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# Association of Clinical Profile and Treatment Outcomes of Pediatric Patients with Anaphylaxis from 2018 to 2022 in Ospital ng Makati: A Five-Year Cross-Sectional Study\*

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**ABSTRACT**

**Objective:** To evaluate the association between clinical profiles, including symptom presentation, medical history, triggers, and comorbidities; clinical outcomes, such as admission to ICU or ward, mortality, and biphasic anaphylaxis in pediatric patients aged 0-18 years old admitted for anaphylaxis at Ospital ng Makati - Department of Pediatrics from January 2018 to December 2022.

**Methodology:** This cross-sectional study utilized a retrospective chart review of pediatric patients aged 0 to 18 years who were admitted for anaphylaxis during the study period. Patient confidentiality was maintained throughout the review. Demographic and clinical characteristics were recorded and summarized using descriptive statistics. The association between demographic characteristics, clinical profile, management, and outcomes was assessed using the Chi-square or Fisher's exact test, with odds ratios calculated as the measures of association.

**Results:** From 2018 to 2022, 97 pediatric patients were diagnosed with anaphylaxis. Food was the most common trigger (86.6%), followed by medications (9.3%). The majority of patients presented with skin/mucosal involvement (97.9%), respiratory compromise (61.9%), and gastrointestinal symptoms (36.1%). Respiratory compromise ( $p = 0.001$ ) and cardiovascular instability ( $p = 0.010$ ) were associated with severe outcomes, including ICU admission. A history of atopy ( $p = 0.002$ ) was linked to biphasic anaphylaxis.

**Conclusion:** This study highlights the increasing incidence of anaphylaxis in older age groups, with food being the most common etiology. Respiratory compromise and cardiovascular instability are predictors of severe outcomes of anaphylaxis, emphasizing the importance of detailed patient history and prompt management in such cases.

**Keywords:** anaphylaxis, anaphylactic shock, atopy, food allergy, asthma



## INTRODUCTION

Anaphylaxis is now universally defined as a serious allergic reaction that is rapid in onset. It is a severe and life-threatening systemic hypersensitivity reaction that can manifest with systemic symptoms and can potentially lead to significant morbidity and mortality. It is a medical emergency with an overall mortality risk estimate of 1% worldwide. It is also one of the most preventable conditions in children with proper education. Evidence-based guidelines recommend that prompt administration of epinephrine can be lifesaving. A study in Europe identified that cardiovascular and thyroid diseases, as well as a history of atopy, are contributing factors to severe cases of anaphylaxis.<sup>1</sup> Similarly, a study in Singaporean children found that food was the most common trigger for anaphylaxis, followed by medications, with a median age presentation of 7.9.<sup>2</sup> Drug-induced anaphylaxis was associated with more severe features compared to food-induced anaphylaxis. In the local setting, one study reported that 70% of pediatric and adult patients presenting with anaphylaxis had comorbidities, with malignancy being the most common comorbidity linked to severe outcomes.<sup>3</sup> Interestingly, anaphylaxis has consistently been among the top 10 conditions seen and admitted in the Emergency Department of Ospital ng Makati – Department of Pediatrics.

Anaphylaxis is a systemic allergic reaction with rapid onset and is potentially fatal. It is a predominantly childhood disease, estimated to occur in 1 out of 170 children compared to 30 per 100,000 person-years in adults, and its incidence among children has been increasing in recent years.<sup>4</sup> In the United States, the annual incidence of anaphylaxis is estimated at 42 cases per 100,000 person-years, totaling more than 150,000 cases per year.<sup>5</sup> The rate of pediatric emergency department visits is reported to be approximately 2–4 per 1000 patients. Moreover, anaphylaxis in children, particularly in infants, is underdiagnosed.<sup>6</sup> Most studies on the clinical features and causes have focused on adult or combined adult and pediatric populations. A study in Australia showed that in the last decade, only one small study focused specifically on pediatric anaphylaxis in the emergency setting. The study had 57 children (upper age of 15 years) presenting with anaphylaxis to a pediatric emergency department.<sup>7</sup> In Asia, a prevalence study done by Jeong K et al., in 2018 showed that the overall prevalence of anaphylaxis is 26.23, which increased from 20.55 in 2010. The average prevalence was >35 per 100,000 person-years among 50–69-year-olds, and the mean crude prevalence in children was 22.3 (0–2 years), 17.3 (3–6 years), 12.1 (7–12 years), and 14.9 (13–17 years) per 100,000 person-years, respectively. The overall prevalence increased 1.7-fold, with the highest rate of increase in 0–2 years of age.<sup>8</sup>

The World Allergy Organization Anaphylaxis Committee defines anaphylaxis as a serious systemic hypersensitivity reaction, typically rapid in onset and potentially fatal.<sup>9</sup> Severe anaphylaxis is characterized by potentially life-threatening compromises in the airway, breathing, and/or circulation and may occur without typical skin features. Most cases of anaphylaxis are attributed to the activation of mast cells and basophils via cell-bound allergen-specific IgE molecules. This releases various mediators (histamine, tryptase) and cytokines that can produce allergic symptoms in any or all target organs. However, clinical anaphylaxis may also be caused by mechanisms other than IgE-mediated reactions, including the direct release of mediators from mast cells by medications and physical factors (morphine, exercise, cold), disturbances of leukotriene metabolism (aspirin and nonsteroidal anti-inflammatory drugs), immune aggregates and complement activation (blood products).<sup>10</sup>

Anaphylaxis is a medical emergency requiring aggressive management with intramuscular epinephrine. It is also important to follow additional measures such as removing exposure to the trigger and assessing the airway, breathing, circulation, mental status, and skin. Other vasopressors may be used as an alternative to epinephrine for refractory hypotension. In severe cases, intubation may be necessary.<sup>1</sup> Patients may also experience biphasic anaphylaxis, which occurs when anaphylactic symptoms recur after apparent resolution. More than 90% of these cases occur within 4 hours but potentially up to 72 hours.<sup>3</sup>

Furthermore, an analysis from the European Anaphylaxis Registry has divided the risk factors for severe anaphylactic reaction into non-modifiable/stable/independent/intrinsic and modifiable/unstable/dependent/extrinsic. Nonmodifiable factors include age, sex, comorbidities, basic tryptase level, and a previous reaction triggered by the same factor. Modifiable factors include long-term pharmacotherapy, especially with non-steroidal anti-inflammatory drugs (NSAIDs), proton pump inhibitors (PPIs), exercise, alcohol, and emotional stress. Certain populations are at a greater risk for more severe anaphylactic reactions such as a history of anaphylactic reaction; history of asthma, especially if poorly controlled; allergy to peanuts, nuts, fish, and shellfish; teenagers, and patients on beta-blockers or angiotensin-converting enzyme inhibitors.<sup>1</sup> Common triggers for anaphylaxis may include food, insect stings, and medications. A study in Singapore found that food was the most common trigger among pediatric patients, followed by medications, with Ibuprofen as the most implicated drug. In some cases, the triggers were still idiopathic.<sup>3</sup> A local study done in 2020 showed that most adult and pediatric patients had comorbidities, but only 25% had a history of allergic disease. In the same study, medications were the most

common trigger, with antibiotics as the most common type of medication implicated.<sup>3</sup> A study by Motosue et al. showed that the presence of comorbidities (including cardiac and chronic lung diseases) is at risk for severe anaphylaxis, and having eczema and a history of asthma have decreased risk for severe anaphylaxis.<sup>10</sup> Currently, there are still no local studies focused on the pediatric population as to the demographics and clinical predictors of anaphylaxis in the Philippines.

The purpose of this study is to identify clinical profiles such as age, sex, and presenting symptoms and define risk factors, including comorbidities, if any, that are associated with patients diagnosed with anaphylaxis. In addition, this study shows possible demographics in determining the clinical outcomes of patients with anaphylaxis, which may affect decision-making regarding triaging admissions and management. This study may help in prognosticating patients with risk factors presenting with anaphylaxis. It can also help increase awareness among parents and caregivers of patients with risk factors in preventing anaphylaxis. This may also give us an overview of possible topics to discuss in the community to increase knowledge about anaphylaxis.

## OBJECTIVES

### General Objectives

To determine the association of clinical profile such as symptoms presentation, medical history, triggers, and associated comorbidities; and clinical outcomes such as admission to ICU or ward, mortality, and biphasic anaphylaxis of pediatric patients aged 0-18 years admitted for anaphylaxis at Ospital ng Makati - Department of Pediatrics from January 2018 to December 2022

### Specific Objectives

1. To determine the socio-demographic profile of patients admitted for anaphylaxis
2. To determine the clinical profile of patients admitted for anaphylaxis according to
  - 2.1. presenting symptoms
  - 2.2. medical history (including history of drug allergy, history of atopy such as bronchial asthma, allergic rhinitis, and atopic dermatitis)
  - 2.3. triggers (such as food, animal sting, medication, cosmetics, immunotherapy, and blood products)
  - 2.4. associated comorbidities
3. To determine common triggers of patients with anaphylaxis based on age group
4. To determine presenting symptoms of patients with anaphylaxis according to age group
5. To determine management and treatment outcomes of patients managed as a case of anaphylaxis

6. To determine the association of medical history and treatment outcome, including ICU admission of patients with anaphylaxis

## METHODOLOGY

### Study Design

The study was a cross-sectional study using a retrospective chart review of patients admitted for anaphylaxis in Ospital ng Makati from January 2018 to December 2022.

### Study Population

#### Inclusion Criteria

Patients admitted fulfilling the criteria of anaphylaxis such as skin/mucosal symptoms associated with either respiratory or cardiovascular compromise; 2 or more rapid occurrence of symptoms after exposure such as skin/mucosal symptoms, respiratory compromise, and cardiovascular dysfunction; abrupt cardiovascular compromise or reduced BP after exposure to a possible allergen from January 2018 to December 2022 at the Ospital ng Makati January 2018 to December 2022. A total population of 97 patients were included in this study.

#### Exclusion Criteria

This study excluded patients who did not fulfill the anaphylaxis criteria, such as those with hypersensitivity reactions. However, patients seen at the emergency level who opted to be discharged against medical advice at the time of consultation were also excluded from this study.

#### Description of Treatment Outcomes

1. **Mortality** – defined as death of a person or the irreversible cessation of circulatory and respiratory functions, including the brain and brain stem.
2. **Admission** – refers to a medical decision for inpatient care, which includes Ward or ICU service for closer monitoring
3. **Intubated** – refers to a status in which a patient has to be introduced with a tube into the trachea, which may keep the airway open for respiration
4. **Sent Home or Discharge** – describes the point at which inpatient hospital care ends

### Data Collection Procedure

A review of the records of admitted patients at Ospital ng Makati - Department of Pediatrics who fulfilled the clinical criteria of anaphylaxis set by the World Allergy Organization from January 2018 to December 2022 was done. The medical records were reviewed using the electronic document viewer and the patients' charts in the medical records section.

Patients' demographics, such as age, sex, location, presenting signs and symptoms, associated family and medical histories of atopy and asthma, possible triggers, and comorbidities such as asthma and hypersensitivity reactions, were collected and tallied. Treatment outcomes, including their course, length of stay, and other medications used, and treatment outcomes, including intubation and mortality, were tabulated.

## Data Analysis

### Statistical Analysis

Demographic and clinical characteristics of patients were recorded and summarized using descriptive statistics. Numerical data were summarized as mean and standard deviation or median and interquartile range depending on the nature of data distribution. Categorical data were presented as frequencies and percentages. All of the information was recorded and analyzed using the statistics program (SPSS – Statistical Package for Social Science) for Windows, version 27. The association of demographic characteristics, clinical profile, management, and outcomes were assessed using Chi-square or Fisher's exact test. Odds ratios were computed as the measure of association. All tests were performed at 5% level of significance.

### Sample Size Calculation

The average yearly census of pediatric anaphylaxis patients seen and being admitted to our institution was 24 patients. The minimum number of patients was determined based on the assumed proportion of severe anaphylaxis equal to 10% and was calculated using the formula below:

$$n = \frac{N * X}{X + N - 1} \quad \text{where } X = \frac{\left(\frac{Z_{\alpha/2}}{2}\right)^2 * p(1-p)}{E^2}$$

$Z_{\alpha/2}$  was the critical value of the normal distribution at  $\alpha/2$  (e.g., for a confidence level of 95%,  $\alpha$  is 0.05 and was  $Z_{\alpha/2} = 1.96$ ),  $E$  was the margin of error,  $p$  was the assumed proportion, and  $N$  was the population size. Assuming  $N = 1,000$ ,  $p = 10\%$ ,  $\alpha = 0.05$  and  $E = 5\%$ , the recommended minimum sample size was 122. This sample size was also applied to perform association tests using G\*Power software (version 3.1.9.6). Based on effect size  $w = 0.4$  (large), 95% level of confidence, and 80% power of test, the minimum sample size was 97 patients.

### Ethical Considerations

Confidentiality of the patient's information gathered in this study was protected in relation to the Declaration of Helsinki. This study was subjected to approval by the Hospital Research Ethics Board. Data per patient was assigned with alphanumeric codes to maintain confidentiality. All data gathered were stored for 3 years

and will be deleted. Approval from RDI and OMREB was obtained before data gathering to ensure data privacy when data was accessed during data collection. The information was stored in a password-protected laptop/computer known only to the primary investigator and co-investigator and the only ones who had access to the file.

## RESULTS

Figure 1 shows the total number of cases of anaphylaxis from January 2018 to December 2022. Most of the cases were recorded in 2019, with 27. The lowest recorded cases were in 2020, with 14. The decrease in cases during 2020 was attributed to the COVID-19 pandemic. After this, a rise in cases was seen in the succeeding years due to easing protocols in those years.

Table 1 depicts the overall clinical profile of patients diagnosed with anaphylaxis in Ospital ng Makati. Most patients are aged 16 to 18 years (27.8%), followed by ages 13 to 15 (24.7%). It was seen that the incidence increases as the age with a median age of 13 years, IQR 9 to 16. The mean age was 12.1, SD 4.8. There were 45 (46.4%) males and 52 (53.6%) females (Figure 2). Making male to female ratio 1:1.16. Majority of them were residing in District 2 of Makati (77.3%). Food trigger was the most common cause of anaphylaxis among cases seen (86.6%), followed by medication triggers (9.3%). The most common food trigger identified was fish (11.9%), followed by chicken (9.5%), then shrimp (7.1%), and egg (4.8%). For medication triggers, the most common were NSAIDs (66.7%) and paracetamol (33.3%). One case was caused by an animal sting (1%) by an unknown insect bite.

Among the cases seen, almost all patients presented with skin/mucosal involvement (97.9%), followed by respiratory compromise (61.9%) and gastrointestinal symptoms (36.1%). Pertinent with past medical history is that 27 cases had a previous history of food allergy (27.8%) followed by bronchial asthma (21.6%). Only two patients had comorbidities, which were renal, specifically hypokalemic periodic paralysis, and hematologic, which was immune thrombocytopenia (Table 1).

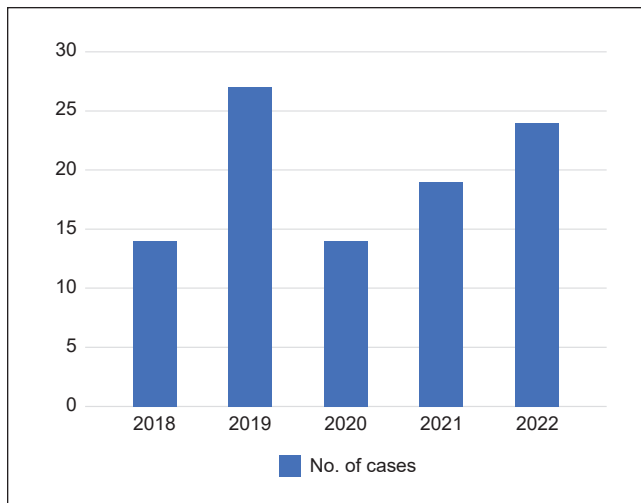
Across all age groups, majority of the patients still had food triggers as a cause of anaphylaxis followed by drug allergy (Table 2).

Similarly, skin involvement, which presents as urticarial rash, is the most common symptom among all age groups, followed by respiratory compromise and gastrointestinal symptoms (Table 3).

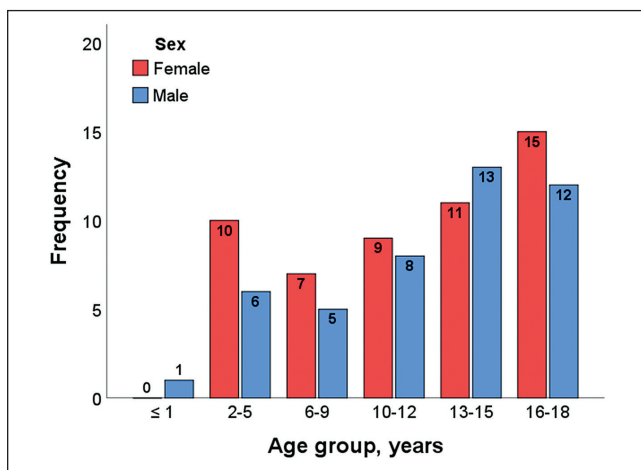
Patients presented with anaphylaxis received epinephrine treatment during the diagnosis of anaphylaxis. Majority only

**Table 1.** Clinical profile of pediatric patients with anaphylaxis from January 2018 to December 2022 (n = 97)

Demographics	n (%)
<b>Age of patient</b>	
28 days to 1 year	1 (1.0)
2 to 5 years	16 (16.5)
6 to 9 years	12 (12.4)
10 to 12 years	17 (17.5)
13 to 15 years	24 (24.7)
16 to 18 years	27 (27.8)
<b>Sex</b>	
Female	52 (53.6)
Male	45 (46.4)
<b>Location</b>	
District 1	21 (21.6)
District 2	75 (77.3)
Other	1 (1.0)
<b>Presenting symptoms</b>	
Mucosal involvement	95 (97.9)
Respiratory compromise	60 (61.9)
Persistent gastrointestinal symptoms	35 (36.1)
Reduced BP or cardiovascular instability	17 (17.5)
<b>Triggers</b>	
Food	84 (86.6)
Drug	9 (9.3)
Animal sting	1 (1.0)
<b>Past history of allergy</b>	
History of food allergy	27 (27.8)
Bronchial asthma	21 (21.6)
History of drug allergy	5 (5.2)
<b>Family history</b>	
Atopy	59 (60.8)
<b>Comorbidities</b>	
Renal	1 (1.0)
Hematologic	1 (1.0)



**Figure 1.** Yearly incidence of anaphylaxis in Ospital ng Makati from January 2018 to December 2022.



**Figure 2.** Age and sex distribution of anaphylaxis in Ospital ng Makati from January 2018 to December 2022.

**Table 2.** Common triggers of pediatric patients per age group with anaphylaxis (n = 97)

Triggers	Age group, years				
	≤ 5	6 to 9	10 to 12	13 to 15	16 to 18
<b>Food</b>	17 (20.2)	12 (14.3)	14 (16.7)	21 (25.0)	20 (23.8)
<b>Drug</b>	0 (0.0)	0 (0.0)	1 (11.1)	3 (33.3)	5 (55.6)
<b>Animal sting</b>	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)

**Table 3.** Presenting symptoms per age group of pediatric patient with anaphylaxis (n = 97)

Symptoms	Age group, years				
	≤5	6 to 9	10 to 12	13 to 15	16 to 18
<b>Skin/Mucosal involvement</b>	17 (17.9)	12 (12.6)	17 (17.9)	24 (25.3)	25 (26.3)
<b>Respiratory compromise</b>	11 (18.3)	6 (10.0)	6 (10.0)	16 (26.7)	21 (35.0)
<b>Persistent gastrointestinal</b>	5 (14.3)	6 (17.1)	7 (20.0)	9 (25.7)	8 (22.9)
<b>Reduced BP</b>	4 (23.5)	0 (0.0)	4 (23.5)	5 (29.4)	4 (23.5)

**Table 4.** Treatment of patients with anaphylaxis (n = 97)

Parameter	n (%)
<b>Epinephrine Use</b>	
1	90 (92.8)
2	5 (5.2)
3	2 (2.1)
<b>Other medications</b>	
Steroids	92 (94.8)
Beta-agonist nebulization	16 (16.5)
H1-Antagonist	94 (96.9)
H2-Antagonist	29 (29.9)
<b>Supportive treatment</b>	
Oxygen support	22 (22.7)
Fluid bolus	16 (16.5)

**Table 5.** Treatment outcomes of pediatric patients with anaphylaxis (n = 97)

Outcomes	n (%)
<b>Treatment Outcomes</b>	
Admission (Ward)	22 (22.7)
Admission (ICU)	75 (77.3)
<b>Length of stay (Median)</b>	3.2 ± 1.1
<b>Occurrence of biphasic anaphylaxis</b>	7 (7.2)

had one dose (92.8 % of the cases), and few cases needed a second (5.2%) or a third dose (2.1%) (Table 4). Three of the five patients who had two doses of epinephrine had a strong family history of atopy and presented with mucosal involvement with respiratory compromise. Similarly, both patients who had three doses of epinephrine also had a strong family history of atopy presenting as mucosal involvement with respiratory compromise.

Most cases were admitted to the intensive care unit (75/97), followed by ward admissions (22/97) (Table 5). All of the admitted patients were sent home, and no mortality nor intubation was observed from all patients. Those patients admitted to the intensive care unit usually presented with skin/mucosal involvement and respiratory compromise (57 out of 75 cases, followed by cardiovascular instability (17 out of 75 cases) and gastrointestinal symptoms (15 out of 75 cases). Mean length of stay was 3 days (SD ± 1.1), with a range of 8 days as the longest and 2 days as the shortest. There were 7 cases of biphasic anaphylaxis in which 4 out of 7 cases presented with mucosal and respiratory symptoms and had a family history of atopy.

Table 6 depicts the association between the clinical profile and the admission outcome of patients admitted with anaphylaxis. Respiratory compromise ( $p = 0.001$ ) and cardiovascular instability ( $p = 0.010$ ) result in severe anaphylaxis outcomes, often leading to ICU admission. Patients who presented with gastrointestinal symptoms were more likely to be admitted to the wards ( $p = 0.001$ ).

**Table 6.** Characteristics, medical history and treatment outcomes of pediatric patients with anaphylaxis (n = 97)

Demographics	Ward	ICU	p-value
<b>Age of patient</b>			
28 days to 1 year	4 (18.2)	13 (17.3)	0.757
2 to 5 years	4 (18.2)	8 (10.7)	
6 to 9 years	4 (18.2)	13 (17.3)	
10 to 12 years	6 (27.3)	18 (24.0)	
13 to 15 years	4 (18.2)	23 (30.7)	
16 to 18 years	4 (18.2)	13 (17.3)	
<b>Sex</b>			
Female	10 (45.5)	42 (56.0)	0.468
Male	12 (54.5)	33 (44.0)	
<b>Location</b>			
District 1	3 (13.6)	18 (24.0)	0.525
District 2	19 (86.4)	56 (74.7)	
Other	0 (0.0)	1 (1.3)	
<b>Presenting symptoms</b>			
Mucosal involvement	22 (100.0)	73 (97.3)	0.999
Respiratory compromise	3 (13.6)	57 (76.0)	<b>0.001</b>
Persistent gastrointestinal symptoms	20 (90.9)	15 (20.0)	<b>0.001</b>
Reduced BP or cardiovascular instability	0 (0.0)	17 (22.7)	<b>0.010</b>
<b>Triggers</b>			
Food	20 (90.9)	64 (85.3)	0.726
Drug	1 (4.5)	8 (10.7)	0.679
Animal sting	0 (0.0)	1 (1.3)	0.999
<b>Past medical history</b>			
Food allergy	6 (27.3)	21 (28.0)	0.999
Bronchial asthma	1 (4.5)	20 (26.7)	<b>0.037</b>
Drug allergy	1 (4.5)	4 (5.3)	0.999
<b>Family history</b>			
Atopy	7 (31.8)	52 (69.3)	<b>0.002</b>
<b>Comorbidities</b>			
Pulmonary	0 (0.0)	3 (4.0)	0.999
Renal	0 (0.0)	1 (1.3)	0.999
Hematologic	0 (0.0)	1 (1.3)	0.999

Patients who had a family history of atopy ( $p = 0.002$ ) and a personal history of bronchial asthma ( $p = 0.037$ ) were more likely to be admitted to the ICU.

Table 7 shows that patients with respiratory symptoms were 18 times more likely to be admitted to the ICU than patients without respiratory symptoms (OR 18.36, 95% CI 2.9 to 114). All patients were then sent home, and no mortality or intubation was recorded among all patients seen.

## DISCUSSION

Overall, the importance of studying nonfatal but severe outcomes of anaphylaxis lies in identifying key intervention points that could potentially improve future patient outcomes.<sup>1</sup> Study results showed that the incidence of

**Table 7.** Logistic regression of characteristics, medical history and treatment outcomes of pediatric patients with anaphylaxis

Predictors	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
<b>Presenting symptoms</b>				
Respiratory compromise	<b>20.1 (5.3 to 75.7)</b>	<b>0.001</b>	<b>18.4 (3.0 to 114.1)</b>	<b>0.002</b>
Persistent gastrointestinal symptoms	0.03 (0.01 to 0.12)	<b>0.001</b>	0.26 (0.03 to 2.07)	0.202
Reduced BP or cardiovascular instability	13.5 (0.8 to 233.4)	0.074	Too wide	
<b>Past history of allergy</b>				
Bronchial asthma	4.8 (1.7 to 13.5)	<b>0.002</b>	2.5 (0.6 to 11.5)	0.228
<b>Family history</b>				
Atopy	7.6 (1.0 to 60.5)	<b>0.054</b>	2.0 (0.2 to 24.5)	0.593

anaphylaxis increases with age in the pediatric population. However, this increase was not associated with more serious outcomes. These were in contrast to other studies, which showed that as age increased, the odds of having a serious outcome increased by 1.9%. Similarly, a study in Korea also showed a higher risk of serious outcomes among the older age group. This may be due to the diminished ability to cope with the systemic effect of anaphylaxis, especially if there is a pre-existing health status among the older age group.<sup>2</sup> In one study, severe anaphylaxis requiring PICU admission occurred mainly in adolescents with nearly equal gender distribution. This was similar to our results, which showed that the incidence of anaphylaxis was increasing in each age group with no gender difference. Results of our study also showed that food was the most common trigger of anaphylaxis, similar to other literature. However, food had no direct correlation with the severity of anaphylaxis in our study. This was in contrast with studies in which food and venom triggers were associated with decreased odds of severe anaphylaxis. Conversely, medication as a trigger was associated with increased odds of severe anaphylaxis.<sup>3</sup> This may be due to the limited number of drug-induced cases in this study and the inclusion of the adult population in other studies. In the same study, the majority exhibited cutaneous manifestations, and all experienced some degree of cardiorespiratory compromise, similar to our findings.<sup>4</sup> Lastly, suboptimal asthma control, in addition to the presence of asthma, increases the likelihood of having severe anaphylaxis.<sup>5</sup> This was consistent with our findings, in which 22 out of 23 patients with a history of bronchial asthma were admitted to the PICU due to severe anaphylaxis. However, this was in contrast to the study by Motosque, who reported a decreased risk for severe anaphylaxis in individuals with a history of asthma.<sup>8</sup>

## CONCLUSION AND RECOMMENDATION

In summary, prompt diagnosis and thorough history-taking are essential in the management of anaphylaxis. This is to ensure prompt and timely management of patients experiencing anaphylaxis. The results of this study are similar to those published in previous studies in terms of age group, possible triggers, and the significance of

prior medical history in determining patient outcomes. The present study supports the increase in the incidence of anaphylaxis in the older pediatric age group, with food-induced anaphylaxis as the most common etiology. This emphasizes the need for pediatricians and other specialties to investigate specific food triggers to manage anaphylaxis. Respiratory compromise and cardiovascular instability result in severe anaphylaxis and are associated with a history of atopy. Similarly, all cases with biphasic anaphylaxis also had a history of atopy. However, the studies specifically for pediatric populations are limited globally and locally. Overall outcomes of patients managed as anaphylaxis in the pediatric population were favorable. Diagnostic tests, such as skin testing or serum-specific IgE levels, were not performed in this study, representing a limitation in identifying possible triggers. Further recommendations should include a larger pediatric population with comorbidities. Additionally, first-aid interventions before emergency room consultation should be obtained since they were not considered and elicited in this study.

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## Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

## Authors Disclosure

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