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Adherence to National Guidelines by Healthcare Practitioners in the Management of Acute Asthma among Children at a Nairobi County Facility, Kenya

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Keywords:

*Asthma,
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Kenya.*

Asthma is a global health burden, with over 300 million people affected. Guidelines provide a framework of reference by healthcare workers for the management and improvement of care for patients. The Ministry of Health has provided Kenya Asthma Management Guidelines to help reduce the mortality and morbidity of asthma. This study assessed adherence to national asthma guidelines and short-term patient outcomes at Mama Lucy Kibaki Hospital (MLKH), Kenya and identified barriers to their implementation. A mixed-methods study conducted included a retrospective design that quantitatively reviewed the medical records of 135 children aged 3-18 years where data on initial assessment, severity classification, treatment adherence, and outcomes while qualitative methods of data collection included (Key Informant Interviews (KIIs) from twenty-six healthcare workers and three focused discussions groups (FDGs) that highlighted insights on the challenges to implementation of guidelines. Among the 135 children enrolled, the median age was 4 years, with 55.6% male versus 44.4% female participants. Most (76.3%) were inpatients with an average hospital stay of 4 days. Severity classification adherence was low (11.2%), while 60.7% received oxygen, 82.2% antibiotics, and 77% systemic corticosteroids. Nebulisation was used in 86.7 %, but only 0.7% received an inhaler with a spacer and mask. Follow-up at the Pediatric Respiratory Clinic was booked for only 29.6%, while 72.6% were discharged on oral antibiotics. Pneumonia was the most common comorbidity (75.6%), significantly increasing hospital stay ($p < 0.0001$). Challenges to implementing guidelines included shortages of resources, training deficiencies, and operational constraints. The healthcare workers

pointed out gaps in the availability of essential medications, equipment, and printed protocols, while the patient loads were associated with poor adherence. A significant gap exists between national asthma management guidelines and their implementation in practice, while outcomes were influenced by co-morbidities that need further study. Addressing challenges like inadequate resources and training is key to improving adherence and patient outcomes.

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INTRODUCTION

About 300 million people worldwide are affected by asthma, a heterogeneous disease characterized by chronic airway inflammation. However, this figure is likely an underestimate (Maspero et al., 2022). The prevalence of asthma in Africa is variable and on the rise, especially among children aged 12-14 years, with an estimated prevalence of 6-20% according to International Study of Asthma and Allergies in Childhood (ISAAC) studies (Pearce et al., 2007). While the exact prevalence of asthma in Kenya remains undefined, it is estimated that approximately 10% of the population –about 4 million people –is affected by the condition (Chakaya et al., 2024). This burden is further exacerbated by adverse weather changes and increasing air pollution, which contribute to frequent acute exacerbations in children with

asthma. As a result, recurrent hospitalizations lead to a rise in healthcare costs (Kline & Prunicki, 2023).

Asthma affects all aspects of life, including productivity and quality of sleep, among others. This not only holds for the patient's quality of life but also for the caregivers who have to intensify their attention in symptom identification, avoidance of triggers and dealing with high economic burdens (Serebrisky & Wiznia, 2019). Good compliance with medications by the patients plays a pivotal role in controlling symptoms, hence reducing severity and frequent exacerbations. Several studies have shown very high rates of noncompliance to treatment ranging from 20% to 80% (GINA, 2024). Although patient and /or caregiver barriers significantly contribute to non-compliance, healthcare providers also play a huge role, and thus

it is important to assess their knowledge and understanding of asthma guidelines as well as correct utilization (Simba et al., 2018). Adherence to guidelines has remained sub-optimal among healthcare providers despite regular updates with only 39% of residents shown to adhere to GINA guidelines in Nigeria (Ayuk et al., 2017).

A study done in Kenya demonstrated that only 57% of patients had good adherence to asthma control measures (H. M. Kagwaini et al., 2018). To institute correct management, it is critical to classify patients appropriately since it dictates the kind of management to be initiated. According to Hoosen et al., the severity of the asthma exacerbation was unclassified in the majority, 92.3%, of cases (Hoosen et al., 2020).

Healthcare providers play a central role in asthma management and must stay updated daily on the latest guidelines to ensure optimum care for the patients (Jafarnejad & Khoshnezhad Ebrahimi, 2020). A study in the USA showed poor adherence to asthma guidelines in primary care, varying by clinician group (Akinbami et al., 2020).

In Sweden, a significant gap between actual care for paediatric asthma and national guidelines was reported (Jonsson et al., 2012). In Kenya, 60% of asthma patients are mainly on oral prednisolone and salbutamol (Mortimer et al., 2022) despite having a national asthma guideline which provides well-stipulated classification and management of patients with asthma (*Kenya Asthma Management Guidelines*, 2022). A quality improvement study in Kenya demonstrated that establishing a dedicated paediatric respiratory clinic led by a pulmonologist significantly improved adherence to long-term asthma therapy from 32.3% to 93.5%. This improvement was likely driven by enhanced knowledge, better understanding of the condition and adherence to updated guidelines (Simba et al., 2021).

Anecdotally, a disparity was seen in the prescriptions of paediatric patients at the facility on

management for acute asthmatic exacerbations despite the presence of national guidelines that are simple and flexible to use to improve and standardize the quality of care. Existing studies in Kenya have limited scope regarding adherence to asthma guidelines in acute asthmatic care in children. Therefore, this study aims to investigate adherence to national asthma guidelines in the management of acute asthma, the short-term outcomes and the challenges to the implementation of national guidelines in the management of acute asthma among children at a county (secondary) level facility in Kenya. These findings will improve the overall outcomes of patients by providing a reference point on areas to improve on and promote better adherence to guidelines.

METHODS

Study Design

This study utilized a mixed-methods research approach, combining quantitative and qualitative methodologies. By integrating these two designs, the study achieves a comprehensive, evidence-based understanding of asthma guideline adherence, leading to practical recommendations for improving patient outcomes and healthcare practices. The quantitative component focused on assessing adherence to asthma management guidelines and associated clinical outcomes, while the qualitative aspect explored healthcare providers' perceptions of guideline use, their knowledge and skills, and barriers to adherence. This comprehensive methodology provided both procedural and contextual insights into acute asthma care at Mama Lucy Kibaki Hospital (MLKH).

Study Setting

The study was conducted at MLKH, a county referral hospital in Nairobi County, Kenya, serving a diverse urban population, located in the Eastlands of Nairobi. Data were collected for the period between June 2022 and June 2023, and the study targeted two groups: children aged 3–18 years diagnosed with acute asthma exacerbations and

healthcare providers involved in paediatric asthma management. To be eligible for inclusion, patient medical records needed to document a diagnosis of asthma or related symptoms and to contain complete information relevant to the study's objectives.

Sample Size

For the quantitative component, the sample size for patient records was determined using Fisher's formula. Assuming a 57.1% adherence rate to national asthma guidelines, with a 95% confidence interval and a 5% margin of error, the study adjusted for the finite population of eligible patients treated during the study period. This resulted in an adjusted sample size of 135 medical records. Consecutive sampling was used to identify eligible records from both inpatient and outpatient settings.

Study Population

Healthcare providers were selected using convenience sampling, ensuring representation from each of the seven professional cadres. A total of 26 in-depth interviews were conducted with three participants from each cadre to explore their perspectives on guideline availability, utility, and barriers to adherence. Additionally, three focus group discussions were held, each comprising eight participants, to gather collective insights on the challenges and opportunities in managing paediatric asthma. The healthcare providers in this study represented a diverse range of experience, from less than six months to 20 years, ensuring a balance of seasoned expertise and fresh perspectives. The team consisted of Paediatricians (2), Registrars (4), Medical Officers (4), Medical Officer Interns (2), Clinical Officers (5), Clinical Officer Interns (4), and Nurses (5), each playing a critical role in patient care. Their training levels varied, as shown by the qualifications. In the management of asthma, these providers are responsible for diagnosis, acute care, long-term management, and patient education. Paediatricians and Registrars oversee complex

cases, initiate treatment plans, and guide junior staff.

Quantitative data was abstracted from physical and electronic health records of eligible patients treated during the study period, and this translated to a sample size of 135 medical records. Consecutive sampling was used to identify eligible records from both inpatient and outpatient settings.

Inclusion and Exclusion Criteria

Medical records of children aged 3-18 years who had a diagnosis of asthma and were managed for an acute asthmatic exacerbation were included, while records of children with incomplete or missing medical records were excluded.

Healthcare providers eligible for the study included paediatricians, registrars, medical officers, clinical officers, medical officer interns, clinical officer interns, and nurses who consented to participate in interviews or focus group discussions and had been involved in the management of acute asthma patients. Exclusion criteria included participants unwilling to consent to qualitative data.

Variables

The independent variables were demographic characteristics, presenting symptoms, clinical classification, and treatment interventions, while the dependent variables were the length of hospital stay and discharge instructions. The qualitative data included transcripts from KII interviews and focus group discussions, which were transcribed verbatim for analysis.

Data Collection Tools

A total of 135 medical records were reviewed using a data abstraction form to extract quantitative data on patient characteristics, symptoms, clinical classification, management, hospital stay, and discharge outcomes. For qualitative data, 26 interviews with healthcare providers were conducted using a Key Informant Interview guide, exploring their perceptions of guideline usefulness,

availability, knowledge, and adherence barriers. Additionally, focused group discussions (FGDs) were held physically using a Focused Discussion Group guide to assess the availability and implementation challenges of asthma guidelines.

Data Management

De-identified patient-level data on demographic and clinical variables of children and adolescents aged 3-18 years who met the eligibility criteria was extracted from physical and electronic forms to data sheets in the form of Google Forms. It was then extracted into an Excel database, followed by data cleaning, consistency checks, and analysis. The results were presented in tables, figures, and text. Data accuracy and confidentiality were maintained throughout the process to ensure reliable and valid findings for meaningful interpretation and conclusions.

Statistical Analysis

Quantitative Data was coded and entered into an Excel database, and data cleaning and confirmation of accuracy/consistency/inconsistencies were done. The data was analyzed using R version 4.3.3. Descriptive statistics such as frequencies,

proportions, means, and medians summarized patient demographics and clinical outcomes. A chi-square test was employed to assess associations between guideline adherence and clinical outcomes. Significance was set at a p-value of <0.05 . Qualitative data were analyzed using NVIVO 13 software, where transcripts were coded to identify recurring themes, patterns, and concepts. Thematic analysis provided insights into healthcare providers' experiences and barriers to adherence.

Ethical Considerations

Ethical approval was obtained from the Jomo Kenyatta University of Agriculture and Technology (JKUAT) Institutional Ethics Review Committee reference number (JKU/ISERC/02316/0963). The National Commission for Science, Technology, and Innovation (NACOSTI), The reference number {REF: NACOSTI/P/23/28982}, Nairobi County and the MLKH research committee (REF: MLKH/ADM/RES/2). Informed consent was sought from healthcare providers, and patient records were anonymised to ensure confidentiality.

RESULTS

Table 1: Characteristics of Study Participants

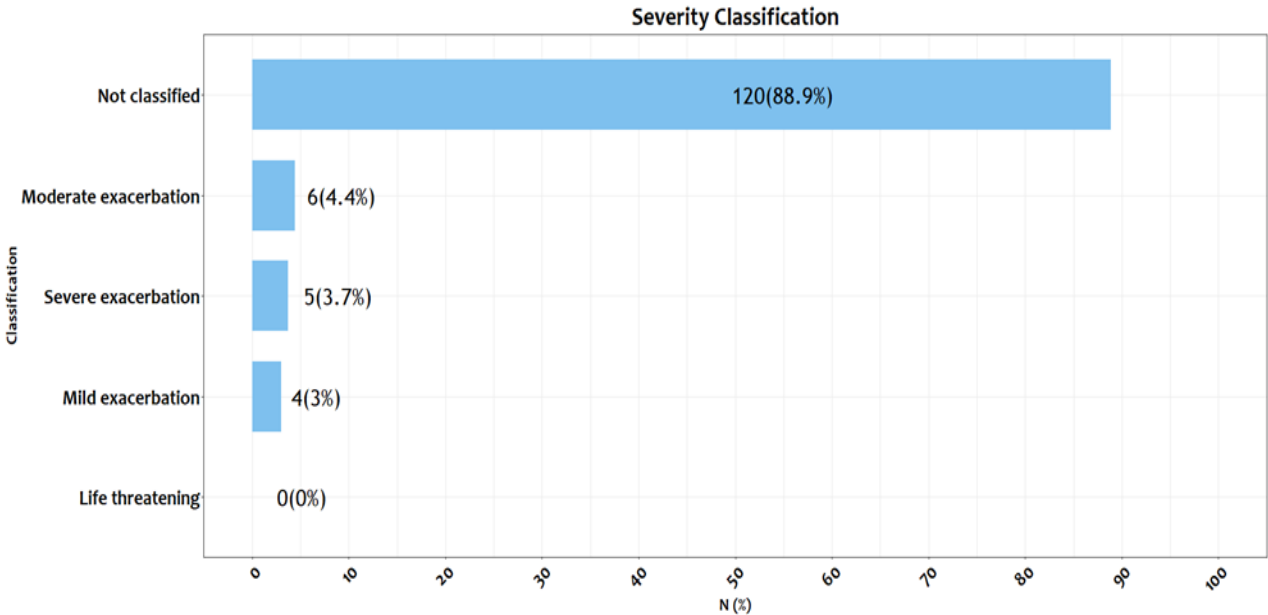
Characteristic		Number of participants.
Age in years	3-6 years	104 (77 %)
	7-12 years	26(19.3%)
	13-18 years	5(3.7%)
Gender	Female	60(44.4%)
	Male	75(55.6%)
Service category	Inpatient	103(76.3%)
	Outpatient	32(23.7%)
	0 days(outpatient)	32 ****
Length of stay in days	1-3 days	45(43.7%)
	4-7 days	49(47.5%)
	8-14 days	8 (7.8%)
	>14 days	1(1.0%)

A total of 135 children and adolescents aged 3 to 18 years were included in this study. The median age was 4 years, with females being 44.4% (n=60) while males were 55.6% (n=75). The inpatient

participants were n=103 (76.3%) of the children, while 32 (23.7%), participants were managed as outpatients. The average length of stay was 4 days, with a range of 1 to 32 days for inpatients.

Adherence to Initial Clinical Assessment and Severity Classification. The majority of the participants had an initial clinical assessment done on them, 135 (97.8%), showing a high level of initial clinical assessment

Figure 1: Adherence to Severity Classification.



There was a low level of adherence to severity classification, with only 11.1% classified. Out of these, 3%, 4.4% and 3.7% had mild, moderate and severe exacerbations, respectively.

Table 2: Adherence to Management of Acute Exacerbation of Asthma

Characteristics		Participants (N=135)
Oxygen started	Yes	84 (60.7%)
	No	54 (39.3%)
Antibiotics commenced	Yes	111 (82.2%)
	No	24 (17.8%)
Dexamethasone	Yes	50 (37.0%)
Hydrocortisone	Yes	4 (3.0%)
Prednisolone	Yes	50 (37.0%)
	No	31 (23.0%)
Nebulization with salbutamol.	Yes	117 (86.7%)
	No	18 (13.3%)
6 Puffs Inhaler (spacer and mask)	Yes	1 (0.7%)
	No	137 (99.3%)

Oxygen therapy was administered to 84(60.7%) participants. Antibiotics were commenced on 82.2%, n =111, Nebulization was done in n=117 (86.7%) with salbutamol, while only 1 participant, 0.7%, was given 6 puffs of salbutamol inhaler. Systemic steroids were started in 77% with dexamethasone and prednisolone being the most preferred.

Upon discharge home, only 40% were discharged on the ICS+SABA inhaler combination, while only 19.3% were discharged on the ICS+SABA+ Spacer + Mask combination. Oral Salbutamol was administered at 8.1% (n=11). Only 29.6% were

booked for follow-up with the pediatric respiratory clinic, (N=40), Only 2.2% were counselled on danger signs and 6.7% were educated on inhaler technique. Additionally, 72.6% were discharged on oral antibiotics.

Short-term Outcomes and Co-morbid Conditions.

The average length of stay was 4 days of inpatient care. There was 1.5% mortality while 85.8% had an

improvement in symptoms despite the poor classification. Pneumonia was the most co-morbid condition was pneumonia 75.6% (n=102), 2.2% had allergic rhinitis and Gastroesophageal Reflux Disease, while 1.5% had eczema. Others included cases of meningitis, Diabetes, autism, malaria, malnutrition, febrile convulsions and sickle cell disease. Due to limiting sample distribution across length of stay categories, only Pneumonia is included in the *chi-square test*.

Table 3: Effects of Co-morbid Conditions on Hospital Stay

Comorbid condition	Chi-statistic	P-value
Pneumonia	29.7	<0.0001
Others	21.7	<0.0001

A chi-square test was used in this study to evaluate the relationship between the length of hospital stay and pneumonia as a concomitant illness. With a highly significant p-value ($p = <0.0001$) and a chi-

square value of 29.71, the results showed a statistically significant correlation between pneumonia co-morbidity and length of hospital stay.

Table 4: Correlation between Classification of Patients and Outcomes

Outcome	Odds Ratio	95% CI	P Value
Improvement on non-classified	1		
Improvement on classified	0.405	(0.009, 2.984)	0.694
Adverse outcomes on non-classified	1		
Adverse Outcomes on classified	0.264	(0.028, 1.252)	0.086
Length of Hospital Stay of more than 4 days	1		
Length of Hospital stay more than 4 days	0.903	(0.248, 1.051)	1.000

On improvement there was no difference between those patients who had a classification of severity compared to those who were not (OR 0.405, 95% CI [0.009, 2.984]) P value 0.694) although the odds ratio was less than 1, suggesting that patients classified are less likely to show clinical improvement compared to those who had no classification. Regarding no adverse outcome, there was no difference between the classified and non-classified based on severity, (OR 0.264, 95% CI [0.028, 1.252] P value 0.086) even though the odds ratio of less than 1 showed a lower likelihood of experiencing adverse outcomes. Classified patients showed a reduced likelihood of staying in the hospital for more than 4 days compared to non-

classified (OR 0.903) however the (CI 0.248, 1.051, P Value 1.00) shows no strong evidence.

Challenges Faced by Healthcare Practitioners in Implementation

The qualitative data demonstrated the overall theme of limited resources as a challenge to the implementation of national asthma guidelines. This was significantly influenced by systemic, operational, and knowledge-based barriers. Lack of essential resources was the most common problem cited, with the health workers lamenting the shortages in medications, nebulizers, and spacers as the big barrier. As one participant observed, "*There has been poor or even no supply of medicines and spacers.*"

Other frequent themes included a lack of training in the guidelines; in fact, many indicated having no formal training regarding asthma management guidelines. One participant expressed, "*No training at all on the national guidelines.*" Such a lack of training led to gaps in knowledge and a lack of confidence in the application of these guidelines.

Other barriers to adherence included operational issues, such as heavy workload and staffing shortages. Healthcare workers themselves felt strained between having heavy workloads while adhering to protocols; one such response noted, "*Due to high patient numbers, it's difficult to adhere to all guidelines precisely.*" Apart from that, the lack of printed or easily accessible guideline copies was adding to the woes, as one participant outlined: "*The protocols are not in hard copy*".

The findings underscore the need for regular training, improved availability of resources, and better dissemination of guideline materials are some of the interventions needed to enhance adherence and improve patient outcomes.

DISCUSSION

The prevalence of asthma is increasing due to genetic and environmental factors, making it a major global health concern, especially for children (Maspero et al., 2022). Acute asthma exacerbations must be appropriately managed to lower morbidity and enhance immediate results. At Mama Lucy Kibaki Hospital (MLKH), Kenya, this study evaluated medical professionals' compliance with national asthma standards and the effects of this on patient outcomes.

This study demonstrated that there are significant gaps in the management of acute asthma and the recommended Kenya asthma national guidelines consistent with previous studies globally while highlighting the barriers to adherence to the guidelines. The results showed that 88% were unclassified based on severity of acute asthmatic exacerbation which was similar to a study in South Africa by (Hoosen S. et al., 2020) that showed

92.3% were unclassified. Similar studies in Nigeria demonstrated low levels of compliance with the guidelines among paediatric residents (Ayuk et al., 2017). For example, despite the low adherence to severity classification, 60.7% of children were started on oxygen therapy, with 86.7% nebulized and only 0.7% of patients were managed with an inhaler with a spacer and mask, an equally effective method (GINA, 2024). A study in the USA demonstrated inhalers are more effective and cheap to use in the management of acute asthmatic exacerbations (Graybill et al., 2024). These findings suggest that healthcare providers may be over-relying on nebulization due to familiarity or perceived effectiveness, despite evidence supporting inhalers as a viable alternative. According to the study, there are discrepancies between recommended asthma management guidelines and actual clinical practice.

Systemic corticosteroids were started on 77% (n=104) despite the poor classification and the associated side effects of systemic corticosteroids (Bleecker et al., 2022). Even though they are essential for managing acute asthma, mild acute exacerbations do not require steroids, hence the need for classification (*Kenya Asthma Management Guidelines, 2022*). The inadequate use of corticosteroids at MLKH could be attributed to either physicians' preferences for syrups and oral medications in the belief that they work better or deficiencies in the application of guidelines (Simba et al., 2021).

Regarding treatment and discharge practices, only 39.1% of patients were discharged with the recommended inhaled corticosteroids and short-acting beta-agonists (ICS+SABA) regimen. This was similar to studies done in Nigeria (Oshikoya et al., 2020) that showed less than 50% had an ICS prescribed as part of their management plan. Similarly, a study in Sweden showed poor compliance to inhaled corticosteroids at 58% (Jonsson et al., 2012). This shows poor adherence to guidelines as inhaled corticosteroids are a backbone

in the management of asthma for reducing inflammation (Alangari, 2014).

Antibiotic use was notably high, with 82.2% of children being started on antibiotics, despite guidelines recommending their use only when a bacterial infection is present. Additionally, a Cochrane review found limited evidence that antibiotics help acute asthmatic exacerbations (Normansell et al., 2018). This finding indicates a tendency towards overuse of antibiotics (Denholm et al., 2020), which could contribute to antibiotic resistance and unnecessary side effects. Given that 75.6% of the children had comorbid pneumonia, the high antibiotic use is somewhat justified, but it still underscores the need for careful assessment before prescribing antibiotics. It is possible that these children did not have pneumonia but were misclassified based on clinical presentation, as the symptoms of pneumonia are similar to those of acute asthmatic exacerbation. This calls into question the appropriateness of widespread antibiotic use in these children, urging a more rigorous diagnostic approach.

The study also identified gaps in patient referral and continuity of care. Only 29.6% of children were discharged through a Paediatrics Respiratory Clinic (PRC) showing poor compliance to routine follow-up, zero had a written asthma action plan demonstrating key gaps and 40% were discharged on an Inhaler combination (ICS+SABA), this is in agreement with a study done in Kenya that shows the value of a dedicated paediatric respiratory clinic (Simba et al., 2021).

For the clinical correlation between outcomes and classification of patients, none of the p-values are below 0.05, meaning there is no statistically significant relationship between severity classification and any of the outcomes. However, pneumonia increased the length of hospital stay significantly.

The study found that high patient volumes, insufficient training, and resource constraints were

some of the obstacles to following guidelines. Major challenges were identified by healthcare providers as a lack of printed protocols, nebulizers, and necessary drugs. "*There has been poor or even no supply of medicines and spacers,*" said one participant. Studies conducted in sub-Saharan Africa have found similar results, indicating that adherence to recommended practices is hampered by resource limitations (Mortimer et al., 2022). To close these gaps, more money must be spent on infrastructure and necessary medical supplies.

The study also pointed to shortcomings in official asthma guidelines training. Inconsistencies in practice resulted from the fact that many healthcare personnel reported never having received systematic training. Similarly, in Nigeria, training is key to improving asthma outcomes. (Onubogu et al., 2024). According to one reply, "*No training at all on the national guidelines.*" This is consistent with research from Nigeria, where, as a result of ignorance, only 39% of pediatric registrars followed the Global Initiative for Asthma (GINA) standards (Ayuk et al., 2017). Frequent refresher courses and training sessions could aid in closing this knowledge gap. A study in Australia demonstrated that the implementation of evidence-based interventions improved adherence to guidelines (Weber et al., 2019)

Operational challenges, such as high patient loads and staff shortages, further complicate adherence to guidelines. A healthcare worker remarked, "*Due to high patient numbers, it's difficult to adhere to all guidelines precisely.*" This sentiment reflects broader systemic issues in many resource-limited settings, where overstretched staff struggle to balance patient care with guideline compliance. Solutions such as task-shifting, electronic decision-support tools, and improved workflow management could enhance efficiency and adherence.

Strength and Limitations

A mixed-method approach guarantees an in-depth comprehension of both qualitative and quantitative

elements and also recognises particular obstacles enabling focused measures to enhance compliance.

Missing data in some patient records may have impacted the accuracy of adherence assessments while the study limits the ability to control for variations in data quality and practitioner consistency due to its retrospective nature.

Possible recall bias and self-reported adherence in qualitative responses from healthcare providers and also research performed at one institution restrict applicability to different environments.

CONCLUSION AND RECOMMENDATIONS

Conclusions:

While healthcare practitioners at this facility demonstrated good adherence to national guidelines during the initial assessment of children with acute asthma, there was poor adherence in subsequent management and discharge instructions. Poor adherence to national guidelines in asthma management did not significantly impact the length of hospital stay. However, the presence of comorbidities played a key role in prolonging hospitalization, highlighting the need for comprehensive patient evaluation beyond asthma management alone. Similar challenges affected both the management and discharge processes, including limited resources, high patient load, and variations in practitioner training. These barriers contribute to poor adherence to national guidelines beyond the initial assessment phase, potentially affecting overall patient care quality.

Recommendations

Implementation of structured asthma management and discharge protocols, including standardized checklists and electronic reminders, to improve consistency in care. In addition, the provision of targeted training and resources to healthcare practitioners, focusing on practical solutions to improve adherence beyond the initial assessment phase is likely to have an impact on the care of children with asthma.

Conflict of Interest Statement

There are no conflicts of interest to be disclosed by the author.

Authorship

The study idea was conceived by Dr. Vincent Munene Ngore (MBChB), Dr. Justus Maingi Simba (MBChB, MMED, PhD), Dr. Patrick Mwirigi Mburugu (MBChB, MMED), Dr. Elizabeth Atieno Jowi (MBChB, MMED), Dr. Michuki Maina (MBChB, MMED), Dr. Penina Kanario (MBChB) and Dr. Catherine Munyendo (MBChB, MMED). Vincent Munene collected and analysed as the lead in manuscript writing with support from co-authors as supervisors, mentors, editors and reviewers.

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Disclaimer

The content of this publication is the sole responsibility of the authors.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request and approval from the Hospital Research Committee.

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