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AGE-RELATED PATTERNS OF CHILDHOOD INJURIES IN PORT HARCOURT METROPOLIS HOSPITALS: A COMPARATIVE STUDY ACROSS FOUR AGE GROUPS

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Abstract: This comparative study analyzed age-related childhood injury patterns across four age groups in selected model primary healthcare centers in Port Harcourt metropolis (mPHCs). The research design was a descriptive study. The study population comprised 50 pediatric nurses from the mPHCs. Census sampling selected all eligible nurses. A self-structured instrument, age-related childhood injury patterns questionnaire, elicited data on injury trends. Expert review and pilot testing ensured validity and a Cronbach's alpha of 0.75 confirmed reliability. Data collection involved self-administered 50 copies of questionnaire distributed to participants. Descriptive statistics addressed the research questions on injury types and prevalence per age group. Inferential statistics using Chi-square and Likelihood ratio analyzed variable associations and tested hypotheses on age-injury associations. Key findings showed distinctive injury profiles for infants, toddlers, young children, and adolescents, indicating age as a major determinant of childhood injury patterns. Bruises, minor burns and ingestions predominated among infants and toddlers while cuts, fractures, and sprains were more prevalent in older groups. Injury prevalence per age revealed 1-5 years as the highest risk group. Inferential statistics confirmed significant associations between age and injuries like ingestion, sprains, and fractures. The study concluded that recognizing age-specific injury patterns is vital to guide targeted interventions and protocols for childhood injury prevention and management within pediatric primary care. Recommendations included developmental screening, age-appropriate parental education, and multi-sectoral collaboration to bolster child safety.
Keywords: Age-Related; Childhood injury patterns; Ingestion; Sprains; Fractures

1 BACKGROUND TO THE STUDY

Childhood represents a dynamic phase of exploration and growth, yet it is also a period where the risk for injuries significantly escalates, marking a fundamental public health concern worldwide. The World Health Organization (WHO) emphasizes the gravity of childhood injuries as a principal cause of death and disability globally, advocating for targeted healthcare interventions to mitigate these risks [1]. In the bustling urban landscape of Port Harcourt metropolis, the investigation into age-related patterns of childhood injuries within metropolitan hospital settings becomes indispensable. Such research is pivotal in comprehending the spectrum of injuries—ranging from falls, burns, ingestions, to lacerations—sustained by children and treated in these healthcare facilities, underlining the importance of age as a determinant in injury occurrence and pattern [2-3].

Notably, the categorization of childhood injuries according to age is not merely statistical but is crucial for tailoring risk factors and prevention strategies to align with different developmental stages. Studies have consistently indicated that the incidence and types of injuries children encounter vary markedly across age groups. For instance, infants and toddlers are predominantly at risk for unintentional injuries such as falls and burns, largely due to their confined mobility and nascent understanding of their environment [4]. Conversely, as children grow and engage more actively in outdoor activities and social interactions, they become increasingly vulnerable to injuries from road traffic accidents and violence, showcasing a distinct shift in the nature of risks encountered [5-6].

Moreover, the severity and outcomes of injuries, including the necessity for intensive care or the potential for long-term disability, exhibit significant variation by age, further are complicating the landscape of childhood injuries [3, 7]. Unintentional injuries, such as those resulting from falls, burns, and poisoning, are more common among younger children, often occurring within the ostensibly safe confines of their homes. On the other hand, older children are more susceptible to injuries sustained through road traffic accidents, sports, and outdoor activities, reflecting a broader range of exposure [3-4, 8]. Thus, this study sought to conduct a comparative analysis across four distinct age groups in Port Harcourt metropolis hospitals, to identify prevalent injury types within each age category and compare them. By exploring age-specific trends, the research endeavours to reveal nuances in injury patterns among children, informing targeted interventions to enhance primary health care providers' capabilities and improve pediatric emergency services and child health and safety in Port Harcourt metropolis and other metropolis in other parts of the world.

1.1 Statement of the Problem

The expanding field of midwifery and child health practice has brought to light a concerning issue - the rise of age-related childhood injuries, from minor bumps to concussions. These injuries are a significant worry for midwives, impacting children's developmental stages differently. The distinct injuries related to age groups, ranging from infants to adolescents, emphasize the need for thorough examination. Exploring these patterns is crucial for enhancing pediatric care and ensuring child safety in Port Harcourt's metropolis model primary healthcare centers (mPHCs) and the world at large.

1.2 Aim and Objectives

The study aimed to conduct a comparative analysis of age-related childhood injury patterns in selected mPHCs across four age groups in Port Harcourt metropolis, Rivers State. Specifically, the objectives were to:

1) Compare the types of childhood injuries across different age groups (<1 year, 1–5 years, 6–10 years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis
2) Identify the prevalence of childhood injuries among different age groups (<1 year, 1–5 years, 6–10 years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis.

1.3 Research Questions

1) What are the types of childhood injuries across different age groups (<1 year, 1–5 years, 6–10 years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis?
2) What is the prevalence of childhood injuries among different age groups (<1 year, 1–5 years, 6–10 years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis?

1.4 Hypothesis

H_0: There is no significant association between age groups (<1 year, 1–5 years, 6–10 years, >11 years) and prevalence of specific types of childhood injuries presented in selected mPHCs in Port Harcourt metropolis.

1.5 Conceptual Framework

The concept of this study is situated on comparative analysis of age-related childhood injury patterns in selected mPHCs across selected age groups as diagrammatically represented in Figure 1 below.

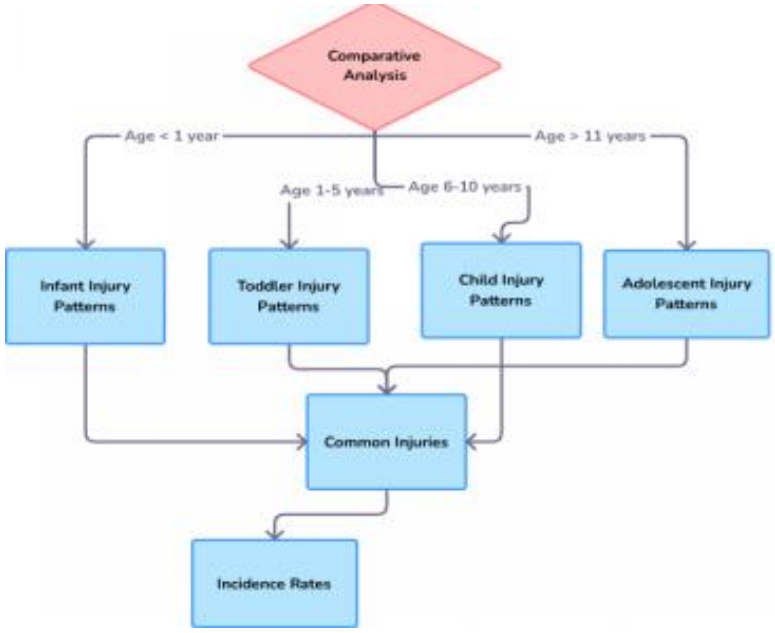

Figure 1 Schematic diagram on comparative analysis of age-related childhood injury patterns (Source: Researchers' conceptualization (2024))

2 LITERATURE REVIEW

Studies have shown that any childhood injury is a health problem if it restricts the child's normal life gratification; interferes with school, work, or family activities; results in professional visits or phone calls for prescription of remedies; requires debriding or sutures; needs surgery; or leaves lifelong marks [9-10]. As such, there is a public health interest in preventing and controlling childhood injuries due to the high societal cost, unique vulnerability, preventability, etiology, and the potential benefits of well-coordinated intervention. Thus, age-related childhood injuries significantly vary with the child's developmental stage, a fact that is crucial in primary healthcare, particularly within midwifery and child health practice. According to Ali et al. and Irgebay et al., injuries in children are distinctly marked by their prevalent age group, with the nature of these injuries intricately linked to the child's growth phase[11-12]. This aligns with Schuster et al., who emphasize the importance of a comparative analysis of these injury patterns to tailor healthcare interventions effectively. Infants, in their first year, face injury risks primarily due to their limited mobility[3]. Chaudhary et al. explain that the common injuries in this group include those that occur as a result of their developmental limitations[13]. This perspective is supported by Shields et al. and Shimony-Kanat and Benbenishty [14-15], who note that the rates of infant injuries surge with inexperienced caregivers. As children transition to the toddler stage, their injury patterns shift accordingly. Shimony-Kanat and Benbenishty point out that falls become a leading cause of injury, a notion supported by Bou-Karroum et al., and akin to Chaudhary et al. observations on the increased incidents of falls and collisions due to toddlers' enhanced mobility and curiosity[13, 15-16]. Moreover, Yu et al. and Odatuwa-Omagbemi et al. add that ingestion of small objects[17], alongside burns and drowning in water bodies, are significant concerns for toddlers. Damashek and Kuhn concur with this, stressing the importance of preventive measures for healthy growth and development during these early years[18]. For school-aged children, injuries during sports and recreational activities become more prevalent, leading to fractures, concussions, and soft tissue injuries as presented by Roby et al. [19].

More so, Bou-Karroum et al. and Kennedy et al. suggest that educational interventions targeting parents and caregivers play a crucial role in mitigating these injuries [10, 16]; a position supported by Roby et al. that commonality of such injuries in this age group[19]. Adolescent injury patterns diverge, with a higher prevalence of injuries from risk-taking behaviours like road traffic accidents and violence, as Mutto et al. and Yu et al. point out [17, 20]. Roby et al. emphasize the importance of addressing behavioral and mental health aspects to reduce these incidences. Moreover[19], Valerio et al. and Shields et al. note that seasonal variations influence the incidence rates of adolescent injuries, especially sports injuries, highlighting the need for environmental modifications to protect adolescents, as Chang et al. equally agree [14, 21].

3 THEORETICAL FRAMEWORK

The Haddon Matrix, a comprehensive framework developed by William Haddon Jr. in 1972, serves as a pivotal tool in injury prevention theory. This matrix, comprising three key factors - the host, agent, and environment, categorizes these elements across pre-event, event, and post-event phases[22]. By utilizing this structure, the Haddon Matrix theory enables a thorough examination of age-related injury patterns, particularly in childhood injuries within the Port Harcourt Metropolis Hospitals' various age groups (<1 year, 1–5 years, 6–10 years, >11 years). Such analysis facilitates the identification of injury causes and guides the implementation of targeted preventative measures and healthcare strategies tailored to developmental stages and specific injury agents. The host component pertains to the individual who sustains the injury**.**

4 METHODOLOGY

This study involved a comparative descriptive analysis of age-related childhood injury patterns in Port Harcourt metropolis hospitals across four age groups: <1 year, 1–5 years, 6–10 years, and >11 years. The study included all 50 pediatric trauma nurses, comprising both full-time and clinical staff from selected model primary healthcare centers. Census sampling was utilized to select participants with expertise in pediatric care and childhood injury management. A self-structured questionnaire, titled "Age-Related Childhood Injury Patterns Questionnaire (A-CIPQ),"was used to elicit information from the participants. The questionnaire items were designed to capture insights into age-related injury trends and nurses' experiences with childhood injuries. It underwent validation and reliability through expert review and pilot testing, achieving a reliability coefficient of 0.75 based on Cronbach's alpha. Data collection was performed using 50 copies of self-administered *A-CIPQ*. Descriptive statistics, such as frequencies and charts, were used to address the research questions, while inferential statistics, including Chi-square and Likelihood ratio, were employed to explore variable associations to test the hypotheses at 0.05 level of significance.

5 RESULTS

5.1 Answer to Research Questions

Research Question 1: What are the types of childhood injuries across different age groups (<1 year, 1–5 years, 6–10

years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis?

Table 1 Data on the types of childhood injuries across different age groups (<1 year, 1–5 years, 6–10 years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis.

Injuries		Age Group (Years)			
Types	Number of cases	<1	1–5	6–10	>11
Bruises	45	10	20	15	0
Minor burns	20	5	10	5	0
Ingestion	13	3	10	0	0
Cuts	12	2	5	5	0
Sprains	20	0	0	10	10
Fractures	10	0	0	0	10

Source: Omemu (2024)

Results in Table 1 show distinct categories of childhood injuries exhibited across varying age groups within the Port Harcourt metropolitan primary healthcare centers. Among infants under the age of one year, instances of bruising were reported, alongside incidents of inadvertent ingestion of hazardous substances. Additionally, minor burns were observed in this age group, with a particular vulnerability seen in children aged 1 to 5 years, predisposing them to such risks. Incidences of cuts and fractures were also noted. Furthermore, in the age range of 1 to 5 years, children encountered injuries stemming from play activities, manifesting as bruises, cuts, and fractures. Moreover, children aged 6 to 10 years faced a spectrum of childhood injuries, including bruises from sports engagements, burns, cuts resulting from tool handling, and sports-related fractures. Similarly, the older age bracket of 11 years and above presented reports of sports-related as well as road accident injuries, encompassing bruises, sprains, and fractures.

Research Question 2: What is the prevalence of childhood injuries among different age groups (<1 year, 1–5 years, 6–10 years, >11 years) presenting to selected mPHCs in Port Harcourt metropolis?

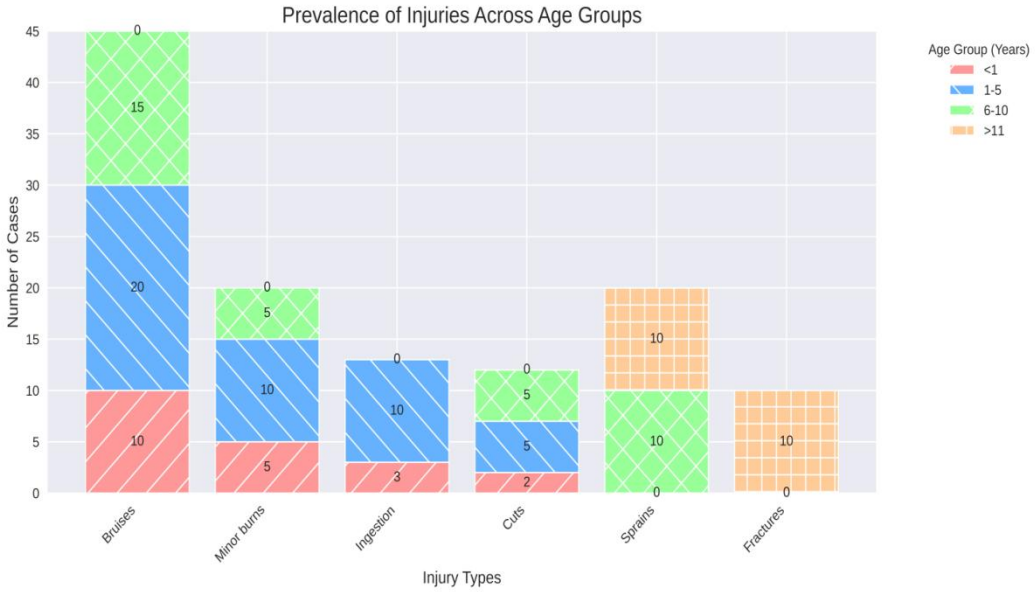

Figure 2 Prevalence of childhood injuries across age groups in selected mPHCs in Port Harcourt Metropolis

Results in Figure 1 showed the bar charts on childhood injuries cases among pediatric patients in selected mPHCs in Port Harcourt metropolis. Bruises have a high frequency across all age groups, with the most cases in the 1-5 years age group. Minor burns and ingestion injuries appear relatively consistent across the age groups, with a slightly higher occurrence in the 1-5 years age group. Cuts show a notable number of cases in the 1-5 years and 6-10 years age groups. Sprains and fractures are most common in the >11 years age group, indicating these types of injuries might be more prevalent in older children and teenagers. The prevalence indicates that the age group 1-5 years ranks the highest in the number of cases for bruises, minor burns, and ingestion. The age group 6-10 years and the age group >11 years rank the highest in the number of cases for cuts and sprains respectively. Lastly, the age group >11 years ranks the highest in the number of cases for fractures.

5.2 Test of Hypotheses

H0: There is no significant association between age groups (<1 year, 1–5 years, 6–10 years, >11 years) and prevalence of specific types of childhood injuries presented in selected mPHCs in Port Harcourt metropolis.

Table 2 Observed and Expected Frequencies for Childhood Injuries by Age.

	Observed Frequency					Expected Frequency				
Injuries	Age Groups				Total	Age Groups				Total
	<1	1-5	6-10	>11		<1	1-5	6-10	>11	
Bruises	10	20	15	0	45	15.00	20.00	15.00	10.00	60.00
Minor burns	5	10	5	0	20	6.67	8.89	6.67	4.44	26.67
Ingestion	3	10	0	0	13	5.50	7.33	5.50	3.67	23.00
Cuts	2	5	5	0	12	4.40	5.87	4.40	2.93	17.60
Sprains	0	0	10	10	20	4.40	5.87	4.40	2.93	17.60
Fractures	0	0	0	10	10	3.33	4.44	3.33	2.22	13.33

Results in Table 2 indicate that in the observed and expected frequencies of the childhood in selected mPHCs in Port Harcourt metropolis, bruises displayed notably higher observed frequencies than expected within all age groups. Minor burns generally corresponded closely with the anticipated values. Incidents of ingestion exceeded anticipated figures in all age categories, while cuts also manifested higher observed frequencies across the various age brackets. Noteworthy is the absence of observed sprains in the under 11 age group, aligning with the expected values in other demographics. Similarly, fractures were not documented in the under 11 and 5-6 age ranges, tracking closely with the projected values in the remaining age groups.

5.3 Calculating the Chi-Square Statistic

The formula used:

$$\boldsymbol{\chi}^2 = \sum \frac{(O_1 - E_1)^2}{\boldsymbol{E_1}} \quad (1)$$

where:
O_1 = Observed frequency
E_1 = Expected frequency
Degrees of freedom:
df = (r - 1) (c - 1)
where:
r = Number of rows
c = Number of columns
df = (6- 1) (4 - 1)

Table 3 Chi-Square Statistics for Each Childhood Injury Type

	Test	Statistic/Value	Degrees of Freedom	Critical Value (5% Significance Level)	Decision
Bruises	Chi-Square	11.788	3	7.815	Retained
	Likelihood Ratio	6.317	3		
Minor Burns	Chi-Square	11.788	3	7.815	Retained
	Likelihood Ratio	4.416	3		
Ingestion	Chi-Square	11.788	3	5.991	Not retained
	Likelihood Ratio	7.543	2		
Cuts	Chi-Square	11.788	3	7.815	Retained
	Likelihood Ratio	3.958	3		
Sprains	Chi-Square	11.788	3	3.841	Not retained
	Likelihood Ratio	25.265	1		
Fractures	Chi-Square	11.788	3	3.744	Not retained
	Likelihood Ratio	14.320	1		

The Chi-square and Likelihood ratio tests were applied to hypothetically test childhood injury types in line with the age groups. Table 3 exhibited a Chi-square value of 11.788 universally, with 3 degrees of freedom-- contrasting with varied critical values at a 5% significance level revealed insights. For Table 3a, the likelihood ratio test for bruises yielded 6.317 with 3 degrees of freedom, below the critical value of 7.815, suggesting no significant association between age groups and bruises. Similarly, Table 3b showed a likelihood ratio test of 4.416 with 3 degrees of freedom for minor burns, falling short of the critical value of 7.815, indicating a minor association with age groups. In Table 3c, the likelihood ratio test demonstrated a statistic of 7.543 with 2 degrees of freedom for ingestion, surpassing the critical value of 5.991, indicating a notable association. Table 3d's likelihood ratio test revealed 3.958 with 3 degrees of freedom for cuts, below the critical

value of 7.815, suggesting no substantive link. In Table 3e and f, the likelihood ratio test of 25.265 and 14.320 with 1 degree of freedom for sprains and fractures respectively surpassed the critical value of 3.841 and 3.744, emphasizing a significant association with age groups. As such, it can be established that the null hypotheses with regards to the associations between childhood injury patterns, such as ingestion, sprains as well as fractures, and the selected age groups are not retained while childhood injury patterns, such as bruises, minor burns as well as cuts, and the selected age groups are retained.

6 DISCUSSION

The research on age-related patterns of childhood injuries in Port Harcourt metropolis hospitals indicated that bruises were most common in infants (<1 year), followed by minor burns and ingestion-related injuries. This aligns with previous studies highlighting the high prevalence of bruises in infants [23-24]. As children aged into toddlers and young children (1-5 years), all injury types increased, with bruises remaining predominant and ingestion-related injuries rising significantly. Similarly, research by Chaudhary et al. recognized a broader range of injuries in this age group as injury risks evolved[13]. For school-age children (6-10 years), bruises remained prevalent, while sprains started appearing, contradicting the absence of sprains in younger age groups as reported by Trotter et al. [25]. The notable decrease in ingestion-related injuries with corresponding persistence of cuts and minor burns as observed by other authors [23-24] goes hand in hand with the findings of this study. In contrast, older children and adolescents (>11 years) showed a shift towards more severe injuries like sprains and fractures, a trend supported by Schuster et al.[3]. This evolving pattern of injury severity with age resonates with Valerio et al.'s examination of fractures across pediatric age groups, emphasizing the changing nature of injury risks as children progress through different developmental stages[21].

7 CONCLUSION

Based on the findings of this study, it can be concluded that childhood injury patterns vary markedly across age groups, with age functioning as a key determinant of injury susceptibility and type. Infants and toddlers predominantly face minor household injuries like bruises, burns, and ingestion, reflecting mobility and comprehension limits. As motor skills develop in early childhood, exposure expands to more diverse accidental injury risks through play and exploration. Older children encounter more recreational and outdoor hazards leading to cuts and fractures. Finally, adolescents show increased propensity for multi-system minor injuries stemming from risk-taking, signaling behavioral factors. Tracking these age-differentiated nuances is vital to advance child safety through tailored, developmentally-appropriate prevention, monitoring, and treatment aligned to injury profiles at each life stage. Although wider efforts are needed, targeted enhancements in pediatric primary care guided by these insights can strengthen prevention and evidence-based management across childhood.

8 RECOMMENDATIONS

1) The Ministry of Health should develop standardized protocols and training for mPHCs to implement age-specific injury prevention education and developmental screening as part of routine pediatric well-visits.
2) Relevant government agency should support mPHCs to establish community outreach initiatives to increase parents' and guardians' awareness of common childhood injury risks and precautionary measures appropriate for their child's developmental stage.
3) The Ministry of Education should mandate injury prevention topics in school curricula and require school management to conduct safety audits to minimize recreation-related injury hazards to school-aged children.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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