Clinical Profile and Prescribing Patterns of Therapy in Children with Bronchial Asthma in a Rural Site in the Philippines: A Retrospective Cohort Study

Gayle Therese K. Gonzales-Javier, MD,[1] Leonila F. Dans, MD, MSc,[1] Kristine Tanega-Aliling, MD,[1] Carol Stephanie C. Tan-Lim, MD,[2] Cara Lois T. Galingana,[3] Mia P. Rey,[4] Maria Rhodora D. Aquino,[3] Josephine T. Sanchez[3] and Antonio L. Dans, MD, MSc[3,5]

[1]*Department of Pediatrics, Philippine General Hospital, University of the Philippines Manila*
[2]*Department of Clinical Epidemiology, College of Medicine, University of the Philippines Manila*
[3]*Philippine Primary Care Studies, UP Center for Integrative and Development Studies, University of the Philippines Diliman*
[4]*Department of Accounting and Finance, Cesar E.A. Virata School of Business, University of the Philippines Diliman*
[5]*Institute of Clinical Epidemiology, National Institutes of Health, University of the Philippines Manila*

ABSTRACT

Background. Bronchial asthma is one of the most common chronic childhood diseases encountered in the primary care setting. Adherence to recommendations from clinical practice guidelines on asthma can be utilized as an indicator of quality of care when evaluating the implementation of the universal health care in the Philippines.

Objectives. To determine the clinical profile of pediatric patients with bronchial asthma; and to evaluate the prescription patterns for asthma treatment in a primary care setting.

Methods. This was a retrospective cohort study that involved review of the electronic medical records in a rural site of the Philippine Primary Care Studies (PPCS). All patients less than 19 years old who were diagnosed with asthma from April 2019 to March 2021 were included. Quality indicators for asthma care were based on adherence to recommendations from the 2019 Global Initiative for Asthma (GINA) Guidelines.

Results. This study included 240 asthmatic children with mean age of 6 years (SD ± 4.9) and a slight male preponderance (55.4%). Majority (138 children or 57.5%) were less than 6 years old. Out of the 240 children, 224 (93.3%) were prescribed inhaled short-acting beta-agonists (SABA) and 66 (27.5%) were prescribed oral SABA. Only 14 children (5.8%) were prescribed inhaled corticosteroids (ICS), with 13 children (5.4%) given ICS with long-acting beta-agonists (LABA) preparations, and one child (0.4%) given ICS alone. Quality indicators used in this study revealed underutilization of ICS treatment across all age groups, and an overuse of SABA-only treatment in children 6 years old and above. Moreover, 71.3% of the total patients were prescribed antibiotics despite the current GINA recommendation of prescribing antibiotics only for patients with strong evidence of lung infection, such as fever or radiographic evidence of pneumonia.

Conclusion. There were 240 children diagnosed with asthma over a 2-year period in a rural community, with a mean age of 6 years old and a slight male predominance. This quality-of-care study noted suboptimal adherence of rural health physicians to the treatment recommendations of the GINA guidelines, with overuse of SABA and underuse of ICS for asthma control.

Keywords: bronchial asthma, adherence, prescription patterns

eISSN 2094-9278 (Online)
Published: January 15, 2025
https://doi.org/10.47895/amp.vi0.8536

Corresponding author: Gayle Therese K. Gonzales-Javier, MD
Department of Pediatrics
Philippine General Hospital
University of the Philippines Manila
Taft Avenue, Ermita, Manila 1000, Philippines
Email: gtkgj25@gmail.com
ORCiD: https://orcid.org/0000-0003-4845-5998

INTRODUCTION

The Philippine healthcare system faces a myriad of problems which stems from inequities in healthcare access in different areas of the country. These problems prompted a gradual shift towards a primary care system.

One global public health problem is asthma. Asthma is a chronic inflammatory condition of the lung airways resulting in episodic airflow obstruction. The incidence of this disease affects both adults and children, but it is more predominant in the pediatric age group. It is regarded as the most common chronic disease of childhood in developing countries and can cause significant morbidity and mortality if poorly managed and left uncontrolled. According to the World Health Organization (WHO) report in 2019, asthma affected approximately 262 million people, causing 455,000 deaths.[1] In the Philippines, it is reported that 12% of the population have asthma, of which 98% are not given proper treatment.[2]

More than 90% of children with asthma usually present with their first episode of wheezing and other asthma symptoms before 5 years old.[3] Male sex was found to be a risk factor for asthma. Other identified risk factors for asthma development include diet, obesity, and genetic predisposition.[4] Family history of asthma is a significant predictor of physician-diagnosed asthma in children regardless of race and socioeconomic status.[5]

Asthma management is aimed at reducing airway inflammation by minimizing pro-inflammatory environmental exposures, using anti-inflammatory controller medications, and controlling comorbid conditions that can worsen asthma.[6] Worldwide, there are several evidence-based publications used for the diagnosis and management of asthma, such as the Global Initiative for Asthma (GINA) guidelines, British Thoracic Society (BTS)/Scottish Intercollegiate Guideline Network (SIGN) British Guideline on the Management of Asthma, and Japanese guidelines for asthma.[7] Locally, the Philippine College of Physicians (PCP), Philippine Pediatric Society (PPS), Philippine Academy of Pediatric Pulmonologists (PAPP), and the Philippine Society of Allergy, Asthma and Immunology (PSAAI) adhere to the GINA guidelines for the management of asthma. Local clinical practice guidelines (CPGs) on asthma management have also been published, which is largely based on the GINA guidelines. The latest local asthma CPG was published in 2021.

A fundamental change made in the 2019 GINA guidelines was the recommendation for adults and children 6 years and older with mild asthma to receive as-needed inhaled corticosteroids (ICS) with long-acting beta-agonists (LABA) for adults and adolescents, or as needed ICS with short-acting beta-agonists (SABAs) for children 6 to 11 years old. This is in contrast to the previous practice of giving short acting beta-2 agonists (SABA)-only treatment for mild asthma. This change was a risk-reduction strategy to lower the risk of severe exacerbations and asthma-related death.[8]

Based on the 2019 GINA Guidelines, a stepwise approach to asthma management is recommended where the age and asthma severity are used as guides in selecting the recommended treatment regimen. Adolescents 12 years and up with intermittent asthma (symptoms less than twice a month) or mild persistent asthma (symptoms twice a month or more but less than 4-5 days a week) are started on Step 1 or 2 treatment, respectively (as-needed ICS + LABA), those with moderate asthma (symptoms most days, or waking with asthma once a week or more) with Step 3 treatment (daily ICS + LABA), and those with severe asthma (daily symptoms, or waking with asthma once a week or more, and low lung function) require Step 4 or 5 treatment (higher dose ICS + LABA with possible add-on treatments). Children 6 to 11 years with mild symptoms (less than twice a month) are started on Step 1 treatment (as-needed ICS + SABA), those with more persistent symptoms (twice a month or more) are started on Step 2 treatment (daily ICS), those with daily symptoms and night waking are started on Step 3 treatment (daily ICS + LABA), and those with severe symptoms are started on Step 4 or 5 treatment (higher dose ICS + LABA with possible add-on treatments). Children less than 5 years with intermittent asthma are started on Step 1 treatment (as-needed SABA), while those with mild persistent or moderate asthma are started on Step 2 treatment (daily ICS). Treatment is stepped up to Steps 3 or 4 when initial therapy with Step 2 fails to control symptoms.[3]

Good asthma control is important to avoid asthma exacerbations and improve outcomes.[3] Several international studies have reported on the most prescribed drugs for children with asthma. In Dubai, the most prescribed drugs include SABA for short term symptom relief, leukotriene receptor antagonists (LTRA), and corticosteroids.[9] In European countries, ICS were predominantly used, accounting for 15% of all asthma prescriptions.[10] A UK study reported suboptimal adherence to asthma management guidelines with regard to prescription patterns of asthma controller therapy for children in the primary care setting. Combination therapy with ICS and LABA accounted for less than 1.3% of asthma prescriptions for children. Asthma management guidelines were often not followed due to the following reasons: incomplete dissemination, lack of agreement, time pressure, inertia of prior practice, and lack of appropriate formulations in younger patients.[11] In Nigeria, oral steroids and oral SABA were commonly prescribed for long term control of asthma.[12] In Australia and South Korea, it was found that LTRA were most frequently prescribed in school-age children, followed by LABA and ICS.[13] This was attributed to the steroid phobia of parents, where there was fear of serious adverse effects of steroid use such as growth impairment.

This study evaluates the demographic profile of asthmatic children and prescribing patterns for asthma medications in a rural site of the Philippine Primary Care Studies (PPCS). The PPCS is a network of pilot studies that determined the impact of several strategies to strengthen the outpatient

primary care system in three pilot sites in the Philippines, namely an urban, rural, and remote site. One strategy was the development of electronic medical records (EMRs) in the pilot sites. The EMR serves as a reliable data source for monitoring quality of care by examining management plans for specific disease conditions in relation to the relevant demographic characteristics, medical history, and physical examination of the patients.

This study aims to assess the quality of care among children diagnosed with asthma in accordance with existing guidelines, and to assess the degree to which physicians adhere to the recommended treatment regimen from published guidelines in the PPCS rural site. Adherence refers to the degree to which the prescribed drug is in accordance with the recommendations from relevant clinical practice guidelines. It also serves as a quality indicator of the primary care system.

OBJECTIVES

General Objectives

To determine the clinical profile of pediatric patients with bronchial asthma based on age, sex, weight, and exposure to passive smoking; and to identify the prescription pattern of asthma treatment in a primary care setting at a rural site.

Specific Objectives

1. To describe demographic variables of pediatric patients with bronchial asthma in a rural community, including age, sex, weight, and exposure to passive smoking;
2. To identify utilization rate of prescribed drugs used in asthma in a primary care setting;
3. To describe the level of adherence to recommended drugs in each treatment step per age group based on GINA 2019.

METHODS

Study Design

This is a retrospective cohort study conducted in a rural site of the Philippine Primary Care Studies. All patients less than 19 years old, who were diagnosed with bronchial asthma from April 2019 to March 2021, were included in the study. The EMRs of this rural site were reviewed, and records of all pediatric patients with ICD codes J45-J46 (corresponding to bronchial asthma) were retrieved. The demographic data and drugs prescribed to the participants were encoded into the EMR in real time by their attending physician during the patient consult. These data were extracted from the EMR by the PPCS data management team.

Data Analysis

The PPCS data management team compiled the data using Microsoft Excel. Data entries were thoroughly checked for completeness, accuracy, and consistency prior to data analysis. Continuous variables were reported as mean with standard deviation (SD). Categorical variables were reported as frequency with percentages. Missing data were reported as "no data recorded" in the results section and excluded in the analysis.

Quality Indicators

The quality indicators for adherence to asthma treatment were based on recommendations of the 2019 GINA Guidelines that had evidence level A or B. Evidence level A signifies strong evidence from randomized controlled trials, meta-analyses, or strong observational evidence providing consistent findings. Evidence level B signifies results from a limited body of data with somewhat inconsistent results. This study used the preferred controller of choice to assess adherence to the guidelines. Level of adherence was reported per age subgroup (5 years and below, 6 to 11 years, 12 to 18 years).[14]

Since the EMRs did not include the severity classification of asthma per patient, patient asthma severity was estimated using the asthma control study conducted in the Asia-Pacific region last 2003, which reported that 60% of pediatric asthma cases meet the criteria for intermittent asthma, 19% for mild persistent asthma, 13% for moderate persistent asthma, and 8% for severe persistent asthma.[15] Hence, these prevalence rates were used to estimate the proportion of children with intermittent, mild persistent, moderate, and severe asthma in this study. This allowed the estimation of the adherence of the rural site healthcare workers in the recommended stepwise approach in asthma management. Utilization rate was calculated as the actual number of prescriptions divided by the ideal number of prescriptions and converted to percentage. Those with percentages greater than 100 indicate overutilization of the drug, while those with percentages lower than 100 indicate underutilization of the drug.

Ethical Considerations

This study maintained anonymity and confidentiality of the data gathered, and adhered to the principles of good clinical practices in research. Patient data was anonymized, and patient identifiers were not extracted during data collection. Ethical approval was under the performance indicators of the Philippine Primary Care Studies under study protocol code UPMREB 20-15-489-01.

RESULTS

Out of the 14,462 pediatric consults in the PPCS rural pilot site from April 2019 to March 2021, there were 240 children (1.6%) who had asthma. All 240 children were included in this study (Figure 1).

There were 138 children (57.5%) aged 5 years and below, 66 (27.5%) aged 6 to 11 years, and 36 (15%) aged 12 to 18 years. The average age of the 240 children was 6 years (SD ± 4.9). There were slightly more males (55.4% or 133/240). Only 14.2% (34/240) of the children had passive exposure

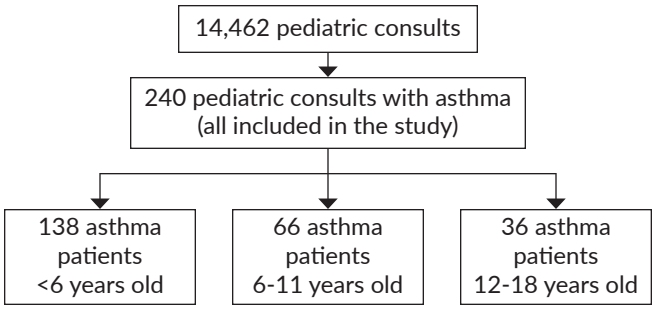

Figure 1. Flow diagram of participants.

to cigarette smoke. All participants did not have data on anthropometric measurements and family medical history recorded in the EMR. Moreover, the level of asthma control, as well as parameters needed to classify the level of control (i.e., frequency of daytime symptoms per week, limitation of activities, nocturnal symptoms, need for reliever treatment per week) were not recorded in the EMR. The demographic profile of the 240 study participants is shown in Table 1.

Table 2 shows the frequency distribution of the prescribed medications for the 240 children with asthma. The most prescribed drug (93.3%) was inhaled SABA. This was followed by oral SABA (27.5%). There were 40 patients (16.6%) who were prescribed both inhaled and oral SABA. Other prescribed drugs were LTRA (14.6%) and oral corticosteroids (7.9%). The least prescribed was ICS-containing drugs, with only 14 children (5.8%) prescribed ICS. Of the 14 children, 13 were prescribed ICS with LABA and one child was prescribed ICS alone.

Table 1. Demographic Profile of the 240 Children with Asthma

Variables	Frequency (N=240)	Percentage (%)
Age in years		
<6	138	57.5
6-11	66	27.5
12-18	36	15.0
Sex		
Male	133	55.4
Female	107	44.6
Passive smoking		
Yes	34	14.2

Table 2. Frequency Distribution of Drugs Used for Bronchial Asthma

Prescription drugs	Frequency (N=240)	Percentage (%)
Inhaled SABA	224	93.3
Oral SABA	66	27.5
LTRA	35	14.6
OCS	19	7.9
ICS + LABA	13	5.4
ICS	1	0.4

SABA – short acting beta agonist; ICS – inhaled corticosteroid; LTRA – leukotriene receptor agonist; LABA – long-acting beta agonist; OCS – oral corticosteroid

Adherence to the quality indicators is summarized in Table 3. For children 5 years and below, the ideal number of prescriptions was estimated as 60% of patients (83/138) with intermittent asthma requiring Step 1 as-needed SABA treatment. The rest of the patients (40% or 44/138) were estimated to have mild persistent, moderate, or severe asthma and require daily ICS treatment (Steps 2-4). For children 6 to 11 years, it was estimated that 60% of patients (40/66) have intermittent asthma and require Step 1 low dose ICS with as-needed SABA treatment. The rest of the patients (40% or 26/66) are estimated to require daily ICS controller therapy (Steps 2-5). For adolescents 12 years and up, 79% of patients (28/36) are estimated to have intermittent or mild persistent asthma and require Step 1-2 treatment (as-needed ICS + LABA). The rest of the patients (21% or 8/36) are estimated to have moderate or severe asthma and require daily ICS + LABA.

Results showed an overall underutilization of ICS treatment across all age groups. For children 5 years old and below, only two patients were prescribed daily ICS with an estimated adherence rate of only 4.5%. For children 6 to 11 years old, no patients were prescribed ICS with as-needed SABA (0% adherence), while only 12 patients were prescribed daily ICS (46.2% adherence). Similarly, among adolescents 12 years and up, no patients were prescribed as-needed ICS + LABA (0% adherence), while seven patients were prescribed daily ICS+LABA (87.5% adherence).

It is also observed that there is overuse of SABA-only treatment in children 6 to 11 years and adolescents 12 years old and above. Although SABA-only treatment is not recommended, 44% (29/66) of children 6 to 11 years and 44% (16/36) of adolescents 12 years and up were prescribed this treatment.

GINA 2019 does not recommend the use of antibiotics as routine medications for asthma unless there is strong evidence of lung infection, such as fever, purulent sputum, or radiographic evidence of pneumonia. In this study, 171 (71.3%) of the children were given antibiotics as shown in Table 4. However, only 58 children (24.2%) had fever. The presence of purulent sputum was not recorded in the EMR. Chest radiographs were not requested in any of the 240 children.

DISCUSSION

Based on the study, majority of children who consulted for asthma belonged to the <6-year-old age group, with slightly more males. Inhaled SABA was the most prescribed drug. There was an overall underutilization of ICS treatment across all age groups. There was overuse of SABA-only treatment for children 6 years and older, as well as overuse of antibiotics.

In this study, 1.6% of the total pediatric consults in the rural primary care site of PPCS was diagnosed with asthma.

Table 3. Adherence to Quality Indicators

Quality Indicators	Actual Number of Prescriptions (n)	Ideal Number of Prescriptions (N)*	Utilization Rate (n/N, in %)	Interpretation
Children 5 years old and below (n=138)				
SABA as-needed (Step 1)	74	83 (60%)	89.2	Underuse
Daily ICS (Step 2 to 4)	2	44 (40%)	4.5	Underuse
Children 6 to 11 years old (n=66)				
SABA-only treatment NOT recommended	29	**	2,900	Overuse
As needed ICS + SABA (Step 1)	0	40 (60%)	0	Underuse
Daily ICS (Step 2-5)	12	26 (40%)	46.2	Underuse
Adolescents 12 years old and above (n=36)				
SABA-only treatment NOT recommended	16	**	1,600	Overuse
As needed ICS + LABA (Step 1-2)	0	28 (79%)	0	Underuse
Daily ICS + LABA (Step 3-4)	7	8 (21%)	87.5	Underuse

* *N computed based on Asia-Pacific regional study of 60% with intermittent asthma, 19% with mild persistent asthma, 13% with moderate persistent asthma and 8% with severe persistent asthma.*

** *Denominator imputed as 1 to allow mathematical computation*

Table 4. Antibiotic Prescriptions for Asthmatic Children

Quality Indicators	Actual Number of Prescriptions (n)	Ideal Number of Prescriptions (N)*	Utilization Rate (n/N, in %)	Interpretation
Antibiotics indicated only if with evidence of lung infection	171	58	294.8	Overuse

* *Based on GINA guidelines; only 58 children had fever*

This proportion is low compared to the national statistics indicating 12% of the Filipino pediatric population had asthma. This data suggests that a large proportion of children with asthma are not brought for consult in the primary care clinics, consistent with the WHO report that 98% of Filipino asthma patients are underreported and undertreated.[2]

Clinical Profile of Bronchial Asthma Cases

Majority of the asthmatic children in the PPCS rural site were boys less than 6 years old. This finding is consistent with a study by Chowdhury et al.,[16] in which a male preponderance was seen in boys under age 13, with increasing rates of asthma observed as the age also increased. The shift in sex predilection has been correlated to sex hormones. The mean age in the Asia-Pacific study was 7 years old, comparable to this study with a mean of 6 years (SD ± 4.9).

Adherence to Quality Indicators

For children 5 years old and below with intermittent asthma, the preferred treatment is Step 1 or as-needed SABA (Evidence A). However, for children 6 to 11 years old and adolescents 12 years and above, SABA-only treatment is no longer recommended (Evidence A). In this study, SABA-only treatment was still prescribed in 44% of children aged 6 years and up, reflecting overutilization of this treatment.

Use of ICS-containing treatment is recommended for children 5 years and below with mild persistent, moderate or severe asthma, and children 6 years old and above regardless of severity classification (Evidence A). In this study, there is very poor adherence to the recommendations of the GINA guidelines with severe underutilization of ICS. For children 5 years old and below, the estimated adherence rate is very low at 4.5%. For children 6 to 11 years, only 12 out of the 66 patients (18.2%) were prescribed ICS-containing treatment, whether as-needed or as controller therapy. For adolescents 12 years and up, only 7 out of the 36 patients (19.4%) were prescribed ICS-containing treatment, whether as-needed or as controller therapy. The adherence rate was highest for adolescents 12 years and up requiring ICS controller therapy (as daily ICS + LABA) at 87.5%. As-needed ICS (with SABA or LABA) was not prescribed to any patient.

Results of this study are similar to the findings by Tadesse and Beyene[17] in Ethiopia, wherein there was a 24% ICS underutilization rate. Factors contributing to underutilization of ICS from a patient perspective include increased cost, inaccessibility, poor knowledge on the disease mechanism, and misperception on side effects. From a physician perspective, possible reasons for low prescription of ICS include unavailability, increased cost, and lack of knowledge of the recently published guidelines.[17] Given the increased cost of ICS compared to other asthma prescription drugs, and the study setting being a rural site, economic status may have had a major impact in the underutilization of ICS.

Combination ICS + LABA is the preferred treatment option for adolescents 12 years old and above. This recommendation is based on strong evidence that combination therapy is more effective and safer as compared to SABA. In this study, only 19% of patients were prescribed ICS + LABA. Possible reasons for underutilization of this drug include its higher cost and limited availability of the drug. According

to a study by Buendia and Patiño[18] in Colombia, low-dose ICS-formoterol was reported to be cost-effective especially in middle-income countries. Use of this combination drug was found to result in higher quality-adjusted life-years in mild to moderate asthma. However, few other studies have been published regarding this recommendation in affirmation to the quality indicator being evidence level B.[18]

Prescription Patterns

Results of the study showed that the most prescribed drug class was the inhaled short-acting beta agonist at 93.3%. When used for symptomatic relief during exacerbations, SABA-only treatment has been found to increase the risk for exacerbations and asthma-related death. Findings of this study suggest that SABA overuse is a prevalent issue in asthma care. Identified reasons as to why SABA is preferred over ICS include provision of fast relief, relative ease of use, and lower cost.[8]

Oral SABA was the second most prescribed drug at 27.5%. According to Chin et al.,[19] oral SABA was found to be commonly used in low-resource areas due to patient preference for oral medications and low cost especially in areas with fragmented health care system. This practice is not supported by GINA guidelines nor other guidelines.

Oral corticosteroids were prescribed in this study for 7.9% of patients. GINA guidelines state that oral corticosteroids may be used for adults and adolescents as part of Step 5 therapy for those with poor symptom control or frequent exacerbations. OCS is also recommended for the management of asthma exacerbations.[20]

Antibiotic Use

Another important finding in this study is the overutilization of antibiotics. GINA guidelines state that these should not be routinely prescribed in asthma exacerbations. No evidence supports its role in asthma exacerbations unless there is strong evidence of lung infection, such as onset of fever or radiographic evidence of pneumonia. Among the 171 patients who were prescribed with antibiotics, only 34% had fever. This finding implies that antibiotic overuse is a concern in asthma management. This finding is consistent with the results of the Baan et al. study,[21] wherein challenges were encountered in differentiating bacterial respiratory infections, viral respiratory infections, or asthma exacerbations due to the similarities of the presenting symptoms. Healthcare providers may prescribe antibiotics during exacerbations to treat or prevent superimposed bacterial infections even in age groups where viral etiologies are common.[21]

Limitations of the Study

This study was conducted via review of the EMR of the rural health unit of the PPCS site. Totality and completeness of the data were affected by proper and complete documentation. The diagnosis of asthma was based on the ICD code in the EMR, with the premise that the attending physician made a correct diagnosis. Actual diagnosis of asthma could not be verified. It is important to consider that majority of patients were <6 years old, where viral-induced wheezing occurs commonly. In addition, there were several lacking data in the EMR, including anthropometric measurement, family history of the population, categorization whether it was initial or follow-up consult, and parameters needed to classify the severity and level of control of asthma. Hence, possible confounding factors such as nutrition and genetics could not be described. Severity classification of asthma was also not recorded in the EMR; thus, assumptions on the severity classification of the participants were made based on the Asia Pacific asthma control study. Another limitation is that follow-up of participants' outcomes could not be conducted in the study since data collection was conducted through EMR review. Furthermore, the study was conducted only in one rural setting in the Philippines; thus, results may be limited in terms of generalizability and applicability to other healthcare settings.

CONCLUSIONS AND RECOMMENDATIONS

This quality-of-care study described the clinical profile of 240 pediatric asthma cases and measured physicians' adherence to the quality indicators from GINA 2019. Majority of patients belonged to the male sex with age less than 6 years old. Analysis of prescription patterns showed underutilization of ICS, overutilization of SABA-only treatment, and overutilization of antibiotics.

The following recommendations have been formulated based on the results of this study: 1) Review and effective emphasis of asthma guidelines are recommended to promote optimal quality of care and to uphold antibiotic stewardship; 2) Use of local CPGs and evaluation of adaptability of international CPGs are encouraged; 3) Classification and severity of asthma should be included in the EMR to facilitate evaluation of adherence in the stepwise algorithm for asthma control and management; 4) Follow-up of participants to determine treatment outcome.

This study may provide information needed to guide to policy making and better allocation of resources particularly in relation to asthma management. Studies that evaluate the adherence of patients to the prescribed drugs and its impact on quality of life are recommended.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

Funding Source

This study was done through the provisions of Philippine Primary Care Studies (PPCS). This was supported by The

Philippine Department of Health (DOH), the Philippine Health Insurance Corporation (PhilHealth), the Emerging Interdisciplinary Research Program (EIDR), the Center for Integrative and Development Studies (CIDS), and the Philippine Council on Health Research and Development (PCHRD).

REFERENCES

1. Sim KY, Jang YS, Yoon NY, Park EC. Association between Asthma and Oral Health Symptoms in Adolescents. Int J Environ Res Public Health. 2023 Feb 7;20(4):2921. doi: 10.3390/ijerph20042921. PMID: 36833618; PMCID: PMC9958628.
2. Rizal Medical Center Department of Health, Health Center [Internet]. 2022 [cited 2022 Dec]. Available from: https://rmc.doh.gov.ph/patientscorner/health-corner
3. Yadav S. Socio-demographic and clinical profile of children with asthma attending chest clinic at B. P. Koirala Institute of Health Sciences, Nepal. Birat J Health Sci. 2021 Nov 4;6(2):1426–31. doi: 10.3126/bjhs.v6i2.40304.
4. Calcaterra V, Verduci E, Ghezzi M, Cena H, Pascuzzi MC, Regalbuto C, et al. Pediatric obesity-related asthma: the role of nutrition and nutrients in prevention and treatment. Nutrients. 2021 Oct 21;13(11):3708. doi: 10.3390/nu13113708. PMID: 34835964; PMCID: PMC8620690.
5. Burke W, Fesinmeyer M, Reed K, Hampson L, Carlsten C. Family history as a predictor of asthma risk. Am J Prev Med. 2003 Feb;24(2):160-9. doi: 10.1016/s0749-3797(02)00589-5. PMID: 12568822.
6. Kliegman R, St. Geme III J, Blum N, Tasker R, Shah S, Wilson K, et al. Nelson textbook of pediatrics, 21st edition. Philadelphia, PA: Elsevier; 2020. pp. 1186-1208.
7. Tesse R, Borrelli G, Mongelli G, Mastrorilli V, Cardinale F. Treating pediatric asthma according guidelines. Front Pediatr. 2018 Aug 23;6:234. doi: 10.3389/fped.2018.00234. PMID: 30191146; PMCID: PMC6115494.
8. Kuprys-Lipinska I, Kolacinska-Flont M, Kuna P. New approach to intermittent and mild asthma therapy: evolution or revolution in the GINA guidelines? Clin Transl Allergy. 2020 Jun 3;10:19. doi: 10.1186/s13601-020-00316-z. PMID: 32514334; PMCID: PMC7268540.
9. Fahmy SA, Abu-Gharbieh E, Hamidi S. Patterns of prescribing and utilization of asthma medications in a tertiary hospital in Dubai, United Arab Emirates. Trop J Pharm Res. 2016 May 1;15(5):1061–8. doi: 10.4314/tjpr.v15i5.23.
10. Jepson G, Butler T, Gregory D, Jones K. Prescribing patterns for asthma by general practitioners in six European countries. Respir Med. 2000 Jun;94(6):578-83. doi: 10.1053/rmed.2000.0782. PMID: 10921763.
11. Thomas M, Murray-Thomas T, Fan T, Williams T, Taylor S. Prescribing patterns of asthma controller therapy for children in UK primary care: a cross-sectional observational study. BMC Pulm Med. 2010 May 14;10:29. doi: 10.1186/1471-2466-10-29. PMID: 20470409; PMCID: PMC2882363.
12. Fawibe AE, Onyedum CC, Sogaolu OM, Ajayi AO, Fasae AJ. Drug prescription pattern for asthma among Nigerian doctors in general practice: A cross-sectional survey. Ann Thorac Med. 2012 Apr;7(2):78-83. doi: 10.4103/1817-1737.94524. PMID: 22558012; PMCID: PMC3339208.
13. Seo MS, Hillen J, Kang DY, Pratt N, Shin JY. Prescription patterns of asthma preventers among children and adolescents between Australia and South Korea. Front Pharmacol. 2022 May 20;13:834116. doi: 10.3389/fphar.2022.834116. PMID: 35668949; PMCID: PMC9163376.
14. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention, 2019 [Internet]. [cited 2022 Jul]. Available from: www.ginasthma.org.
15. Simões SM, Cunha SS, Barreto ML, Cruz AA. Distribution of severity of asthma in childhood. J Pediatr (Rio J). 2010 Sep-Oct; 86(5):417-23. English, Portuguese. doi: 10.2223/JPED.2030. PMID: 20938593.
16. Chowdhury NU, Guntur VP, Newcomb DC, Wechsler ME. Sex and gender in asthma. Eur Respir Rev. 2021 Nov 17;30(162):210067. doi: 10.1183/16000617.0067-2021. PMID: 34789462; PMCID: PMC8783601.
17. Tadesse S, Beyene Z. Contributing factors for underutilization of inhaled corticosteroids among asthmatic patients attending at Adama Hospital Medical College, Adama, Ethiopia. J Asthma Allergy. 2020 Sep 11;13:333-341. doi: 10.2147/JAA.S264119. PMID: 32982321; PMCID: PMC7494382.
18. Buendía JA, Patiño DG. Cost-utility of as-needed ICS-formoterol versus to maintenance ICS in mild to moderate persistent asthma. BMC Pulm Med. 2021 Dec 5;21(1):397. doi: 10.1186/s12890-021-01775-1. PMID: 34865628; PMCID: PMC8647356.
19. Chin MC, Sivasampu S, Khoo EM. Prescription of oral short-acting beta 2-agonist for asthma in non-resource poor settings: A national study in Malaysia. PLoS One. 2017 Jun 29;12(6):e0180443. doi: 10.1371/journal.pone.0180443. PMID: 28662193; PMCID: PMC5491245.
20. Alangari AA. Corticosteroids in the treatment of acute asthma. Ann Thorac Med. 2014 Oct;9(4):187-92. doi: 10.4103/1817-1737.140120. PMID: 25276236; PMCID: PMC4166064.
21. Baan EJ, Janssens HM, Kerckaert T, Bindels PJE, de Jongste JC, Sturkenboom MCJM, et al. Antibiotic use in children with asthma: cohort study in UK and Dutch primary care databases. BMJ Open. 2018 Nov 28;8(11):e022979. doi: 10.1136/bmjopen-2018-022979. PMID: 30498039; PMCID: PMC6278808.