____ understand that my parent/guardian has given me permission (said it is okay) to participate in this interview.

I am taking part in the study because I want to. I have been told that, I can stop at anytime I want to and nothing will happen to me if I want to stop.

Child's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX B: CAREGIVERS INFORMATION SHEET



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing a research to explore the experiences of paediatric burns patients on the management of burns in the Korle Bu Teaching hospital. This information sheet is to provide information on the nature of the research, procedures, benefits, ethical consideration, and risk that might be associated with the research.

Invitation to Participate

I am asking / inviting you to take part in this research study.

What is involved in the study.

The purpose of this study is to find out your experiences following the burn injury of your child, how it was managed and your child's needs after discharge. This study will involve retrieving demographic information from the hospital folder of your child and participating in an in-depth interview lasting about 45 minutes to 1 hour. The interview session will be audio recorded. Questions regarding your experiences with burns and its management would be asked for you to respond appropriately.

Risks of being involved in the study

There are no direct risks associated with this study. However, if you are feeling any discomfort in the process of the question and answers, I have a distress protocol in place to help you.

Benefits of being in the study

The results obtained from this study will provide useful information on the experiences of children who sustained burn injuries and their outcomes. In addition, you will have access to the information on the study while involved in the project and after the results are available, you will be offered a free results summary, on request.

Participation is voluntary

Participation in this study is voluntary and refusal to participate has no negative effects. You may choose to discontinue participation at any time without any consequences. You will not need to provide a reason for stopping to participate. Any data collected after you stop participating will be automatically destroyed.

Reimbursements for “out of pocket” expenses

I will cater for the cost of your transportation and refreshment the day you are called upon to take part in the study.

Confidentiality and Anonymity

Your identity as a participant will not be disclosed and any data obtained will be kept confidential throughout the study. You will not be identified by your name in any report or publication that comes out of the study. All data collected in the course of the study will be protected for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Distress Protocol

You will be watched if you are showing any signs that is making you feel uncomfortable during the interview and I will help by giving you the necessary support or help you need.

Contact details of researcher

For further information, please contact:

Principal Investigator: Mrs. Alberta Amissah Rockson on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com / 2786206@students.wits.ac.za.

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at sonti.pilusa@wits.ac.za.

Informed Consent

I have been explained into details about this study and my role as a participant has been clearly outlined to me. I understand that my participation in the study is voluntary and that I am free to withdraw at any point in time, without giving any reason, without my care or legal rights being affected. I understand that the data obtained from the study may be used for research publication and I also understand that my identity will not be revealed at any cost.

I _____ have fully understood the aims, methods and conditions to participate in this study and I agree to give my consent for taking part in the above study.

Participant's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and char

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX C: HEALTHCARE PRACTITIONERS' INFORMATION SHEET



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing a research to explore the current paediatric burn management practices in Korle Bu Teaching Hospital. This information sheet is to provide information on the nature of the research, procedures, benefits, ethical consideration, and risk that might be associated with the research.

Invitation to Participate

I am asking / inviting you to take part in this research study.

What is involved in the study.

The purpose of this study is to explore the current paediatric burns management practices in Korle Bu Teaching Hospital. This study will involve a focus group discussion among different healthcare practitioners. The discussion will last about 45 minutes to 1 hour. The entire session of the discussion will be audio recorded and documented.

Risks of being involved in the study

There are no direct risks associated with this study.

Benefits of being in the study

The results obtained from this study will provide useful information on the practices adopted by different healthcare providers in the management of paediatric burns. In addition, you will have

access to the information on the study while involved in the project and after the results are available, you will be offered a free results summary, on request.

Participation is voluntary

Participation in this study is voluntary and refusal to participate has no negative effects. You may choose to discontinue participation at any time without any consequences. You will not need to provide a reason for stopping to participate. Any data collected after you stop participating will be automatically destroyed.

Reimbursements for “out of pocket” expenses

I will cater for the cost of your transportation and refreshment the day you are called upon to take part in the study.

Confidentiality and Anonymity

Your anonymity cannot be assured in the focus group discussions but every effort will be made to do so. In addition, confidentiality in the focus group discussions cannot be guaranteed. All data collected in the course of the study will be protected for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Contact details of researcher

For further information, please contact:

Principal Investigator: Mrs. Alberta Amisshah Rockson on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com / 2786206@students.wits.ac.za

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at sonti.pilusa@wits.ac.za.

Informed Consent

I have been explained into details about this study and my role as a participant has been clearly outlined to me. I understand that my participation in the study is voluntary and that I am free to withdraw at any point in time, without giving any reason, without my care or legal rights being affected. I understand that the data obtained from the study may be used for research publication and I also understand that my identity will not be revealed at any cost.

I _____ have fully understood the aims, methods and conditions to participate in this study and I agree to give my consent for taking part in the above study.

Participant's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX D: EXPERTS INFORMATION SHEET



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing a research geared towards the development of a contextual protocol for holistic paediatric burns management in Korle Bu Teaching Hospital. This information sheet is to provide information on the nature of the research, procedures, benefits, ethical consideration, and risk that might be associated with the research.

Invitation to Participate

I am asking / inviting you to take part in this research study.

What is involved in the study.

The purpose of this study is to develop a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana. This study will involve a Modified Delphi study. This technique uses questionnaires administered in multiple rounds to gather information continually until a consensus is reached.

Risks of being involved in the study

There are no direct risks associated with this study.

Benefits of being in the study

The results obtained from this study will provide useful information for health care providers and other stakeholders in the management of paediatric burns. In addition, you will have access to the information on the study while involved in the project and after the results are available, you will be offered a free results summary, on request.

Participation is voluntary

Participation in this study is voluntary and refusal to participate has no negative effects. You may choose to discontinue participation at any time without any consequences. You will not need to provide a reason for stopping to participate. Any data collected after you stop participating will be automatically destroyed.

Confidentiality and Anonymity

Your identity as a participant will not be disclosed to other experts. All data collected in the course of the study will be protected for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Contact details of researcher

For further information, please contact:

Principal Investigator: Mrs. Alberta Amissah Rockson on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com.

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at sonti.pilusa@wits.ac.za.

Informed Consent

I have been explained into details about this study and my role as a participant has been clearly outlined to me. I understand that my participation in the study is voluntary and that I am free to withdraw at any point in time, without giving any reason, without my care or legal rights being affected. I understand that the data obtained from the study may be used for research publication and I also understand that my identity will not be revealed at any cost.

I _____ have fully understood the aims, methods and conditions to participate in this study and I agree to give my consent for taking part in the above study.

Participant's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX E: PATIENTS ASSENT FOR AUDIO RECORDING



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am studying how children with burns are taken care of at Korle Bu Teaching Hospital. I want to learn about their experiences and understand how the hospital manages their burns. This form I am reading to you will give you all the answers about this study I am doing. You will be taking part in an interview and I would like to seek your permission for the interview to be recorded with a tape.

What is involved in the study.

This study will involve me asking you questions which you will kindly provide answers to it to the best that you can remember, lasting about 45 minutes to 1 hour. I will be using a tape recorder to record all that you have said so that I can play it back. The purpose of the audio recording is to make sure I get the right information from you during the questions and answer time. The recording will later be written in a document.

Risks of being involved in the study

There are no direct risks associated with this study. However, if you are feeling any discomfort in the process of the question and answers, I have a distress protocol in place to help you.

Benefits of being in the study

All what you tell me will help other children who have also gone through what you have gone through in order to help them manage their burn.

Participation is voluntary

You being involved in this audio recording session is not by force and can stop participating at any time without any consequences. You will not need to provide a reason for stopping to participate. Any data collected after you stop participating will be automatically destroyed.

Confidentiality and Anonymity

Your personal information such as name, age etc will not be made known to anyone and every information you tell me will be kept secret. You will not be identified by your name in any report or publication that comes out of the study.

Distress Protocol

You will be watched if you are showing any signs that is making you feel uncomfortable during the question and answers and I will help by giving you the necessary support or help you need.

Contact details of researcher

If you want to get more information about the study, please contact:

Principal Investigator: Mrs. Alberta Amissah Rockson, on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com.

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at [**sonti.pilusa@wits.ac.za**](mailto:sonti.pilusa@wits.ac.za).

Audio Recording Assent

I _____ understand that my parent/guardian has given me permission (said it is okay) to participate in the audio recording for this study.

I am taking part in the study because I want to. I have been told that, I can stop at anytime I want to and nothing will happen to me if I want to stop.

Participant's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX F: CAREGIVERS' CONSENT FOR AUDIO RECORDING



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing a research to explore the experiences of paediatric burns patients on the management of burns in the Korle Bu Teaching hospital. This document serves as an informed consent form for audio recording during an interview. It is important that you read and understand the following information before proceeding with the recording. Your participation is voluntary, and by providing consent, you acknowledge that you have been informed about the purpose, potential risks, and benefits of the audio recording.

What is involved in the study.

This study will involve participating in an in-depth interview lasting about 45 minutes to 1 hour. The interview session will be audio recorded. Questions regarding your experiences with burns and its management would be asked for you to respond appropriately. The purpose of the audio recording is to capture accurate and complete information during the interview process. The recording will be used for transcription of the interview and analysis.

Risks of being involved in the study

There are no direct risks associated with this study. However, if you are feeling any discomfort in the process of the question and answers, I have a distress protocol in place to help you.

Benefits of being in the study

The audio recording will ensure accurate documentation of the interview and reduce the risk of information being misinterpreted or lost. The recording can be used as a point of reference during follow-up discussions and future research.

Participation is voluntary

Participation in the audio recording is entirely voluntary, and you have the right to refuse consent or withdraw your consent at any time without any negative consequences. Your decision to participate or not participate in the audio recording will not impact your ability to participate in the interview process. You may request a copy of the audio recording for personal review or withdraw consent for future use of the recording by contacting the responsible party.

Confidentiality and Anonymity

All information obtained during the interview will be treated as confidential. The audio recording will be securely stored and only accessible to authorized individuals involved in the interview process. Your personal identifying information, such as your name, will be anonymized or pseudonymized to protect your privacy. The audio recording will not be shared publicly without your explicit consent.

Distress Protocol

You will be watched during the interview for signs of distress, emotional disturbance or anything that will make you feel uncomfortable and a distress protocol will be applied to provide you with the appropriate support.

Contact details of researcher

For further information, please contact:

Principal Investigator: Mrs. Alberta Amissah Rockson on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com / 2786206@students.wits.ac.za

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at sonti.pilusa@wits.ac.za.

Audio recording Consent

By providing your consent, you acknowledge that you have read and understood the information provided in this document. You agree to participate in the audio recording process voluntarily, and you understand that you may withdraw your consent at any time without any negative consequences.

I _____ have fully understood the aims, methods and conditions to participate in this study and I agree to give my consent for taking part in the recording for the above study.

Participant's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX G: HEALTHCARE PRACTITIONERS CONSENT FOR AUDIO RECORDING



Study title: Development of a holistic paediatric burns management protocol in Korle Bu Teaching Hospital, Ghana.

Dear Sir/Madam

Introduction

I, Alberta Amissah Rockson, am a PhD student at the University of the Witwatersrand, Johannesburg, in South Africa. I am doing a research to explore the experiences of paediatric burns patients on the management of burns in the Korle Bu Teaching hospital. This document serves as an informed consent form for audio recording during the focus group discussion. It is important that you read and understand the following information before proceeding with the recording. Your participation is voluntary, and by providing consent, you acknowledge that you have been informed about the purpose, potential risks, and benefits of the audio recording.

What is involved in the study.

This study will involve participating in an in a focus group discussion that will last about 45 minutes to 1 hour. The discussion session will be audio recorded and documented. The purpose of the audio recording is to capture accurate and complete information during the discussion process. The recording will be used for transcription of the discussion and analysis.

Risks of being involved in the study

There are no direct risks associated with this study.

Benefits of being in the study

The audio recording will ensure accurate documentation of the discussion session and reduce the risk of information being misinterpreted or lost. The recording can be used as a point of reference during follow-up discussions and future research.

Participation is voluntary

Participation in the audio recording is entirely voluntary, and you have the right to refuse consent or withdraw your consent at any time without any negative consequences. You may request a copy of the audio recording for personal review or withdraw consent for future use of the recording by contacting the responsible party.

Confidentiality and Anonymity

Confidentiality and anonymity cannot be guaranteed in the focus group discussion. However, the audio recording will be securely stored and only accessible to authorized individuals involved in the discussion process. The audio recording will not be shared publicly without your explicit consent.

Contact details of researcher

For further information, please contact:

Principal Investigator: Mrs. Alberta Amissah Rockson on telephone number +233244617942 or by email at nalbertagh.ar@gmail.com / 2786206@students.wits.ac.za

Supervisors: Dr. Natalie Benjamin-Damons on 0835011969 or by email at Natalie.benjamin-damons@wits.ac.za and Dr. Sonti Pilus on 0820536190 or by email at sonti.pilusa@wits.ac.za.

Audio Recording Consent Form

By providing your consent, you acknowledge that you have read and understood the information provided in this document. You agree to participate in the audio recording process voluntarily, and you understand that you may withdraw your consent at any time without any negative consequences.

I _____ have fully understood the aims, methods and conditions to participate in this study and I agree to give my consent for taking part in the recording for the above study.

Participant's Signature..... Date

Researcher's Signature Date

Contact details of HREC administrator and chair

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee") and the Institutional Review Board of KBTH. A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Paul Ruff, who may be contacted via any one member of the secretariat. The telephone numbers for the Committee secretariat are 011 717 2700/1234/2656/1252 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za, Rhulani.Mukansi@wits.ac.za, Mapula.Ramaila@wits.ac.za and Iain.Burns@wits.ac.za.

Thank you for reading this Study Information Sheet.

APPENDIX H – DATA CAPTURE SHEET

Demographic information

Form No:

Area of Residence: Rural []

Urban []

Sex	
Age	
Date of admission	
Date of discharge	
Length of stay	
Cost of Care	

1. Cause of Burn injury	○ Hot liquids ○ Electrical ○ Flame ○ Chemical ○ Other
2. Body Part Involvement	○ Hand/wrist ○ Head/Neck ○ Torso.Back ○ Leg/foot ○ Upper arm/shoulder ○ Perineum/Buttock ○ Inhalational

3. Depth of burn	○ Partial thickness ○ Superficial partial thickness ○ Full thickness ○ Deep thickness ○ Mixed thickness
4. Percentage of Total Body Surface Area (TBSA) (state).	
5. Remarks	○ Discharged home ○ Transferred ○ Died
6. Place of injury	○ Home/Domestic ○ Work/occupational

APPENDIX I: SEMI STRUCTURED INTERVIEW GUIDE FOR PAEDIATRIC PATIENTS

Good morning/afternoon. Thank you for giving your time to interview you. My name is Alberta Amissah Rockson, and I am a PhD student at the University of the Witwatersrand. Today I would like to learn from you about your thoughts and experiences with the management of the burn injury at KBTH and its outcomes. This interview should last 45 minutes to an hour and will be audio recorded. I have specific questions I would like to ask, but feel free to provide additional information. Please ensure throughout the interview that, you remain anonymous by avoiding the use of your own name. Please try to speak loudly, clearly, slowly so that your comments can all be audio recorded.

Section 1: Identification and Demographic information

Patient Identifier:

Date of Interview:

Interview venue:

Name of Interviewer:

1. Sex	
2. Age	
3. Level of education	
4. Date of admission	
5. Date of discharge	
6. Type of burns	
7. Severity	
8. Area of burns	

Section 2: Interview Guide

Theme 1: Experiences with burn	1. Please can you tell me about yourself? 2. Tell me about the time you got burned 3. Probe: what happened? 4. What caused the burns? 5. Who helped you make the burns injury better?
Burns management	6. How was the burns managed? Probes: Did it help?
Needs	7. What are your current needs after discharge? Probes: Physical and psychosocial needs
Suggestions	8. Do you have any suggestions on how the management of paediatric burns at the KBTH can be improved?
Others	9. Is there any other thing that I have not asked you that you want me to know?

APPENDIX J: SEMI STRUCTURED INTERVIEW GUIDE FOR CAREGIVERS

Good morning/afternoon. Thank you for giving your time to interview you. My name is Alberta Amissah Rockson, and I am a PhD student at the University of the Witwatersrand. Today I would like to learn from you about your thoughts and experiences with the management of the burn injury your child sustained. This interview should last 45 minutes to an hour and will be audio recorded. I have specific questions I would like to ask, but feel free to provide additional information. Please ensure throughout the interview that, you remain anonymous by avoiding the use of your own name. Please try to speak loudly, clearly, slowly so that your comments can all be audio recorded.

Section 1: Identification and Demographic information

Patient Identifier:	Date of Interview:
Interview venue:	Name of Interviewer:

1. Sex	
1. Age	
1. Level of education	
1. Marital status	
5. Number of children	
6. Employment status/Occupation	
7. Relation to child	

Section 2: Interview Guide

Theme 1: Experiences with burn	1. Please can you tell me your experience following burn injury of your child 2. What happened? 3. When did it happen?
Burns management	1. Who help your child to treat the burns? 2. How was the injury treated? 3. What worked? 4. How is your child's burns area now? 5. What made managing the burns injury easier? 6. What made managing the burns injury worse?
Needs	1. What are the current needs of your child after discharge?
Suggestions	1. Do you have any suggestions on how the management of paediatric burns at the KBTH can be improved?
Others	1. Is there any other thing that I have not asked you that you want me to know?

APPENDIX K: FOCUS GROUP DISCUSSION GUIDE FOR THE HEALTH PROFESSIONALS

Demographics

Sex	
Age	
Specialty	
Years of practice	

Objective	Focus Group Question
Introductions	1. Can you introduce yourselves and share with everyone the role you play in burns management
Perceptions of health care practitioners on the hospital's paediatric burns management practices	1. Can you share with me your views on the hospital's paediatric burns management practices? Probe: The process the patients follows from admission to discharge Probe: In your view...what is working? Probe: What is not working?

Contextual factors influencing the hospital's paediatric burns management practices.	1. Which factors influence the paediatric burns management? Probe: Personal factors? Probe: Environmental factors? (resources, number of HR, Budget)
Barriers and facilitators to paediatric burns management.	1. What are barriers to paediatric burns management? 2. What are facilitators to the paediatric burns management?
Solutions to barriers in the management of paediatric burns	1. What can the hospital improve care for paediatric burns management? Probe: Solutions to improve outcomes for the patients? Probes: What can we do for the caregivers? Probes: Hospital processes?

APPENDIX L: MODIFIED DELPHI QUESTIONNAIRE

Please rank each of these questions on a scale of 1 to 5 in order of importance, where 1 is least important and 5 is most important. Use the comment section to give valuable insights, contributions or suggestions to any of the item.

Protocol variable	Delphi statements	Rank (1-5)
Infection control and wound care	1. Wound assessment and documentation to prevent wound infection.	
	2. Involving caregivers in the education and training of wound care practices.	
	3. Multidisciplinary team approach in pediatric burn wound management.	
	4. Antimicrobial agents (topical or systemic) in reducing infection rates in pediatric burn wounds.	
	5. Maintaining optimal nutrition on wound healing and infection prevention in paediatric burn rehabilitation.	
	6. Proper hand hygiene and personal protective equipment (PPE) use among healthcare providers in preventing infections during wound care.	
	7. Caregiver education on signs of infection and when to seek medical attention for paediatric burn wounds.	
	8. Continuous monitoring and surveillance of wound healing progress as a preventive measure against infections.	
	9. Easy access and availability of wound care products.	

Pain management	10. Using age-appropriate (paediatric) pain assessment tools for accurately evaluating procedural pain.	
	11. Pharmacological interventions (e.g., analgesics, anesthetics) in managing procedural pain during wound care.	
	12. Significance of distraction techniques (e.g., virtual reality, music therapy) in reducing procedural pain experienced by paediatric burn patients.	
	13. Involving caregivers in the pain management plan for paediatric burn patients.	
	14. Non-pharmacological interventions (e.g., breathing exercises, guided imagery) in managing background pain in paediatric.	
	15. The role of play therapy in alleviating background pain and improving overall comfort in paediatric burns rehabilitation.	
	16. Individualized pain management plans based on the patient's developmental stage and coping abilities in paediatric burn rehabilitation.	
	17. Optimizing the physical environment (e.g., comfortable bedding, colourful rooms, temperature control) in reducing background pain for paediatric burn patients.	
	18. Minimizing pain-related barriers to physical therapy and rehabilitation progress in paediatric burns cases.	
	19. Early and consistent range of motion exercises in preventing contractures in paediatric burn patients.	
	20. Active exercises in promoting functional recovery in paediatric burns rehabilitation.	
	21. Passive exercises in promoting functional recovery in paediatric burns rehabilitation.	
	22. Effectiveness resistive exercises in promoting functional recovery in paediatric burns rehabilitation.	
	23. Using specialised paediatric splints in preventing contractures.	

Physical and Occupational Therapy	24. Role of play-based therapies (e.g., games, activities) in engaging paediatric burn patients during exercise therapy sessions.	
	25. Incorporating activities of daily living (ADL) training into paediatric burns rehabilitation to enhance functional independence.	
	26. Early mobilization and weight-bearing activities in preventing muscle atrophy and joint stiffness in paediatric burn rehabilitation.	
	27. Dynamic splinting (serial casting, orthotic devices) in preventing and correcting contractures in paediatric burn patients.	
	28. Role of caregiver education and training in carrying out home-based exercise therapy and proper positioning for paediatric burn patients.	
	29. Aquatic therapy as a modality for promoting mobility, reducing pain, and preventing contractures in paediatric burns rehabilitation.	
Scar management	30. Early intervention and active scar management techniques in minimizing the long-term impact of scars on paediatric burn patients.	
	31. Silicone-based products (sheets, gels) in reducing scar thickness, color, and overall appearance in paediatric burns.	
	32. Massage therapy as a scar management approach in improving tissue flexibility and texture for paediatric burn patients.	
	33. Patient and caregiver education on proper scar care techniques to promote scar healing and mitigate complications.	
	34. Incorporating sunscreen use into scar management protocols to protect healing skin from hyperpigmentation.	
	35. Pressure garments in preventing hypertrophic scarring and improving scar outcomes in paediatric burns rehabilitation.	
	36. Involving psychologists or mental health professionals in scar management.	
	37. Nutritional support (e.g., vitamins, minerals) on scar healing and overall tissue regeneration in paediatric burn patients.	

	38. Interdisciplinary collaboration (e.g., involving dermatologists, plastic surgeons, occupational therapists) in developing comprehensive scar management plans for paediatric burns.	
Psychological or Psychosocial support	39. Individual counseling or therapy sessions in helping paediatric burn patients cope with emotional and psychological challenges.	
	40. Involving caregivers in psychosocial support programs to enhance the overall well-being of paediatric burn patients.	
	41. Play therapy and creative arts interventions in promoting emotional expression and psychological healing for paediatric burn patients.	
	42. Impact of peer support groups or interactions with other paediatric burn survivors in facilitating social and emotional recovery.	
	43. Cognitive-behavioral therapy (CBT) or similar approaches in managing anxiety, depression, and trauma-related symptoms in paediatric burn patients.	
	44. Involving school and teachers in supporting the reintegration of paediatric burn patients into their academic environment.	
	45. Assessing and addressing body image concerns as part of the psychosocial support for paediatric burn patients.	
	46. Mindfulness and relaxation techniques in helping paediatric burn patients manage pain and anxiety.	
	47. The role of psychological support and play therapy in reducing stress and anxiety.	
Education	48. Providing comprehensive education to paediatric burn patients and their caregivers about the nature and implications of paediatric burn injuries.	
	49. Using age-appropriate materials and visual aids in conveying essential information to paediatric burn patients and their families.	
	50. Educating caregivers about proper wound care and infection control practices to ensure optimal healing in paediatric burn patients.	

	51. Practical skills training (e.g., mobilization, scar management) as part of patient and caregiver education.	
	52. Facilitating peer support and knowledge sharing among paediatric burn patients and their families.	
	53. Technology-based resources (mobile phones and tablets) in enhancing patient and caregiver education in paediatric burns rehabilitation.	
	54. Role of school reintegration education in preparing paediatric burn patients for a successful return to their academic environments.	
Discharge planning	55. Initiating discharge planning early in the paediatric burns rehabilitation process to ensure a smooth transition from hospital to home.	
	56. Involving a multidisciplinary team in the development of individualized discharge plans for paediatric burn patient	
	57. Assessing the home environment and making necessary modifications to ensure safety and accessibility for paediatric burn patients.	
	58. Involving paediatric burn patients and their caregivers in the decision-making process for discharge plans and goal	
	59. Coordinating with schools and educational institutions to facilitate a seamless reintegration for paediatric burn patients post-discharge.	
	60. Including long-term rehabilitation goals and recommendations in the discharge plan for paediatric burn patients.	
	61. Utilizing technology (e.g., telehealth, remote monitoring) in post-discharge follow-up and support for paediatric burn patients.	
	62. Regular communication and check-ins with paediatric burn patients and their families in the immediate weeks following discharge.	

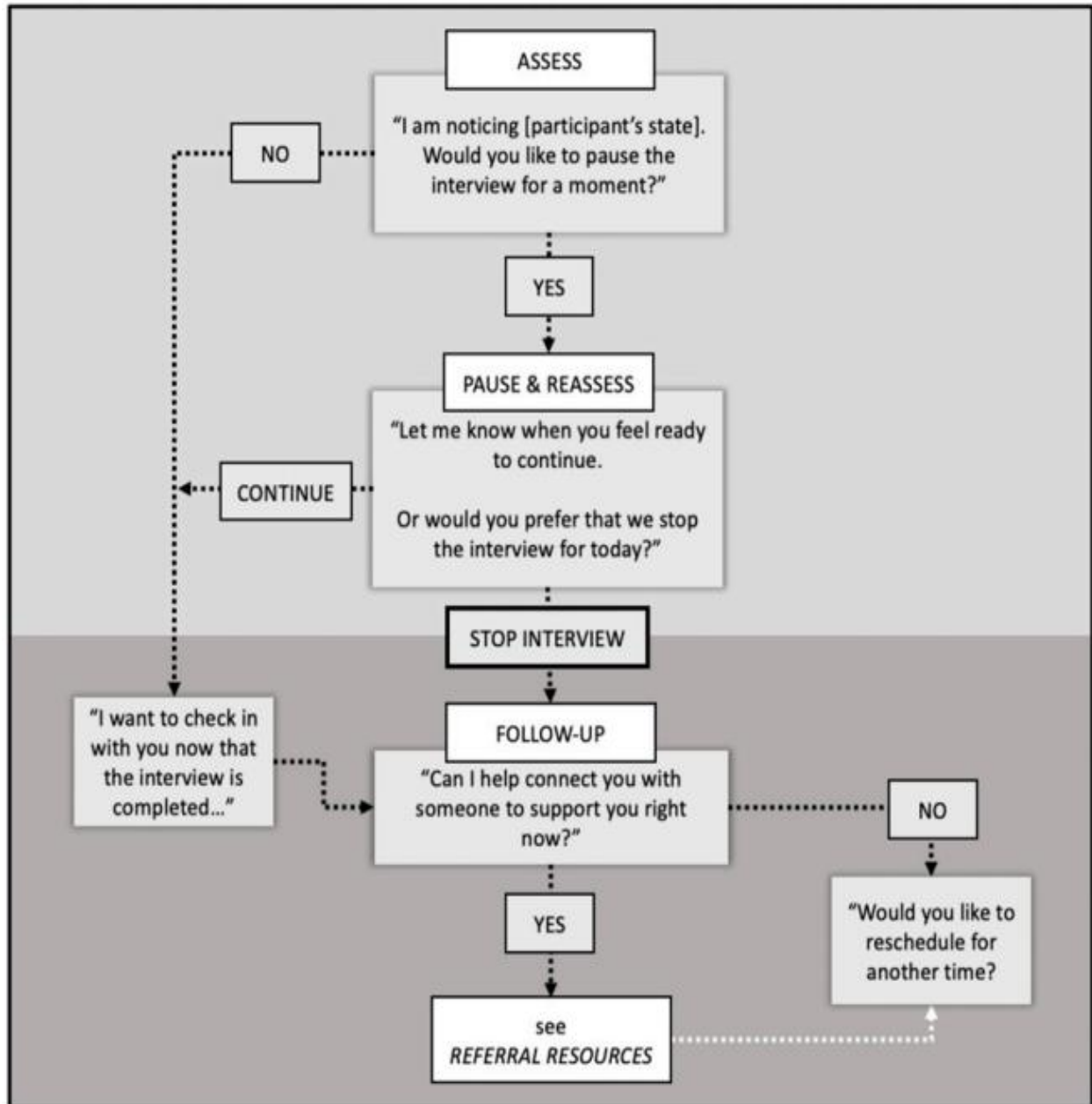
	63. Utilizing standardized tools or checklists to guide the development and implementation of paediatric burn discharge plans.	
Follow up care	64. Establishing a structured and individualized follow-up care plan for paediatric burn patients after their initial rehabilitation.	
	65. Regular and scheduled follow-up appointments with a multidisciplinary team to monitor progress and address evolving needs.	
	66. Providing ongoing scar management and wound assessment during the follow-up period for paediatric burn patients.	
	67. Incorporating psychosocial support and counseling as part of the follow-up care for paediatric burn patients and their families.	
	68. Tracking functional outcomes and rehabilitation progress during the follow-up period for paediatric burn patients.	
	69. Providing clear instructions and guidance for ongoing exercise therapy and home-based interventions during the follow-up period.	
	70. Continuity of care between different healthcare providers and specialists involved in the follow-up care for paediatric burn patients.	

ADDITIONAL COMMENTS FROM EXPERTS

Please provide any additional comments, suggestions, or explanations related to the ranking statements provided above. Your insights are valuable in developing a holistic paediatric burn management protocol. Feel free to elaborate on any aspect you consider relevant to the topics being evaluated.

Item No	Comments/Suggestions/Contributions

APPENDIX M: DISTRESS PROTOCOL



Referral Resource

Name: Elizabeth Yeboah (Clinical Psychologist)

Contact: +233 (0) 207363952

APPENDIX N – ETHICAL APPROVAL FROM UNIVERSITY OF WITWATERSRAND

M230512 MED23-05-033

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG



R14/49 Mrs Alberta A Rockson

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M230512 MED23-05-033

NAME: Mrs Alberta A Rockson
(Principal Investigator)
DEPARTMENT: School of Therapeutic Sciences
Department of Physiotherapy
Korle-Bu Teaching Hospital, Ghana
PROJECT TITLE: Development of a Protocol for Holistic Paediatric
Burns Management, Korle Bu Teaching Hospital, Ghana
DATE CONSIDERED: 26/05/2023
DECISION: Approved unconditionally
CONDITIONS: 
Paul Ruff (Nov 21, 2023 10:49 GMT+2)
SUPERVISOR: Dr Sonti Pilusa and Dr Natalie Benjamin-Damons

APPROVED BY:

Prof P Ruff, Chair, HREC (Medical)

DATE OF APPROVAL: 21/11/2023 **EXPIRY DATE:** 21/11/2028

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report** in May each year until study is closed. Failure to submit annual report will result in ethics clearance certificate suspension. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in May and will therefore be due in the month of May each year. Unreported changes to the application invalidate the clearance given by the HREC (Medical). Email signed copy of this ethics clearance certificate prior to commencing with the study hrec-medical.researchoffice@wits.ac.za

Principal Investigator Signature

Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX O – ETHICAL APPROVAL FROM KORLE BU TEACHING HOSPITAL

In case of reply the number
And the date of this
Letter should be quoted

My Ref. No. KBTH/MD/03/23
Your Ref. No. _____



KORLE BU TEACHING HOSPITAL
P. O. BOX KB 77,
KORLE BU, ACCRA.

Tel: +233 302 667759/673034-6
Fax: +233 302 667759
Email: info@kbtgh.gov.gh
prc@kbtgh.gov.gh
Website: www.kbtgh.gov.gh

7th September, 2023

ALBERTA AMISSAH ROCKSON
FACULTY OF HEALTH SCIENCES
SCHOOL OF THERAPEUTIC
DEPARTMENT OF PHYSIOTHERAPY

**DEVELOPMENT OF A HOLISTIC PAEDIATRIC BURNS MANAGEMENT
PROTOCOL, KORLE BU TEACHING HOSPITAL, GHANA**

KBTH-IRB 000166/2023

Investigator: ALBERTA AMISSAH ROCKSON

The Korle Bu Teaching Hospital Institutional Review Board (KBTH IRB) reviewed and granted approval to the study entitled: "Development of a Holistic Paediatric Burns Management Protocol, Korle Bu Teaching Hospital, Ghana"

Please note that the Board requires you to submit a final review report on completion of this study to the KBTH-IRB.

Kindly, note that, any modification/amendment to the approved study protocol without approval from KBTH-IRB renders this certify invalid.

Please report all serious adverse events related to this study to KBTH-IRB within seven days verbally and fourteen days in writing.

This IRB approval is valid till 31st August, 2024. You are to submit annual report for continuing review.

Sincere regards,


DR. DANIEL ANKRAH
VICE CHAIR (KBTH-IRB)
FOR: CHAIR (KBTH-IRB)

Cc: The Chief Executive Officer, KBTH
The Director of Medical Affairs, KBTH

APPENDIX P: ETHICAL APPROVAL EXTENSION LETTER FROM KORLE BU TEACHING HOSPITAL

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Your Ref. No.



KORLE BU TEACHING HOSPITAL
P. O. BOX KB 77,
KORLE BU, ACCRA.

Tel: +233 302 667759/673034-6
Fax: +233 302 667759
Email: Info@kbth.gov.gh
pr@kbth.gov.gh
Website: www.kbth.gov.gh

18th June, 2024

ALBERTA AMISSAH ROCKSON
FACULTY OF HEALTH SCIENCES
SCHOOL OF THERAPEUTIC
DEPARTMENT OF PHYSIOTHERAPY.

RE: REQUEST FOR EXTENSION OF APPROVAL OF STUDY
"DEVELOPMENT OF A HOLISTIC PAEDIATRIC BURNS MANAGEMENT PROTOCOL,
KORLE BU TEACHING HOSPITAL, GHANA"

Reference your letter dated 18th June, 2024 requesting for an extension of the approval of the research protocol.

The Korle-Bu Teaching Hospital Institutional Review Board (KBTH-IRB) reviewed and granted approval to your request for an extension for the approved protocol titled **"Development of a Holistic Paediatric Burns Management Protocol, Korle Bu Teaching Hospital, Ghana"**

KBTH – IRB /000166/2023

Investigator: ALBERTA AMISSAH ROCKSON

This extension requires that you comply with all other terms as specified in the original IRB approval of 7th September, 2023

Please report all serious adverse events related to this study to KBTH-IRB within seven days verbally and fourteen days in writing.

This IRB approval is valid till 31st August, 2025. You are to submit annual report for continuing review.

Sincere regards,

MR OKYERE BOATENG
CHAIR (KBTH-IRB)

Cc: The Chief Executive Officer
The Director of Medical Affairs

APPENDIX Q: INSTITUTIONAL APPROVAL LETTER

In case of reply the number
And the date of this
Letter should be quoted

My Ref. No. *KBTH/111/23*
Your Ref. No.



KORLE BU TEACHING HOSPITAL
P. O. BOX KB 77,
KORLE BU, ACCRA.

Tel: +233 302 667759/673034-6
Fax: +233 302 667759
Email: info@kbth.gov.gh
pr@kbth.gov.gh
Website: www.kbth.gov.gh

12th September, 2023

ALBERTA AMISSAH ROCKSON
FACULTY OF HEALTH SCIENCES
SCHOOL OF THERAPEUTIC
DEPARTMENT OF PHYSIOTHERAPY

**INSTITUTIONAL APPROVAL: KORLE BU TEACHING HOSPITAL-SCIENTIFIC
AND TECHNICAL COMMITTEE/INSTITUTIONAL REVIEW BOARD (KBTH-
STC/IRB/000166/2023**

Following approval of your study entitled "Development of a Holistic Paediatric Burns Management Protocol, Korle Bu Teaching Hospital, Ghana" by the Korle Bu Teaching Hospital-Scientific and Technical Committee/Institutional Review Board.

I am pleased to inform you that institutional approval has been granted for the conduct of your study in Korle Bu Teaching Hospital.

Please contact the Heads of Departments to discuss the commencement date of the study.

Please note that, this institutional approval is rendered invalid if the terms of the Institutional Reviewed Board/Scientific and Technical Committee approval are violated.

Sincere regards,

Dr. Frank Owusu-Sekyere
Director of Medical Affairs

Cc: The Chief Executive, Korle Bu

APPENDIX R – DECLARATION BY STUDENT AND CO-AUTHORS

Declaration: Student's contribution to article(s) and agreement of co-author(s)

I, [Alberta Amissah Nyarko] formally [Alberta Amissah Rockson], student number [2786206], declare that this Thesis/Dissertation/Research Report is my own work and that I contributed adequately towards research findings published in

the article(s) stated below which are included in my
Thesis/Dissertation/Research Report.

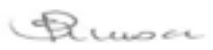


Signature of Student Date...3rd October 2025.....

Name of Supervisor.....Natalie Benjamin-Damons

Signature of Supervisor Date ...3rd October 2025.....

Name of Supervisor Sonti Pilusa

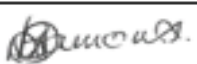
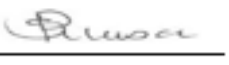


Signature of Supervisor Date...3rd October 2025.....

Agreement by co-authors: By signing this declaration, the co-authors listed below agree to the use of the article(s) by the student as part of his/her Thesis/Dissertation/Research Report. In cases where the student is not the 1st author of a published article, the primary supervisor must explain (under comments) why the student is entitled to use the paper for his/her degree purposes.

Article 1: Title: Prevalence and characteristics of paediatric burns at the National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana.....

Journal name, year, volume and page numbers: ...Burns Open, 2024, Volume 8, Issue 4, 100358.....

Authors	Name	Signature	Date
1 st author	Alberta Amissah Rockson		2/07/2024
2 nd author	Natalie Benjamin-Damons		02/07/2024
3 rd author	Sonti Imogene Pilusa		2/07/2024
4 th author			
5 th author			
6 th author			

Comments by primary supervisor:

Article 2: Title: Healthcare Practitioners' perspectives on paediatric burns management at
Korle Bu Teaching Hospital, Ghana.....

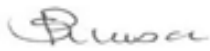
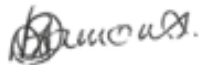
Authors	Name	Signature	Date
1 st author	Alberta Amissah Rockson		4/12/2024
2 nd author	Natalie Benjamin-Damons		4/12/2024
3 rd author	Sonti Imogene Pilusa		4/12/2024
4 th author			
5 th author			
6 th author			

Journal name, year, volume and page numbers: ...Burns Open, 2025, Vo-lume 9, 100387.....

Comments by primary supervisor:

Article 3: Title: ...Experiences of paediatric burn patients and their caregivers on burn management at Ghana's premier burns center: A qualitative study

Journal name, year, volume and page numbers: ...Burns, 2025, 107620

Authors	Name	Signature	Date
1 st author	Alberta Amissah Nyarko		7 th September 2025
2 nd author	Sonti Imogene Pilusa		7 th September 2025
3 rd author	Natalie Benjamin- Damons		7 th September 2025
4 th author			
5 th author			
6 th author			

Comments by primary supervisor:

.....

.....

APPENDIX S – PLAGIARISM DECLARATION



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I ALBERTA AMISSAH NYARKO (Student number: 2786206) am a student
registered for the degree of DOCTOR OF PHILOSOPHY in the academic year 2025.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: 

Date: 25TH MARCH 2025

APPENDIX T- PLAGIARISM REPORT

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108 Ono, Yasuo, Otohiko Kunii, Kunio Kobayashi,
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