



Characteristics of Pediatric Asthma Patients at the Outpatient Clinic of a General Hospital in Padang, Indonesia

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ABSTRACT

Introduction: Pediatric asthma is a chronic respiratory disease that may affect daily activities and quality of life. This study aimed to determine the characteristics of pediatric asthma patients attending a general hospital outpatient clinic in Padang, Indonesia. **Methods:** A retrospective descriptive study was conducted using medical records of pediatric patients diagnosed with asthma from January 2020 to December 2022. Consecutive sampling was used, and 113 eligible medical records were included from 197 records reviewed. We analyzed demographic characteristics, asthma risk factors, disease severity, clinical manifestations, oral medication use, and inhalation device use. **Results:** Most patients were male (57.5%) and aged 5–11 years (64.6%), resided in Padang (91.2%), had health insurance (81.4%), and attended the pediatric outpatient clinic more than five times (54.9%). Among documented risk factors, a history of atopy was recorded in 46.0% of patients, while cigarette smoke was the most frequently documented allergen (39.8%). Intermittent asthma predominated (88.5%), with cough (97.3%) and shortness of breath (84.1%) as the most common clinical manifestations. Inhalation device use was not documented in 65.5% of patients, and most patients did not receive inhalation therapy. **Conclusion:** Pediatric asthma mostly affected school-aged boys and was classified as intermittent asthma. These findings show that oral medications were used more frequently than inhalation therapy, and inhalation device use was often not documented.

Keywords: Asthma severity, characteristics, clinical, inhalation therapy, pediatric asthma.



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INTRODUCTION

Asthma, a respiratory disease characterized by chronic inflammation, airway hyperresponsiveness, and airway remodeling, is heterogeneous.¹ To date, there is no universally accepted definition of pediatric asthma. Several clinical practice guidelines define asthma based on its clinical manifestations, characteristic features, and underlying pathophysiological mechanisms.¹ Approximately 300 million people worldwide are affected by asthma, and this number is projected to increase to 400 million by 2025. Asthma is the most common chronic disease among children and ranks among the top 20 diseases globally. The International Study of

Asthma and Allergies in Childhood (ISAAC) reported that countries in Southeast Asia, including Indonesia, have a high prevalence of pediatric asthma, ranging from 29% to 32%.²

Asthma can affect individuals in varying ways. In some patients, asthma may persist and be associated with clinical symptoms that interfere with daily activities. These limitations may adversely affect productivity and child development, ultimately reducing quality of life. Asthma is also characterized by episodic or recurrent symptoms that are generally reversible.³

This study aimed to determine the characteristics of pediatric asthma patients attending the hospital's outpatient clinic. The hospital is a private type C hospital in Padang, West Sumatra, Indonesia, specializing in maternal and pediatric healthcare, resulting in a large number of pediatric patients, including those with asthma. Both general pediatricians and pediatric subspecialists staff the hospital.

METHODS

A retrospective descriptive study was conducted using secondary data obtained from medical records to determine the characteristics of pediatric asthma patients. Based on a previous study, the prevalence of

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pediatric asthma in Padang was 8%.⁴ Using the sample size formula for a descriptive study with a categorical variable, the alpha level was set at 5%, yielding a standard normal deviate (Z_{α}) of 1.96 and a precision of 5%.⁵ The minimum required sample size was calculated to be 113 patients. The study samples consisted of the medical records of pediatric patients diagnosed with asthma by pediatricians at the pediatric outpatient clinic of the study hospital between 2020 and 2022.

Sample size calculation:

$$n = \frac{Z_{\alpha}^2 \times P \times Q}{d^2}$$

$$n = \frac{(1,96)^2 \times 0,08 \times 0,92}{(0,05)^2}$$

$$n = 113,1 \text{ (rounded up to 113)}$$

n : Required sample size

Z_{α} : Alpha standard normal deviate (1.96)

P : Estimated proportion of pediatric asthma (0,08)

Q : 1-P (0,92)

d : Desired precision (0.05)

The participating hospital did not have a system to record the total number of pediatric asthma patients. Therefore, consecutive sampling was conducted; medical records of pediatric patients from 2020 to 2022 who met the research criteria were consecutively enrolled, regardless of the year of presentation, until the minimum required sample size of 113 was achieved. Data were collected from July 2023 to December 2023. The detailed selection process is illustrated below (**Figure 1**).

A total of 113 medical records met the eligibility criteria and were included in the study. This sample size was obtained after reviewing 197 medical records; 84 were excluded because of incomplete data, such as missing body weight, height, or diagnostic classification. Inclusion criteria were pediatric outpatients younger than 18 years who had been diagnosed with asthma, with the diagnosis documented in the hospital's medical records. The exclusion criterion was incomplete medical records.

Collected variables included demographic characteristics, asthma risk factors, asthma severity, clinical manifestations of asthma, and use of inhalation devices in pediatric asthma therapy. The demographic characteristics included age, sex, referral source, health insurance coverage, frequency of emergency department visits, and frequency of visits to the pediatric outpatient clinic. Asthma risk factors included the patient's history of atopy, family history of atopy, asthma allergens, and nutritional status. Asthma severity was categorized according to clinical guidelines as intermittent, mild persistent, moderate persistent, or severe persistent. Asthma severity and classification were determined based on the criteria from the Pedoman Nasional Asma Anak (PNAA) and the Global Initiative for Asthma (GINA) guidelines. Clinical manifestations of asthma included wheezing, cough, and shortness of breath. These data were used to evaluate the patients' clinical condition. The variable describing the use of inhalation devices in pediatric asthma therapy referred to the use of inhalation devices (e.g., inhalers or nebulizers) for asthma management and was

classified into controller inhalation therapy, reliever inhalation therapy, and no inhalation device use.

We extracted data on asthma risk factors, including history of atopy, family history of atopy, and allergen exposure, from medical records. However, these variables were not routinely documented for all patients, particularly during follow-up visits, as detailed exploration of risk factors was primarily performed during the initial diagnostic assessment. However, these cases were retained in the analysis because the lack of documentation did not indicate the absence of risk factors; rather, it reflected incomplete recording in routine clinical practice.

RESULTS

The characteristics of pediatric asthma at the general hospital in Padang during the period from January 2020 to December 2022 are presented in **Table 1**.

Most pediatric asthma patients were male (57.5%), aged 5–11 years (64.6%), resided in Padang (91.2%), were referred from primary care clinics (51.3%), had health insurance coverage (81.4%), had no history of emergency department visits (52.2%), and attended the pediatric outpatient clinic more than five times (54.9%). Nearly half of the pediatric asthma patients (47.8%) had been referred to the emergency department at least once (**Table 1**).

Several asthma risk factor variables had substantial missing data. History of atopy, family history of atopy, and allergen exposure had missing proportions of 38.1%, 85.0%, and 31.9%, respectively. These missing data occurred because risk factor assessments were not consistently recorded during follow-up visits, particularly among patients already diagnosed with asthma. Among patients with available data, most patients had a history of atopy (52 patients, 46.0%). A positive family history of atopy was reported in 11 patients (9.7%). The most common asthma trigger was exposure to cigarette smoke allergens, affecting 45 patients (39.8%). In addition, 56 pediatric asthma patients (49.6%) had normal nutritional status (**Table 2**).

Most pediatric asthma patients at the hospital had intermittent asthma (100 patients,

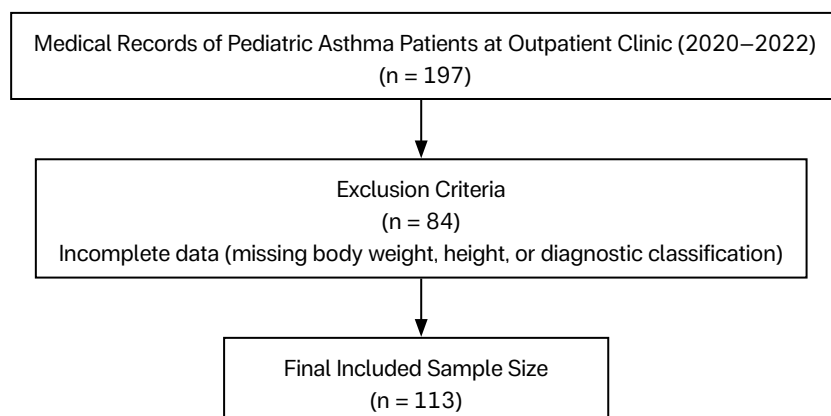


Figure 1. Selection process for the sample size.

**Table 1.** The characteristics of pediatric asthma (n = 113).

Characteristics	Frequency	Percentage (%)
Gender		
Female	48	42,5
Male	65	57,5
Age		
< 2 years old	0	0
2–4 years old	8	7,1
5–11 years old	73	64,6
12–17 years old	32	28,3
Domicile		
Padang	103	91,2
Padang Pariaman	2	1,8
Others*	8	7
Referral		
Self referral	50	44,2
Community center health	4	3,5
Primary clinic	58	51,3
Type D hospital	1	0,9
Financing		
Insurance	92	81,4
Non insurance	21	18,6
Frequency of Emergency Visits		
None	59	52,2
1	16	14,2
2–3	15	13,3
4–5	7	6,2
> 5	16	14,2
Frequency of Pediatric Outpatient Clinic Visits		
1	16	14,2
2–3	22	19,5
4–5	13	11,5
> 5	62	54,9

*Including Sawahlunto, Agam, Bukittinggi, Batusangkar, West Pasaman, Bungo, Bekasi, and Jakarta, each with a frequency of 1.

88.5%). Eleven patients had mild persistent asthma. Moderate persistent asthma and severe persistent asthma were each observed in one patient (**Table 3**).

A total of 110 pediatric asthma patients (97.3%) presented with cough. Most patients

also presented with shortness of breath (84.1%). Wheezing was reported in 23.9% of the patients (**Table 4**).

Inhalation devices were infrequently prescribed for pediatric asthma therapy at the hospital. A total of 39 patients received

inhalation therapy. Meanwhile, 74 patients (65.5%) did not use inhalation devices and were treated with oral medications (**Table 5**).

Most patients (42, 56.7%) received a combination of oral corticosteroids and short-acting β_2 -agonists (SABAs). Oral corticosteroids alone were prescribed to 1 patient (1.35%), whereas oral SABAs alone were prescribed to 31 patients (41.9%) (**Table 6**).

DISCUSSION

This study showed that the proportion of male pediatric asthma patients was higher than that of female patients. This finding is consistent with Runtuwene, *et al.*, who reported 41 male and 33 female pediatric asthma patients. Male children predominated among pediatric asthma patients, which may be attributed to their narrower airway diameter compared with female children, increasing the likelihood of airway narrowing or obstruction.⁶

Purnomo's study conducted at Kudus District Hospital concluded that boys had a 2.11 times higher risk of developing asthma than girls, indicating an association between sex and the occurrence of asthma.⁷ Boys are more susceptible to asthma attacks because they have narrower airways than girls. In addition, dysanaptic lung growth and the reversal phenomenon have been suggested to contribute to the higher prevalence of asthma among male children.^{8,9}

Most pediatric asthma patients in this study were school-age (5–11 years). Data on the prevalence of pediatric asthma in Indonesia indicate that approximately 30% of children have asthma, with a prevalence of 10% among primary school-aged children and 6.5% among junior high school-aged children.¹⁰ Exposure to aeroallergens and air pollutants in the home or school environment, particularly in urban areas, may exacerbate asthma symptoms in children.¹¹

This study showed that most pediatric asthma patients originated from and resided in Padang, followed by Padang Pariaman and other areas, including Sawahlunto, Agam, and Bukittinggi. Arief, *et al.*, reported that individuals living in urban areas have a 1.26 times higher risk of developing asthma

**Table 2.** Risk factors for asthma in childhood asthma (n = 113).

Risk Factors for Asthma	Frequency	Percentage (%)
History of Atopy		
Positive	52	46
Negative	18	15,9
No data	43	38,1
History of Family Atopy		
Positive	11	9,7
Negative	6	5,3
No data	96	85
Allergen		
House dust	16	14,2
Cigarette smoke	45	39,8
Food ingredients	5	4,4
Others	11	9,7
No data	36	31,9
Nutritional Status		
Normal weight	56	49,6
Risk for overweight	15	13,3
Underweight	42	37,2

Table 3. Classification of asthma severity (n = 113).

Asthma Severity	Frequency	Percentage (%)
Intermittent Asthma	100	88,5
Mild Persistent Asthma	11	9,7
Moderate Persistent Asthma	1	0,9
Severe Persistent Asthma	1	0,9

Table 4. Clinical symptoms of pediatric asthma (n = 113).

Clinical Symptoms	Frequency	Percentage (%)
Wheezing		
Positive	27	23,9
Negative	86	76,1
Coughing		
Positive	110	97,3
Negative	3	2,7
Shortness of Breath		
Positive	95	84,1
Negative	18	15,9

than those living in rural areas because urban lifestyles and air pollution increase the risk of asthma.¹² A study by the Centers for Disease Control and Prevention (CDC) also reported that people living in rural areas often need to travel long distances to access specialized healthcare services, resulting in lower healthcare accessibility than that of urban populations. Consequently, asthma in children living in rural areas may be diagnosed later or less promptly.¹³

More than half of the patients attending the pediatric outpatient clinic were referred from primary care clinics. Most pediatric asthma patients used health insurance to cover healthcare costs. A study conducted in Yogyakarta reported no significant difference in asthma control between patients with and without health insurance.¹⁴ Health insurance, particularly Indonesia's National Health Insurance (BPJS Kesehatan), was the most common method of healthcare financing among pediatric asthma patients in this hospital.

Most pediatric asthma patients attended the pediatric outpatient clinic more than five times, either for routine asthma follow-up or for treatment after asthma exacerbations. Regular follow-up visits may help prevent the adverse consequences of asthma. One essential component of asthma management is patient education, which aims to help patients achieve symptom control, adhere to their treatment plan, avoid asthma triggers, and seek medical attention promptly when symptoms worsen. Based on the findings of this study, nearly half of pediatric asthma patients (47.8%) experienced at least one acute exacerbation requiring an emergency department visit (**Table 1**). The relatively high frequency of emergency department visits among pediatric asthma patients may reflect inadequate asthma control.¹⁵

In this study, atopy history and cigarette smoke exposure were frequently identified among patients with available records. However, these findings should be interpreted cautiously because many medical records lacked documentation of asthma-related risk factors. This limitation occurred because risk factor assessments were not routinely documented for all patients, particularly those

**Table 5.** Use of inhalation devices in pediatric asthma therapy (n = 113).

Use of Inhalation Devices	Frequency	Percentage (%)
Inhalation for controller	8	7,1
Inhalation for reliever	31	27,4
No inhalation device use	74	65,5

Table 6. Use of oral medications in pediatric asthma therapy (n = 74).

Use of Oral Medications	Frequency	Percentage (%)
SABA Oral	31	41,9
Combination Corticosteroids-SABA	42	56,7
Corticosteroids	1	1,35

with established asthma diagnoses or during follow-up visits, as comprehensive evaluation of asthma risk factors was mainly conducted during the initial diagnostic assessment.

Childhood-onset asthma is commonly associated with the allergic phenotype, although its characteristics may vary among individuals. This phenotype is frequently associated with a family history of atopy and is characterized by biomarkers related to type 2-mediated inflammation.¹⁴ A prospective longitudinal study demonstrated that the prevalence of asthma from childhood through adolescence was significantly higher among individuals with a history of atopy than among those without atopy.^{16,17} Another study reported that approximately 55% of children with asthma had a parental history of atopy, suggesting that genetic factors may contribute substantially to the increased risk of asthma in the pediatric population. In that study, parental atopy was defined as asthma, allergic rhinitis, or atopic dermatitis in the father, mother, or both parents.¹⁸

Asthma symptoms are often triggered by allergen exposure. Allergic asthma results from an individual's hypersensitivity to allergens, including dust, cigarette smoke, fungal spores, and certain foods. Based on the medical records, 45 patients (39.8%) had parents who smoked, suggesting that these children were likely exposed to secondhand smoke, which may increase the risk of asthma. This finding is consistent with the study by Arifuddin, *et al.*, which reported that 56.5% of children exposed to cigarette smoke had asthma. In contrast, asthma was

not observed among children who were not exposed to cigarette smoke, indicating that cigarette smoke exposure is associated with the development of asthma.¹⁹ Bozinovski, *et al.*, demonstrated that cigarette smoke exposure promotes the release of interleukin (IL)-17A, a pro-inflammatory cytokine involved in the pathogenesis of asthma, thereby exacerbating airway inflammation.²⁰ Most pediatric asthma patients in this hospital had normal nutritional status. This finding is consistent with a study conducted at Dr. M. Zein Regional Hospital, West Sumatra, which reported that 71.7% of hospitalized pediatric asthma patients had normal nutritional status.⁸ A study conducted at Dr. M. Djamil General Hospital, Padang, also found no significant association between nutritional status and the occurrence of pediatric asthma.²¹

Most children had intermittent asthma with relatively mild symptoms (78%), followed by mild persistent asthma (12%), moderate persistent asthma (10%), and severe persistent asthma (0%). The association between age at diagnosis and asthma severity may be explained by the fact that patients who develop asthma during childhood are more accustomed to recurrent airway inflammation, bronchospasm, and mucus hypersecretion, allowing the body to compensate more effectively during hypoxic episodes.²² Furthermore, patients diagnosed with asthma during childhood have been reported to achieve better asthma control than those first diagnosed in adulthood. This may be attributed to greater disease awareness, increased experience in asthma

self-management, and parental supervision during childhood.²³

The present study showed that nearly all pediatric asthma patients presented with cough and shortness of breath. Wheezing, a hallmark symptom of more severe asthma, was observed in approximately one in five pediatric asthma patients at this hospital. This finding warrants further attention to improve asthma control in children. A study conducted at Dr. M. Djamil General Hospital also reported cough as a clinical manifestation in 98.6% of pediatric asthma patients but found no cases of shortness of breath or wheezing.²¹ Recurrent wheezing or recurrent chronic cough may serve as an initial indicator for the diagnosis of pediatric asthma. However, children presenting with chronic cough as the sole symptom, even without wheezing and dyspnea on examination, should also be considered for a diagnosis of asthma.²⁴

This study showed that most pediatric asthma patients were treated without inhalation therapy. More than half of the patients received oral medications, including oral corticosteroids, oral short-acting β_2 -agonists (SABAs), and a combination of oral corticosteroids and oral SABAs. Although dry powder inhalers (DPIs), metered-dose inhalers (MDIs), and spacers offer several advantages for asthma management, their use remains limited. One major challenge is the limited ability of children's lungs to achieve optimal delivery of inhaled medications. Narrow airways, small tidal volumes, and immature breathing patterns reduce the effectiveness of drug deposition in the distal airways. In addition, the limited availability of inhalation devices specifically designed for children may contribute to the lower utilization of inhalation devices for both controller and reliever medications compared with the more frequent use of oral medications.²⁵

Over the past several decades, numerous studies have shown that inhalation therapy, including inhaled bronchodilators and inhaled corticosteroids, effectively reduces asthma symptoms, improves quality of life, and helps prevent asthma exacerbations.²⁶ Nevertheless, despite its well-established effectiveness, access to inhalation therapy remains inadequate in many low- and middle-



income countries.²⁶ Many countries have not yet included the WHO-recommended essential asthma medicines in their Essential Medicines Lists (EMLs), and most do not provide these medications free of charge or at subsidized prices, particularly in low- and middle-income countries.²⁷ These limitations hinder patients' access to appropriate treatment and may contribute to the underprescription and underuse of inhaled corticosteroids (ICSs) and combination inhalers.²⁷

One limitation of this study is that the hospital lacked a centralized patient registry to verify the overall denominator of pediatric asthma patients. Additionally, the study period (2020–2022) overlapped with the COVID-19 pandemic, which may have affected health-seeking behavior and outpatient attendance patterns.

In this study, personal history of atopy, exposure to cigarette smoke, and allergens were frequently identified among patients with available data. However, these findings should be interpreted with caution, as a considerable proportion of medical records lacked complete documentation of risk factors. This limitation arose because comprehensive risk assessments were primarily conducted during initial consultations rather than routinely documented in follow-up visits for established asthma cases. Consequently, this incomplete documentation may introduce selection bias, particularly regarding the reported prevalence of asthma risk factors.

Given these limitations, future studies should use prospective designs with standardized data-collection protocols to ensure comprehensive recording of risk factors during initial and follow-up visits. Furthermore, hospitals are encouraged to implement integrated Electronic Medical Record (EMR) systems with mandatory fields for clinical risk assessments to minimize missing data. Future multi-center studies including post-pandemic cohorts are also warranted to assess long-term trend changes in pediatric asthma characteristics.

CONCLUSION

This study showed that most pediatric asthma patients at the hospital were male, aged 5–11 years, resided in Padang, were referred from primary care clinics, had health insurance coverage, had no history of emergency department visits, and attended the pediatric outpatient clinic more than five times. Most patients had a positive history of atopy, cigarette smoke as the predominant allergen, and normal nutritional status. Intermittent asthma was the predominant severity classification, with cough, shortness of breath, and wheezing as the most common clinical manifestations. Oral medications were used more frequently than inhaled medications.

Ethics Statement

Ethical approval for this study was obtained from the Research Ethics Committee of the Faculty of Medicine, Universitas Andalas, which reviewed and approved the research protocol to

protect the human rights and welfare of research subjects (No. 546/UN.16.2/KEP-FK/2023).

Informed Consent

Informed consent was waived by the Research Ethics Committee of the Faculty of Medicine, Universitas Andalas, as this study used retrospective data obtained from medical records.

Consent for Publication

Consent for publication was not applicable because this study used data from medical records and no identifiable patient information is presented in this manuscript.

Author Contributions

FT contributed to the conception and design, collected data, and wrote the draft of the manuscript. FFY and LI also contributed to the conception, design, and supervise the study. All authors reviewed and approved the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Declaration on the Use of Artificial Intelligence (AI)

The authors declare that no artificial intelligence tools were used in the conduct of this study or preparation of this manuscript.

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None.

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