



From Caseload to Health System Change: Patterns and Outcomes of Pediatric ENT Emergencies in Burundi

—A Hospital-Based Analysis of Burden, Severity Profiles, and Clinical Outcomes

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Abstract

Background: Pediatric ENT emergencies are high-acuity presentations that require rapid intervention. In low-resource settings, they expose system fragilities, limited pediatric airway capacity, inequitable access, and high empirical antibiotic use, yet data from Burundi remain scarce. **Objective:** To analyze epidemiological patterns, etiologies, access inequities, management pathways, and antibiotic exposure among pediatric ENT emergencies at CHUK and derive feasible system-oriented reforms. **Methods:** Retrospective review of 651 pediatric ENT emergency cases (0 - 15 years) at CHUK from January 2018 to December 2019. Variables included sociodemographic features, geographic origin, symptoms, diagnoses, severity category, management, and outcomes. Fisher's exact test assessed associations between age and etiology. Antibiotic use was evaluated relative to WHO AWaRe stewardship principles. **Results:** Pediatric ENT emergencies accounted for 10.73% of all ENT consultations. Children < 5 years constituted 70.81% (mean age 4.08 years). Urban residence dominated (61.14% from Bujumbura Mairie). Peak presentations occurred in March and June. Etiologies were infectious (45.01%), foreign bodies (42.55%), traumatic/hemorrhagic (10.14%), malformative (0.92%), functional (0.92%), and tumoral (0.46%). Absolute emergencies (9.52%) were chiefly tracheo-bronchial foreign bodies (51.61%) and acute laryngitis (20.97%). Antibiotics were prescribed in 91.37% of all cases, including many non-infectious presentations. Outcomes were favorable in 19.35%; complications occurred in 2.31%; no deaths occurred; outcomes were undocumented in 78.19%. **Conclusion:** Pediatric ENT emergencies at CHUK are frequent, preventable, age-concen-

trated, and inequity-skewed. The high rate of non-indicated antibiotic use reflects systemic uncertainty rather than clinical need. Standardized triage training, district-level airway management capabilities, caregiver foreign-body prevention programs, and WHO AWaRe-aligned antibiotic stewardship can significantly reduce morbidity while preserving antimicrobial effectiveness.

Subject Areas

Clinical Medicine

Keywords

Pediatrics, Otorhinolaryngology, Emergencies, Foreign Body Aspiration, Antimicrobial Stewardship, Health Equity, Low-Resource Settings, Burundi

1. Introduction

Pediatric ENT emergencies pose unique risks because small anatomic airways can make minor pathology life-threatening in minutes. The WHO pediatric emergency care framework underscores the urgency of early recognition and standardized triage in resource-limited settings [1].

Across sub-Saharan Africa, ENT services remain under-resourced, with shortages of specialists and uneven geographic distribution of care [2]. Major pediatric foreign-body series from African centers show high caseloads, delayed referral, and preventable morbidity [3]. Parallel analyses of emergency systems in low- and middle-income countries (LMICs) consistently reveal fragmented pathways and limited early airway management capacity [4].

A second structural challenge involves antibiotic stewardship. Many LMIC settings demonstrate high empirical antibiotic use even in cases of mechanical or viral etiology, reflecting diagnostic uncertainty and the absence of guideline-linked prescribing frameworks. The WHO AWaRe classification provides a globally standardized stewardship approach and emphasizes rational pediatric prescribing [5].

This study applies a three-lens conceptual model:

- (1) Clinical Risk Lens: identifies time-critical ENT pathologies;
- (2) Health-Equity Lens: highlights geographic and socioeconomic access gaps documented in African emergency care literature [2] [4];
- (3) Stewardship Lens: evaluates antibiotic exposure in relation to AWaRe recommendations [5].

Using this model, we aim to:

- (1) Characterize the epidemiological burden of pediatric ENT emergencies at CHUK;
- (2) Examine equity-related access patterns;
- (3) Assess antibiotic use within an AWaRe-aligned framework;
- (4) Derive actionable system-level recommendations.

2. Methods

2.1. Study Design and Setting

This retrospective descriptive study was conducted at the CHUK ENT Department, Burundi's national referral center, which faces resource and referral constraints similar to those documented across SSA [2].

2.2. Participants

Children aged 0 - 15 years presenting with ENT emergencies between January 2018 and December 2019 were included. The 0 - 15-year definition aligns with CHUK's institutional pediatric policy and reflects national practice, where patients up to 15 years of age are managed within pediatric service lines. This cutoff also aligns with regional pediatric norms and WHO child health frameworks [1]. Files missing essential demographic or clinical information were excluded.

2.3. Variables and Operational Definitions

2.3.1. Sociodemographic Variables

Age, sex, residence (urban vs rural/peri-urban), province of origin, and school attendance were recorded.

2.3.2. Clinical Presentation

Symptoms, vital signs (when available), physical examination findings, and the organ/system involved were extracted.

2.3.3. Etiologic Categories

Etiologies were categorized following recognized pediatric ENT emergency classifications commonly used in low-resource African centers [2] [3], and were grouped as: Infectious, Foreign body, Traumatic/hemorrhagic, Functional, Malformative, and Tumoral

2.3.4. Severity Categories

Severity categories were aligned with clinical standards from regional emergency practice and pediatric airway risk literature [3] [6]. To enhance clarity and replicability, the severity classification was refined with clinical examples:

1) Absolute Emergency: Immediate threat to airway or life requiring rapid intervention.

Examples: tracheo-bronchial foreign body with respiratory distress; acute laryngitis with stridor and impending airway compromise; deep neck abscess causing airway deviation.

2) Relative Emergency: Urgent conditions requiring prompt evaluation but not immediately life-threatening.

Examples: auricular or nasal foreign bodies; acute otitis media with high fever; uncomplicated peritonsillar infections.

3) Functional Emergency: Conditions causing sudden functional impairment

without acute risk.

Examples: sudden-onset hearing loss; epistaxis without hemodynamic instability; severe dysphonia following minor trauma.

This clarified classification reflects CHUK's clinical decision-making norms and aligns with broader pediatric emergency standards.

2.3.5. Management Variables

Data included imaging, medical therapy, instrumental extraction, surgical intervention, and disposition.

2.3.6. Antibiotic Stewardship Framework (AWaRe-Aligned)

Antibiotic use was evaluated relative to the WHO AWaRe principles [5].

Definitions:

- 1) Indicated use: bacterial infection supported by symptoms and examination (e.g., deep neck infection, purulent otitis, cellulitis).
- 2) Non-indicated use: mechanical or traumatic etiologies without infection (e.g., foreign bodies, laryngitis without suppuration).
- 3) High-risk deviation: antibiotic use in etiologies with *zero* expected bacterial component.
- 4) Agent category: Access, Watch, or Reserve (per 2023 WHO classification).

2.4. Data Collection and Quality Assurance

A standardized data abstraction tool was used. Cross-checking for completeness and internal consistency was done daily. Unclear variables were excluded.

Quality assurance procedures followed WHO recommendations for pediatric emergency record abstraction and anonymization [1].

2.5. Statistical Analysis

Data were entered into Microsoft Excel 2010 and analyzed using standard descriptive statistics (frequencies, percentages, means, and ranges). Age was grouped into three bands (0 - 5, 5 - 9, 10 - 15 years). The association between age category and etiologic group was assessed using Fisher's exact test.

Post-hoc stewardship and prevention analysis included cross-tabulation of antibiotic exposure by etiology, assessment of seasonal clustering, and examination of diurnal presentation patterns to inform targeted reform. These analyses were exploratory and not primarily inferential.

Methods reflect common analytical approaches in pediatric ENT epidemiology and emergency databases [2] [6].

2.6. Ethical Approval

The CHUK Institutional Review Board granted ethical approval. All data were anonymized in compliance with WHO ethical standards for observational emergency research [1].

3. Results

3.1. Prevalence and Demographic Profile

Of 6281 ENT contacts during the study period, 651 pediatric emergencies were analyzable, representing 10.73% of all ENT consultations. The majority of patients were aged 0 - 5 years (461/651; 70.81%), followed by 5 - 9 years (125; 19.20%) and 10 - 15 years (65; 9.99%). The mean age was 4.08 years (range 1 - 15 years) (**Figure 1**). The burden in children under five mirrors findings from major African pediatric foreign-body and emergency ENT series [3] [7] [8].

Males accounted for 52.4% and females for 47.6% of cases (sex ratio 1.10) (**Figure 2**).

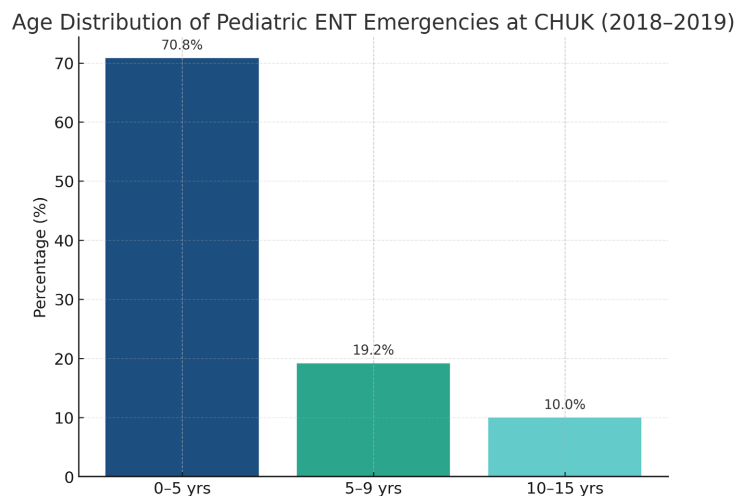


Figure 1. Age distribution of pediatric ENT emergencies at CHUK (2018-2019).

Caption: Age distribution bar chart in which the 0 - 5 years' group dominates, accounting for roughly 71% of pediatric ENT emergencies, with much smaller contributions from older age bands.

Sex Distribution of Pediatric ENT Emergencies

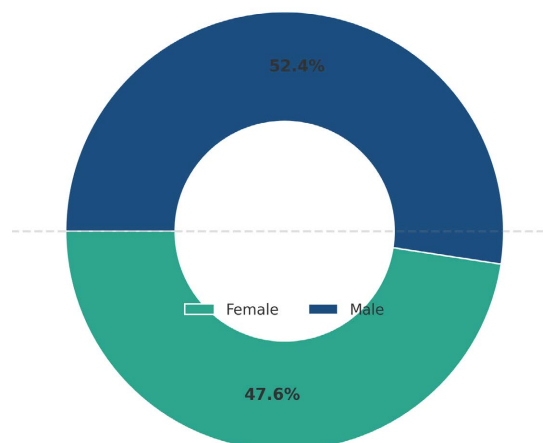


Figure 2. Sex distribution of pediatric ENT emergencies at CHUK.

Caption: Semi-circular chart split into two near-equal segments showing 52.4% of cases in males and 47.6% in females.

3.2. Geographic Access and Pathways of Care

Most patients resided in Bujumbura Mairie (398/651; 61.14%), followed by Bujumbura Province (102; 15.67%); the remaining cases were distributed across other provinces, with five referrals from the Democratic Republic of Congo. Within Bujumbura Mairie (n = 398), Ntakangwa commune accounted for 321 patients (80.65%), highlighting a pronounced urban cluster.

Overall, 68.36% of children presented directly to CHUK, while 31.64% were transferred, predominantly from district hospitals (Figure 3). This pattern replicates those observed across the SSA, where tertiary ENT services are concentrated in urban hospitals [2]. Most consultations occurred during office hours (70.66%), suggesting both an urban access advantage and potential under-representation of severe rural cases.

Mode of Admission for Pediatric ENT Emergencies

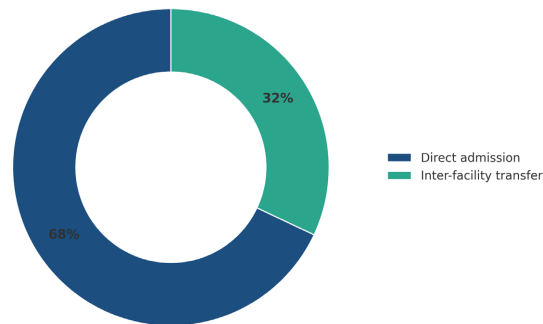


Figure 3. Mode of admission for pediatric ENT emergencies.

Caption: Donut chart showing that approximately two-thirds of pediatric ENT emergencies present directly to CHUK, while one-third are referred from other facilities.

3.3. Consultation Patterns over Time

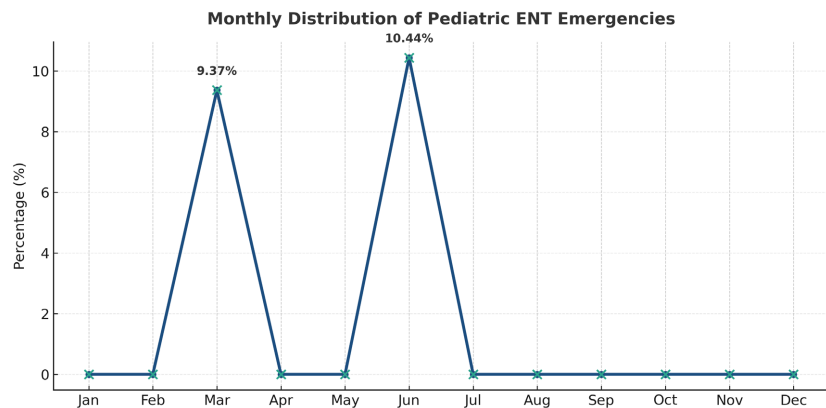


Figure 4. Monthly distribution of pediatric ENT emergencies (2018-2019).

Caption: Line graph showing monthly pediatric ENT emergency counts with pronounced peaks in March and June and lower numbers in other months.

Monthly case distribution revealed peaks in June (68/651; 10.44%) and March (61/651; 9.37%), suggesting seasonality consistent with respiratory infections and school-related exposures (**Figure 4**). Seasonal peaks correspond to patterns observed in pediatric respiratory and infectious disease data in LMICs [8].

3.4. Presenting Complaints and Examination Findings

The leading motives for consultation were foreign body (271/651; 41.62%), pain (138; 21.19%), fever (128; 19.66%), swelling (102; 15.66%), and respiratory difficulty (65; 9.98%) (**Table 1**). Foreign bodies dominated presentations, consistent with multiple African clinical series [3] [9]-[11].

Table 1. Main motives for consultation among pediatric ENT emergencies (n = 651).

Motive	Frequency	Percentage (%)
Foreign body	271	41.62
Pain	138	21.19
Fever	128	19.66
Swelling	102	15.66
Respiratory difficulty	65	9.98

Caption **Table 1**: Foreign body complaints dominate initial presentations, followed by pain, fever, and swelling in pediatric ENT emergencies at CHUK.

On examination, many children had normal findings, but notable abnormalities included external auditory canal foreign bodies (19.81%) and congested tympanograms (17.05%).

3.5. Etiology and Severity

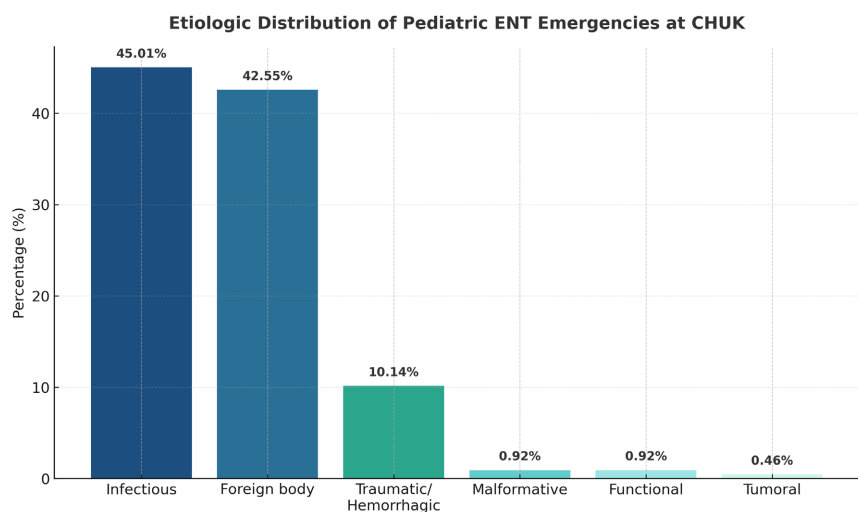


Figure 5. Etiologic distribution of pediatric ENT emergencies at CHUK.

Caption: Bar chart showing that infectious (45.0%) and foreign body (42.6%) etiologies dominate pediatric ENT emergencies, with much smaller contributions from trauma and rare malformative, functional, and tumoral causes.

Infectious etiologies accounted for 293/651 cases (45.01%), foreign bodies 277 (42.55%), traumatic/hemorrhagic 66 (10.14%), malformative and functional etiologies 6 each (0.92%), and tumoral causes 3 (0.46%) (**Figure 5**).

Urgency classification revealed that relative emergencies comprised 582/651 cases (89.40%), absolute emergencies 62 (9.52%), and functional emergencies 7 (1.08%). Among absolute emergencies, tracheo-bronchial foreign bodies (32/62; 51.61%) and acute laryngitis (13/62; 20.97%) were dominant (**Table 2**). High representation of tracheo-bronchial foreign bodies among absolute emergencies corresponds to established airway emergency literature [3] [9].

Table 2. Absolute pediatric ENT emergencies (n = 62).

Diagnosis	Frequency	Percentage (%)
Tracheo-bronchial foreign body	32	51.61
Acute laryngitis	13	20.97
Adenophlegmon	5	8.06
Choanal atresia	5	8.06
Peritonsillar abscess	3	4.84
Other	4	6.45

Caption **Table 2**: Composition of absolute pediatric ENT emergencies, led by tracheo-bronchial foreign bodies and acute laryngitis.

Relative emergencies were dominated by auricular foreign bodies, acute otitis media, nasal foreign bodies, hot abscesses, and acute tonsillitis (**Table 3**). Deep neck infections, though less frequent, require airway vigilance as emphasized in pediatric airway literature [6] [12].

Table 3. Main relative pediatric ENT emergencies (top diagnoses).

Diagnosis	Frequency	Percentage (%)
Auricular foreign body	129	22.16
Acute otitis media	101	17.35
Nasal foreign body	84	14.93
Hot abscess	83	14.26
Acute tonsillitis	50	8.58

Caption **Table 3**: Top relative emergencies showing a high burden of auricular and nasal foreign bodies and acute otitis media.

Fisher's exact test showed a significant association between age category and etiologic group ($p < 0.0001$), with malformative etiologies clustered in the 0 - 5-

year band and functional etiologies more frequent in adolescents, indicating that emergencies are not evenly distributed across developmental stages [7]-[10].

3.6. Foreign Body Types and Risk-to-Harm Profile

Foreign bodies accounted for 277 cases (42.55%). The most frequent items were beans/haricot grains (15.67%), coins (8.96%), maize grains (3.73%), pearls (2.99%), metal fragments (2.61%), and insects (1.12%), among others (Figure 6).

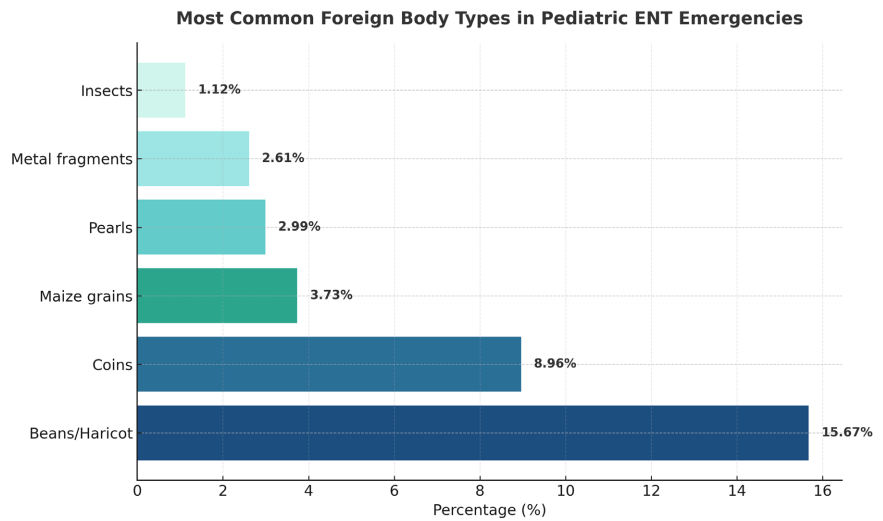


Figure 6. Common foreign body types in pediatric ENT emergencies (top 10, n = 277).

Caption: Horizontal bar chart showing beans and coins as the most frequent pediatric ENT foreign bodies, followed by maize, pearls, and smaller numbers of stones, metal fragments, and insects.

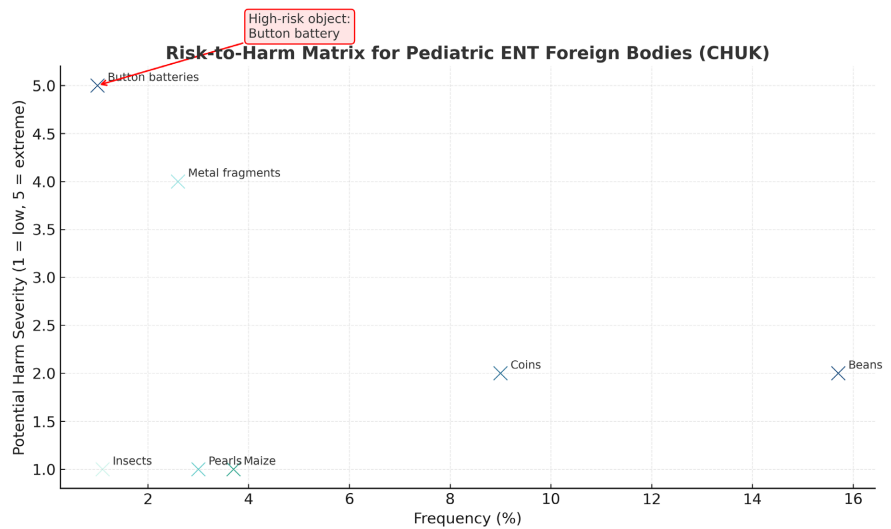


Figure 7. Risk-to-harm matrix for pediatric ENT foreign bodies (CHUK).

Caption: Scatter plot mapping common foreign bodies by how often they occur

and how dangerous they are, with beans and coins frequent but relatively less harmful, and button batteries rare but extremely high-risk.

Although several objects (e.g., beans, coins) were low-risk from a tissue-injury perspective, the risk-to-harm relationship was not proportional to frequency. The conceptual risk-to-harm matrix (**Figure 7**) illustrates that button batteries, though infrequent ($\approx 1.1\%$), occupy the highest severity zone because of rapid caustic injury and mucosal necrosis, while beans and coins cluster in the high-frequency but lower-severity quadrant unless airway obstruction occurs. Frequency–severity discordance (beans frequent; button batteries rare but catastrophic) mirrors global pediatric safety reports and battery injury data [8] [13].

This pattern underscores the dual nature of CHUK’s foreign body burden: common, household-driven objects that are largely preventable, and rare but high-stakes objects requiring rapid recognition and definitive intervention.

3.7. Diagnostics and Management

Imaging was used selectively: chest X-ray in 9.06%, sinus X-ray in 1.23%, and ultrasound in 2.61% of cases. Radiography most frequently identified esophageal (34.34%) or bronchial (26.86%) foreign bodies, while 23.39% of radiographs were reported as inconclusive.

Ambulatory care accounted for 89.09% of management episodes. Care sites included the ENT clinic (55.30%), operating room (41.32%), and inpatient ward (3.38%). Treatments included medical therapy (69.43%), instrumental procedures (42.55%; foreign-body extraction success 96.75%), and surgery (18.74%; incision–drainage comprising 72.95% of surgical cases) (**Figure 8**). Extraction success rates aligned with African tertiary center outcomes for pediatric foreign bodies [9]–[11].

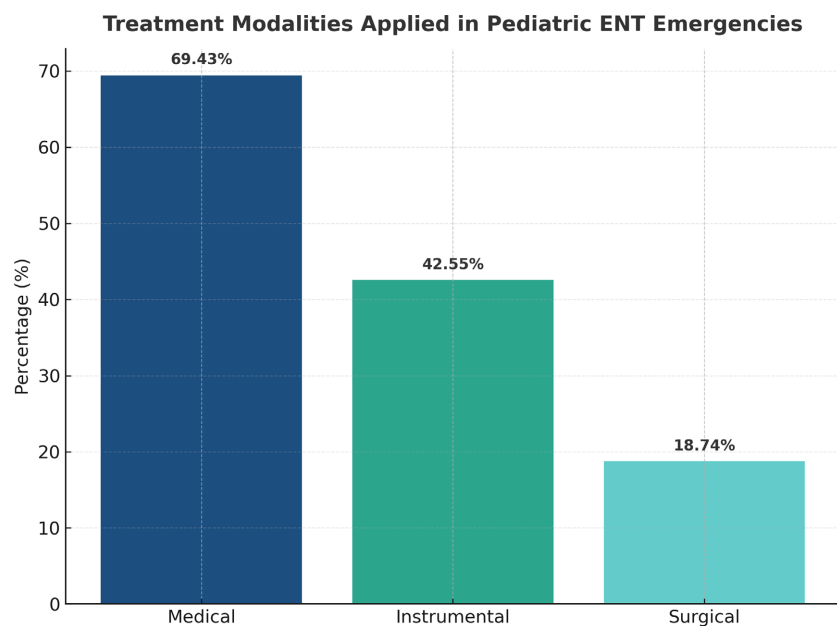


Figure 8. Treatment modalities applied in pediatric ENT emergencies (n = 651; non-exclusive).

Caption: Bar chart comparing how often children received medical, instrumental, or surgical treatment, showing that medical treatment is most common, followed by instrumental procedures and then surgery.

3.8. Antibiotic Exposure Relative to AWaRe

Antibiotic exposure was high across etiologies. Among clearly infectious cases (45.01%), antibiotics were expected and administered at a high rate. Parallels LMIC pediatric antibiotic exposure studies [14] and AMR surveillance trends documented in the WHO GLASS report [15]. Strikingly, foreign body cases (42.55%), traumatic/hemorrhagic etiologies (10.14%), and other etiologies (<2%) also showed high antibiotic exposure, despite antibiotics being indicated only selectively or on a case-by-case basis (Table 4; Figure 9).

Pediatric antimicrobial stewardship interventions have shown significant benefits in similar hospital settings [16] [17], and caregiver education reduces unnecessary prescribing [18].

Table 4. Antibiotic exposure by etiologic group (stewardship focus).

Diagnosis	Frequency	Percentage (%)
Auricular foreign body	129	22.16
Acute otitis media	101	17.35
Nasal foreign body	84	14.93
Hot abscess	83	14.26
Acute tonsillitis	50	8.58

Caption **Table 4:** Antibiotic exposure patterns demonstrate high use even in etiologic groups where antibiotics are not routinely indicated, signaling stewardship gaps.

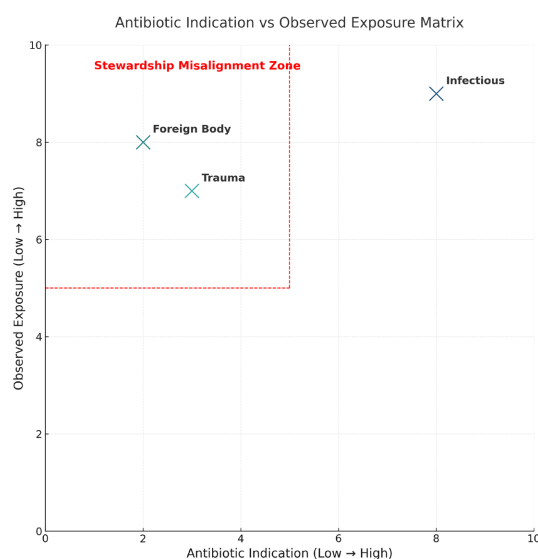


Figure 9. Antibiotic indication versus exposure matrix.

Caption: Grid diagram showing that infectious cases sit where both indication and use are high, while foreign body and traumatic cases sit where indication is low but use is still high, indicating over-prescription.

3.9. Outcomes

Documented outcomes were favorable in 19.35% of cases; complications occurred in 2.31%, and 0.15% of patients were transferred. Outcome status was not documented in 78.19% of cases, although no deaths were recorded.

Outcome documentation gaps reflect system-level constraints typical of manual record environments in low-resource settings [4].

4. Discussion

4.1. Summary of Dominant Findings

This study reveals a high burden of pediatric ENT emergencies driven predominantly by early-childhood susceptibility, foreign-body injuries, and infectious conditions. Major inequities in access and referral patterns, combined with high rates of non-indicated antibiotic exposure, underscore critical health-system gaps.

These findings demonstrate a preventable, early-childhood-dominated emergency burden, matching patterns across SSA pediatric ENT literature [2] [3] [8]-[11].

4.2. Health Equity and Referral Differentials

The over-representation of urban cases mirrors known geographic inequities in Burundi's health system. Rural under-representation likely reflects several systemic barriers, including:

- 1) Long travel distances and transportation costs are inhibiting timely care;
- 2) Limited ENT recognition capacity at primary health facilities;
- 3) Variable district-level readiness for airway stabilization;
- 4) Delayed referral due to inadequate triage or diagnostic uncertainty;
- 5) Caregiver hesitation caused by limited awareness of danger signs.

Similar patterns have been described in sub-Saharan Africa, where ENT services are concentrated in a few urban tertiary centers, leaving district hospitals with minimal capacity for airway stabilization or foreign-body removal [2] [6]. Broader emergency care system reviews across 59 LMICs highlight fragmented referral pathways and underdeveloped early-recognition systems, further contributing to delayed care [4]. Strengthening district-level ENT readiness and pre-referral stabilization emerges as a clear priority.

4.3. Developmental and Behavioral Drivers of Emergencies

Children under five exhibit the highest vulnerability, consistent with aspiration and ingestion physiology described in global and African studies [7]-[10]. Behavioral tendencies (oral exploration), immature neuromuscular coordination, and household risk factors (small objects within reach, inadequate supervision) col-

lectively contribute to this pattern. Battery ingestion remains a particularly high-severity event, with rapid mucosal necrosis documented in clinical Series [8].

4.4. Preventable Etiologies and Public-Health Opportunities

Foreign bodies, especially beans, coins, and other small household items, accounted for the majority of emergency etiologies. Similar to Nigerian and East African centers [9]-[11], highlight the potential for targeted prevention: caregiver education, safe-storage campaigns, and community messaging around choking hazards. A two-tier model combining school-based education with community health-worker engagement could significantly reduce incidence.

Deep neck infections, although less frequent, require high-acuity capacity and underscore the importance of early detection at district facilities; studies show that outcomes improve with earlier diagnosis and stabilization [12] [13].

4.5. Airway Emergencies as System “Stress Tests”

Tracheo-bronchial foreign bodies constituted a major proportion of absolute emergencies. Large pediatric foreign-body series from Algeria [3] and Nigeria [9] [10] show similar dominance, reinforcing the vulnerability of children under five who engage in oral exploration and lack coordinated swallowing reflexes. Tanzanian data likewise demonstrate that foreign-body emergencies remain among the most frequent ENT presentations and are strongly shaped by caregiver practices and early recognition gaps [11]. High extraction success rates at CHUK suggest that system delays occur upstream, at the community and district levels, rather than at the tertiary center.

4.6. Antibiotic Overuse and Stewardship Gaps (AWaRe-Aligned)

Although infectious etiologies were common, antibiotic exposure occurred even in conditions with zero expected bacterial component, such as mechanical foreign bodies. Beyond structural gaps in stewardship frameworks, high antibiotic use likely reflects:

- 1) Clinical diagnostic uncertainty in facilities without imaging or endoscopy;
- 2) Prescribing norms and habits rooted in training and systemic expectations;
- 3) Caregiver-driven pressure in acute pediatric presentations;
- 4) Over-reliance on empiric therapy due to the absence of rapid diagnostic tools.

The 91% antibiotic exposure rate observed in this study, including in non-infectious etiologies, aligns with LMIC estimates of very high antibiotic exposure in children under five [14]. Global AMR surveillance through the WHO GLASS system indicates that inappropriate pediatric antibiotic use substantially contributes to resistance patterns worldwide [15].

Pediatric antimicrobial stewardship programs (ASPs) have demonstrated meaningful reductions in inappropriate prescribing when implemented in hospitals, combining guideline reinforcement, clinician decision-support, and targeted

audits [16] [17]. Notably, caregiver expectations strongly influence prescription behavior; randomized trials show that parent-level education can significantly reduce unnecessary antibiotic use [18].

In this context, aligning CHUK's pediatric ENT pathways with AWaRe principles [5] [19], including clearer definitions of "indicated" versus "non-indicated" use, represents a high-yield system reform with immediate feasibility.

4.7. Outcome Documentation Gap

A striking 78.19% of patient outcomes were undocumented, representing a major systems-level blind spot. Several structural reasons likely contribute:

- 1) High patient volume limits time for end-of-care documentation;
- 2) Fragmented or manual record-keeping systems;
- 3) Lack of standardized discharge templates;
- 4) Clinical workflow prioritizing acute care over data capture;
- 5) Minimal audit culture reinforcing completion.

This documentation gap obscures true morbidity estimates, complicates quality-improvement initiatives, and limits the ability to evaluate the effectiveness of clinical interventions [4]. Strengthening record-keeping should be a central quality-improvement priority.

4.8. Strengths and Limitations

Strengths of this study include the relatively large sample size, representation of national-referral-level practice, and explicit integration of health equity and stewardship lenses rather than purely descriptive epidemiology.

Limitations include the retrospective design, incomplete documentation of outcomes (78.19% unknown), and lack of granular dose-duration data for antibiotic prescriptions. Community-level cases that never reached CHUK are not captured, so our estimates of national burden are conservative. Finally, etiologic categorization was based on available clinical records; misclassification cannot be excluded.

5. Strategic Implications for CHUK and National Reform

As the national referral center, CHUK is uniquely positioned to anchor a phased pediatric emergency care reform:

5.1. Clinical Readiness and Triage

Strengthening pediatric airway readiness is essential. WHO ETAT recommends standardized triage and early recognition systems suitable for low-resource emergency units [1].

5.2. District-Level Capacity and Referral Optimization

Sub-Saharan ENT service gaps, including the bottlenecks seen in Tanzania and Nigeria [2] [6] [10] [11], highlight the need for:

- 1) Basic ENT emergency kits at district hospitals.

- 2) Standardized pre-referral stabilization.
- 3) Direct communication channels with CHUK to mitigate LMIC-style referral fragmentation.

5.3. AWaRe-Aligned Antimicrobial Stewardship

Given high antibiotic exposure rates, integrating AWaRe principles into pediatric ENT algorithms is a feasible, high-yield system improvement [5] [19]. Evidence shows pediatric ASPs reduce inappropriate prescribing [14] [17], particularly when reinforced by community and parent-level education strategies [18].

Developing local diagnostic-linked prescribing pathways is essential.

5.4. CHUK as National Tele-ENT and Simulation Hub

Telemedicine improves diagnostic concordance and satisfaction in ENT care [20].

CHUK can extend expert oversight to district hospitals through:

- 1) Tele-ENT consultation channels.
- 2) Airway simulation training programs.
- 3) Remote decision-support for foreign-body management.

This helps distribute specialist expertise more equitably across Burundi.

6. Actionable Recommendations

6.1. Clinical Practice

- 1) Implement ETAT-aligned pediatric ENT triage protocols in the emergency department;
- 2) Maintain ready-to-use airway and foreign-body carts in the ER and operating room, with monthly readiness checks;
- 3) Use the stewardship pathway as the default framework for antibiotic decisions in ENT emergencies.

6.2. Policy and System Organization

- 1) Integrate pediatric ENT indicators (e.g., foreign body aspiration, deep neck infection, acute otitis media with complications) into the national health information system;
- 2) To operationalize district readiness, each district hospital should be equipped with a minimum pediatric ENT emergency kit, including:
 - a) Headlamp with rechargeable power source.
 - b) Pediatric and adult Magill forceps.
 - c) Manual or battery-powered suction device with pediatric tubing.
 - d) Basic foreign-body extraction tools (crocodile forceps, ear cures).
 - e) Portable flexible nasopharyngoscope, where feasible.
 - f) Nebulization set for airway emergencies (e.g., for adrenaline and corticosteroid delivery).

This structured kit list enhances implement ability and supports national-level procurement planning.

3) Strengthen coordinated transport and referral mechanisms for time-critical emergencies.

6.3. Research and Quality Improvement

1) Establish a prospective CHUK-anchored pediatric ENT emergency registry with a limited, pragmatic variable set;

2) Evaluate the effectiveness of school-based and caregiver-focused choking-prevention campaigns in high-incidence communities;

3) Assess the impact of tele-ENT support on referral appropriateness, delays, and complication rates.

7. Conclusion

Pediatric ENT emergencies in Burundi represent a preventable yet high-burden clinical domain marked by early-childhood vulnerability, geographic inequities, and substantial stewardship gaps. Strengthening district-level capacity, integrating WHO AWaRe principles, improving documentation practices, and expanding tele-ENT support represent practical, scalable pathways toward improved outcomes.

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Ethics Approval

Ethical approval was granted; individual consent was waived due to the retrospective design and anonymized data.

Data Availability

An anonymized dataset underlying this article is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] World Health Organization (2013) Pocketbook of Hospital Care for Children: Guidelines for the Management of Common Childhood Illnesses. 2nd Edition, WHO.
- [2] Mulwafu, W., Kuper, H., Viste, A. and Goplen, F.K. (2017) Ten Years of Ear, Nose, and Throat Services in Malawi: Trends and Challenges. *Global Health Action*, **10**, Article 1289736.

- [3] Boufersaoui, A., Smati, L., Benhalla, K.N., Boukari, R., Smail, S., Anik, K., *et al.* (2013) Foreign Body Aspiration in Children: Experience from 2624 Patients. *International Journal of Pediatric Otorhinolaryngology*, **77**, 1683-1688. <https://doi.org/10.1016/j.ijporl.2013.07.026>
- [4] Obermeyer, Z., Abujaber, S., Makar, M., Stoll, S., Kayden, S.R., Wallis, L.A., *et al.* (2015) Emergency Care in 59 Low- and Middle-Income Countries: A Systematic Review. *Bulletin of the World Health Organization*, **93**, 577-586. <https://doi.org/10.2471/blt.14.148338>
- [5] World Health Organization (2022) WHO Model List of Essential Medicines for Children, 8th List (2021): Including the 2022 AWARe Antibiotic Book. World Health Organization
- [6] Adoga, A., Ma'an, N.D., Embu, H.Y. and Obindo, T.J. (2017) Management of Upper Airway Obstruction in a Resource-Limited Setting *Annals of African Medicine*, **16**, 81-84.
- [7] Kitcher, E.D., Jangu, A. and Baidoo, K. (2007) Emergency ENT Admissions at Korle-Bu Teaching Hospital. *Ghana Medical Journal*, **41**, 9-11.
- [8] Litovitz, T., Whitaker, N., Clark, L., White, N.C. and Marsolek, M. (2010) Emerging Battery-Ingestion Hazard: Clinical Implications. *Pediatrics*, **125**, 1168-1177. <https://doi.org/10.1542/peds.2009-3037>
- [9] Ibekwe, T.S., Onotai, L.O. and Otaigbe, B. (2007) Foreign Body in ENT in Children. *Emerg Med Australas. Emergency Medicine Australasia*, **19**, 76-77.
- [10] Onotai, L.O. and Ibekwe, M.U. (2012) Foreign Bodies in ENT in a Nigerian Tertiary Hospital. *African Journal of Paediatric Surgery*, **9**, 3-7.
- [11] Abraham, Z.S., Kahinga, A.A., Khamis, K.O. and Liyombo, E. (2023) Clinical Spectrum of ENT Foreign Bodies. *Annals of Medicine & Surgery*, **85**, 3403-3408.
- [12] Coticchia, J.M., Yun, R.D., Nelson, L., Koempel, J., Carron, J.D. and Chan, K.H. (2004) Pediatric Deep Neck Infections. *Archives of Otolaryngology-Head & Neck Surgery*, **130**, 201-207.
- [13] Patigaroo, S.A., Raina, R.K., Ahmad, R. and Ahmad, R. (2012) Foreign Body Aspiration in Children: Retrospective Analysis. *Emergency Medicine (Los Angeles)*, **2**, Article 117.
- [14] Fink, G., D'Acromont, V., Leslie, H.H. and Cohen, J. (2020) Antibiotic Exposure among Children Younger than 5 Years in Low-Income and Middle-Income Countries: A Cross-Sectional Study of Nationally Representative Facility-Based and Household-Based Surveys. *The Lancet Infectious Diseases*, **20**, 179-187. [https://doi.org/10.1016/s1473-3099\(19\)30572-9](https://doi.org/10.1016/s1473-3099(19)30572-9)
- [15] World Health Organization (2024) Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2024. WHO.
- [16] Donà, D., Barbieri, E., Daverio, M., Lundin, R., Giaquinto, C., Zaoutis, T., *et al.* (2020) Implementation and Impact of Pediatric Antimicrobial Stewardship Programs: A Systematic Scoping Review. *Antimicrobial Resistance & Infection Control*, **9**, Article No. 3. <https://doi.org/10.1186/s13756-019-0659-3>
- [17] Wang, H., Wang, H., Yu, H., *et al.* (2021) Antibiotic Stewardship to Reduce Inappropriate Pediatric Prescribing. *Frontiers in Pharmacology*, **12**, Article ID: 601561.
- [18] Taylor, J.A., Kwan-Gett, T.S.C. and McMahon, E.M. (2005) Effectiveness of a Parental Educational Intervention in Reducing Antibiotic Use in Children. *Pediatric Infectious Disease Journal*, **24**, 489-493. <https://doi.org/10.1097/01.inf.0000164706.91337.5d>

- [19] World Health Organization (2023) WHO Aware Classification of Antibiotics, 2023 Update. WHO.
- [20] Ning, A.Y., Cabrera, C.I. and D'Anza, B. (2020) Telemedicine in Otolaryngology: A Systematic Review of Image Quality, Diagnostic Concordance, and Patient and Provider Satisfaction. *Annals of Otolaryngology, Rhinology & Laryngology*, **130**, 195-204. <https://doi.org/10.1177/0003489420939590>