# RESEARCH





Precipitating factors and outcome of acute asthma attack patients attended to the emergency unit at Cairo University Specialized Pediatric Hospital in 2019 "before COVID era"

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# Abstract

**Background** Asthma is a common and potentially serious chronic disease that imposes a substantial burden on patients, their families, and the community.

**Objectives** The aim of this study was to find a correlation between precipitating factors of acute asthma attacks of patients attending to emergency departments and different factors such as socioeconomic status.

**Methods** The study included patients 2–12 years old of both sexes who were already diagnosed with bronchial asthma coming to ER with acute asthmatic attacks. Data were collected by a questionnaire which includes personal data (name, age, and sex), anthropometric data, score for assessment of socioeconomic status (SES), symptoms of asthmatic attack, risk factors, mode and type of treatment, compliance to treatment, or evaluation of asthma severity and outcome of patients attending to ER.

**Results** This study included 170 patients. Males represented 63.5% of the patients. The mean age of the patients was 5.4±2.7 years. Our patients were distributed into the following: 65.9% were low SES, 22.9% were very low SES, and 11.2% were moderate SES. As regards presenting symptoms of the study group, all the patients (100%) presented to ER with cough, while 88.2% of them presented with wheezes, 85.8% presented with dyspnea, 21.2% of them presented with tightness, and only 0.01% presented with cyanosis. As regards precipitating factors of asthma, the most common precipitating factors among our patients causing attending to ER were irritant inhalers (72.4%), passive smoking (60.6%), exercise (70.5%), certain foods (45.3%), upper respiratory tract infection (12.9%), and non-compliance to asthma treatment (85.2%). The most common causes of non-compliance to treatment were family negligence and illiteracy (34.1%) and poor socioeconomic conditions (17.1%). The majority of patients (96.5%) who could be stabilized with medications were discharged, whereas a merged proportion of critically ill patients (3.5%) required ICU admission. However, no deaths were reported.

**Conclusion** The most common precipitating factors of our patients that led to more attending to ER in the previous 6 months were exercise, irritant inhalers, and non-compliance to asthma treatment.

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Keywords Precipitating factors, Acute asthma attack, Emergency unit

# Background

Asthma is a prevalent disease in children and adolescents, as the prevalence concerns about 10% of the general pediatric population. Asthma is a chronic disease characterized by airway inflammation, bronchial hyperresponsiveness, and variable airflow obstruction [1].

In asthma, leukotriene-mediated effects include bronchospasm, mucosal secretion, vascular permeability, and recruitment of eosinophils [2].

Identifying children with uncontrolled severe asthma is important because they potentially need close monitoring and additional treatment. Uncontrolled asthma may be due to an improper dose of treatment, family negligence, improper use of inhalers, or there is co-morbidity [3].

# Aim of the work

The aim of this study was to find a correlation between precipitating factors of acute asthma attack patients attending to emergency departments and different factors such as socioeconomic status (education and occupation), family negligence or medication unaffordability, and outcome of this attendance.

# Methods

#### Population of study and disease condition

This was cross-sectional observational study carried out during the period from June 2019 to December 2019 on 170 children of both sexes and different ages coming to ER with acute asthmatic attacks based on clinical symptoms such as cough, wheezes, chest tightness, and dyspnea. Patients were recruited from the emergency department at Cairo University Specialized Pediatric Hospital. The patients were selected according to the following criteria:

# Inclusion criteria

Patients 2–12 years old were included if they are already diagnosed with bronchial asthma based on clinical symptoms such as cough, chest tightness, and wheezes coming to ER with acute asthmatic attack.

# **Exclusion criteria**

- 1. Patients with allergic rhinitis alone were excluded but were included if associated with asthma as a co-morbid condition.
- 2. Patients with a history of spirometry.

3. Patients with co-morbidities other than bronchial asthma (ex: anatomical chest disorders, interstitial lung disease, adenoids, GERD, cardiac disorders, neurological disorders, or patients with fever and X-ray finding suspected bronchopneumonia and others)

# Methodology in details Background and demographic characteristics

Both sexes aged 2–12 years old were included in the study. Data were collected by a questionnaire which included the following:

- 1. Personal data (name, age, sex).
- 2. Anthropometric data (weight and length) were assessed and plotted on the WHO growth curves. World Health Organization *z* score values were calculated for weight for age, weight for length, and length for age.
- 3. Score for assessment of socioeconomic status (SES) El-Gilany Modified scale of socioeconomic status had seven domains with a total score of 84 with a higher score indicating better SES. The score was translated into the Arabic language to facilitate the collection of data from the guardian, then the findings were recorded in a tabular form.
- 4. Symptoms of asthmatic attack such as dyspnea, chronic cough, chest tightness, or wheezing.
- Risk factors such as allergy, seasonal variation, family history, or passive smoking.
- 6. Mode and type of treatment.
- 7. Compliance with treatment or not and why.
- 8. Evaluation of asthma severity.
- 9. Outcome of patients attending to ER.

# Statistical analysis

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 25 (IBM Corp., Armonk, NY, USA). Data was summarized using the mean, standard deviation, median, minimum, and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. For comparing categorical data, chi-square ( $\chi^2$ ) test was performed. An exact test was used instead when the expected frequency is less than five [4]. *P* values less than 0.05 were considered as statistically significant. Chan YH [4]: Biostatistics 103: qualitative data – tests of independence. Singapore Med J.; 44(10): 498-503.

The aim of data analysis was to detect the following:

- 1. Most common precipitating factors for ER visits.
- 2. Relation between frequency of ER visits in previous 6 months and different precipitating factors.
- 3. Outcome of patients attending to ER.

# Results

## Study sample

This study included 170 patients of both sex (108 males and 62 females) of different ages 2-12 years old with acute asthmatic attacks coming to the emergency room (ER) at Cairo University Children's Hospital.

The age distribution of patients at the time of questionnaire taking ranged from 2-12 years old with a mean of age  $5.4 \pm 2.7$  years.

Patients were classified into 108 (63.5%) males and 62 (36.5%) females.

Assessment of anthropometric measurements of our patients revealed that the median weight was  $18 \pm 9.17$  kg and median height was  $105 \pm 17.73$  cm.

Almost nine patients (5.3%) were  $\leq$  3rd percentile for weight while around eleven patients (6.5%) were  $\leq$  3rd percentile for height.

Assessment of socioeconomic status by El-Gilany Modified score which included seven domains with a total score of 84. SES level is classified into very low, low, middle, and high depending on the quartiles of the score calculated.

Our patients were distributed into 112 (65.9%) patients who were low SES, 39 (22.9%) who were very low SES, and 19 (11.2%) who were moderate SES.

As regards presenting symptoms of the study group, of all the patients, 170 (100%) presented to ER with cough, 150 (88.2%) presented with wheezes, 146 (85.8%) presented with dyspnea, 36 (21.2%) presented with tightness, and only two (0.01%) presented with cyanosis as shown in Table 1.

As regards precipitating factors of asthma, the most common precipitating factors among our patients causing attending to ER were as follows: irritant inhalers were 123 (72.4%), passive smoking was 103 (60.6%), exercise was 120 (70.5%), certain foods were 77 (45.3%), upper respiratory tract infection was 22 (12.9%), and non-compliance to asthma treatment was 145 (85.2%) as shown in Table 2.

The most common causes of non-compliance to treatment were family negligence and illiteracy 58 (34.1%) while poor socioeconomic conditions were 29 (17.1%) as shown in Table 3.

In our patients, there were 112 (65.8%) where both parents are educated, 19 (11.1%) illiterate, 23 (13.5%) maternal illiterate, and 16 (9.6%) paternal illiterate.

# Table 1 Symptoms of asthma among patients

|           | Count | %     |
|-----------|-------|-------|
| Wheezes   |       |       |
| Yes       | 150   | 0.882 |
| Cough     |       |       |
| Yes       | 170   | 100   |
| Dyspnea   |       |       |
| Yes       | 146   | 0.858 |
| Tightness |       |       |
| Yes       | 36    | 0.212 |
| Cyanosis  |       |       |
| Yes       | 2     | 0.011 |

#### Table 2 Precipitating factors of asthma

|                    | Count | %      |
|--------------------|-------|--------|
| URTI               |       |        |
| Yes                | 22    | 12.90% |
| Irritants inhalers |       |        |
| Yes                | 123   | 72.40% |
| Exercise           |       |        |
| Yes                | 120   | 70.50% |
| Certain foods      |       |        |
| Yes                | 77    | 45.30% |
| Passive smoking    |       |        |
| Yes                | 103   | 60.60% |
| Non-compliance     |       |        |
| Yes                | 145   | 85.20% |

Table 3 Causes of non-compliance to asthma treatment

|                               | Count | %      |
|-------------------------------|-------|--------|
| Family negligence             |       |        |
| Yes                           | 58    | 34.10% |
| Family illiteracy             |       |        |
| Yes                           | 58    | 34.10% |
| Poor socioeconomic conditions |       |        |
| Yes                           | 29    | 17.10% |
|                               |       |        |

As regards medications used in the management of asthma and the route of intake, the majority of patients 157 (92.4%) used systemic bronchodilators such as "Salbutamol and Terbutaline" in the form of syrup (99.4%), while 68 (40%) used inhaled bronchodilator as "Salmeterol" in the form of inhaler (57, 83.8%), nebulizer (11, 16.2%), systemic steroids (76, 44.7%) in the form of tablet (3, 3.9%), syrup as "Dexamethasone" (73, 96.1%), inhaled steroids as "Fluticasone and Beclomethasone" (71, 41.8%) in the form of inhaler (62, 87.3%), nebulizer

(9, 12.7%) and leukotriene receptor antagonists as "Montelukast" (35, 20.6%) in form of sachet (33, 94.3%), tablet (2, 5.7%) as shown in Table 4.

 Table 4
 Medications used in the management of asthma and its route of intake

|                                   | Count      | %      |
|-----------------------------------|------------|--------|
| Systemic bronchodilator           |            |        |
| Yes                               | 157        | 92.40% |
| Systemic bronchodilator method of | medication |        |
| Syrup                             | 157        | 99.40% |
| Inhaled bronchodilator            |            |        |
| Yes                               | 68         | 40.00% |
| Inhaled bronchodilator            |            |        |
| Inhaler                           | 57         | 83.80% |
| Nebulizer                         | 11         | 16.20% |
| Systemic steroids                 |            |        |
| Yes                               | 76         | 44.70% |
| Systemic steroids                 |            |        |
| Tablet                            | 3          | 3.90%  |
| Syrup                             | 73         | 96.10% |
| Inhaled steroids                  |            |        |
| Yes                               | 71         | 41.80% |
| Inhaled steroid route             |            |        |
| Inhaler                           | 62         | 87.30% |
| Nebulizer                         | 9          | 12.70% |
| LTRA                              |            |        |
| Yes                               | 35         | 20.60% |
| LTRA route                        |            |        |
| Sachet                            | 33         | 94.30% |
| Tablet                            | 2          | 5.70%  |

The severity of asthmatic attack of our patients was classified into mild, moderate, and severe according to GINA 2019 [5] classification. Most patients presented to ER with mild asthma were 83 (48.8%), while 81 (47.6%) were with moderate asthma and six (3.5%) with severe asthma as shown in Fig. 1.

Our patients were divided into three groups according to number of ER visits. Patients attending to ER < 5 visits were 38 (22.4%), while from five to nine visits were 48 (28.2%) and  $\geq$  10 visits were 84 (49.4%) as shown in Table 5.

The majority of patients (164, 96.5%) who could be stabilized with medications were discharged, whereas a merge proportion of critically ill patients which were six (3.5%) required ICU admission. However, no deaths were reported as shown in Table 6.

The frequency of ER visits during the previous 6 months was increased with patients who had precipitating factors of asthma such as irritant inhalers, exercise, and non-compliance (p value was 0.041, 0.038, 0.047, respectively) with statistically significant differences as shown in Table 7.

The patients with low SES experienced more ER visits (68.4% had ER visits < 5, 64.6% had 5–9 visits, and 65.5% had  $\geq$  10 visits) in comparison to patients with very low and moderate SES levels. It did not show any statistically significant difference (*p* value = 0.909) as shown in Table 8 and Fig. 2.

#### Regarding systemic bronchodilator

All our patients received systemic bronchodilators regardless number of ER visits with no statistically significant difference (p value = 0.510).



Fig. 1 Assessment of asthma severity

#### **Table 5** Frequency of ER visits during the previous 6 months

|                             | Count               | %     |
|-----------------------------|---------------------|-------|
| Frequency of ER visit durin | g previous 6 months |       |
| <5                          | 38                  | 22.4% |
| 5 to 9                      | 48                  | 28.2% |
| >=10                        | 84                  | 49.4% |

Table 6 Outcome of attending to RE

|                 | Count | %     |
|-----------------|-------|-------|
| Outcome         |       |       |
| Hospitalization | 6     | 3.5%  |
| Discharge       | 164   | 96.5% |

# Regarding systemic steroids

Only three patients received systemic steroids in the form of a tablet dissolved in water due to the heavy weight of these patients. They presented to ER < five visits (6.7%), five to nine visits (5.3%), and  $\geq$  ten visits (2.4%) while those who took syrup presented to ER < five visits (93.3%), five to nine visits (94.7%), and  $\geq$  ten visits (97.6%) without statistically significant difference (*p* value = 0.352).

# Regarding inhaled steroids

The majority of patients were presented to ER more than ten times in the previous 6 months, and they received inhaled corticosteroids in the form of inhalers as a line for a controller of asthma, while patients who took nebulizers were presented to ER < five visits (22.2%), five to

Table 7 Relation between frequency of ER visits during 6 months and different precipitating factors

|                    | Frequency of ER visits during the previous 6 months |        |             |        |       | P value |       |
|--------------------|---|--------|-------------|--------|-------|---------|-------|
|                    | <5  |        | 5 to 9 ≥ 10 |        |       |         |       |
|                    | Count   | %      | Count       | %      | Count | %       |       |
| URTI               | 6   | 15.80% | 6           | 12.50% | 10    | 11.90%  | 0.795 |
| Irritants inhalers | 23  | 60.50% | 35          | 72.90% | 65    | 77.40%  | 0.041 |
| Exercise           | 15  | 39.50% | 27          | 56.30% | 51    | 60.70%  | 0.038 |
| Certain foods      | 14  | 36.80% | 23          | 47.90% | 40    | 47.60%  | 0.494 |
| Passive smoking    | 23  | 60.50% | 31          | 64.60% | 49    | 58.30%  | 0.779 |
| Non-compliance     | 30  | 78.90% | 45          | 93.70% | 70    | 83.30%  | 0.047 |

#### Table 8 Relation between frequency of ER visits with SES

|                  | Frequency of ER visits during the previous 6 months |       |        |       |       | P value |       |
|------------------|---|-------|--------|-------|-------|---------|-------|
|                  | <5  |       | 5 to 9 |       | ≥10   |         |       |
|                  | Count   | %     | Count  | %     | Count | %       |       |
| Socioeconomic st | atus  |       |        |       |       |         |       |
| Very low         | 7   | 18.4% | 11     | 22.9% | 21    | 25.0%   | 0.909 |
| Low              | 26  | 68.4% | 31     | 64.6% | 55    | 65.5%   |       |
| Moderate         | 5   | 13.2% | 6      | 12.5% | 8     | 9.5%    |       |

# Regarding inhaled bronchodilator

Patients who took inhaled bronchodilator in the form of an inhaler presented to ER < five visits (85.7%), five to nine visits (78.3%), and  $\geq$  ten visits (87.1%) while patients who take nebulizer presented to ER < five visits (14.3%), five to nine visits (21.7%), and  $\geq$  visits (12.9%) without statistically significant difference (*p* value = 0.696).

nine visits (9.5%),  $\geq$  ten visits (9.4%) without statistically significant difference (*p* value = 0.390).

# Regarding leukotriene receptor antagonists

Patients who took leukotriene receptor antagonists in form of sachet presented to ER < five visits (100%), five to nine visits (81.8%), and  $\geq$  ten visits (100%) while patients who



Fig. 2 Bar chart illustrates the relation between the frequency of ER visits with SES

take a tablet presented to ER < five visits (0.0%), five to nine visits (18.2%), and  $\geq$  ten visits (0.0%) without statistically significant difference (*p* value=0.653) as shown in Table 9.

# Discussion

Asthma is a multifactorial disease with heterogeneous clinical phenotype and complex genetic inheritance [6].

Childhood multiple environmental exposures and influences contribute to the increased incidence of asthma and excess asthma morbidity among children with asthma [7].

The primary aim of asthma management is to make an early diagnosis and to achieve a prompt control of symptoms, in order to reduce the risk of future exacerbations and progressive loss of lung function [8].

Important factors that have been reported to facilitate improvement in primary care management of asthma include the availability of good organizational support and access to resources within the practice, as well as having a dedicated asthma team [9].

Uncontrolled asthma in children is still highly prevalent despite the availability of effective asthma treatment. Uncontrolled asthma may be due to the improper dose of treatment, family negligence, improper use of inhalers, or the presence of comorbidity [10].

The aim of this study was to find a correlation between precipitating factors of acute asthma attack patients attending to the emergency department and different factors such as socioeconomic status (education, occupation, home sanitation), family negligence, or medication unaffordability and outcome.

Our study included 170 asthmatic patients (diagnosed with asthma according to Global Initiative for Asthma [5] following up in a pediatric allergy clinic in a pediatric specialized hospital at Cairo University.

The mean age of our patients at recruitment was  $5 \pm 2$  years with a minimum of 2 years and a maximum of 12 years.

In our study, we found male predominance. This comes in agreement with Dias et al. who reported that males attended to ER more than females [11].

The majority of our cases were from urban areas (77%) where more pollution, crowdedness, and smoking. These factors may contribute to the increased prevalence of asthma in urban areas.

This is in agreement with Grant et al. study which was conducted on 1600 children were attended to ER. More than 60% of them lived in urban areas. Residence in urban or poor areas was all independently associated with an increased risk of asthma-related ED visits and hospitalizations [7].

We found out those sociodemographic characteristics of patients as age, gender did not have any statistically significant relation with more attendance to the emergency department, this is in concordance to a study by Giraud et al. who demonstrated that age and gender has no impact on attendance to ER [12].

|                     | Frequency of ER visits during the previous 6 months |            |        |         |       | P value |       |
|---------------------|---|------------|--------|---------|-------|---------|-------|
|                     | <5  |            | 5 to 9 |         | ≥10   |         |       |
|                     | Count   | %          | Count  | %       | Count | %       |       |
| Systemic broncho    | dilator   |            |        |         |       |         |       |
| Yes                 | 35  | 92.10%     | 45     | 93.80%  | 77    | 91.70%  | 0.933 |
| Systemic broncho    | dilator method of n                                 | nedication |        |         |       |         |       |
| Nebulizer           | 0   | 0.00%      | 0      | 0.00%   | 0     | 0.00%   | 0.51  |
| Syrup               | 35  | 100.00%    | 45     | 100.00% | 77    | 100.00% |       |
| Inhaled bronchod    | ilator  |            |        |         |       |         |       |
| Yes                 | 14  | 36.80%     | 23     | 47.90%  | 31    | 36.90%  | 0.418 |
| Inhaled bronchod    | ilator method                                       |            |        |         |       |         |       |
| Inhaler             | 12  | 85.70%     | 18     | 78.30%  | 27    | 87.10%  | 0.696 |
| Nebulizer           | 2   | 14.30%     | 5      | 21.70%  | 4     | 12.90%  |       |
| Systemic steroids   |   |            |        |         |       |         |       |
| Yes                 | 15  | 39.50%     | 19     | 39.60%  | 42    | 50.00%  | 0.39  |
| Systemic steroid m  | nethod  |            |        |         |       |         |       |
| Tablet              | 1   | 6.70%      | 1      | 5.30%   | 1     | 2.40%   | 0.584 |
| Syrup               | 14  | 93.30%     | 18     | 94.70%  | 41    | 97.60%  |       |
| Inhaled steroids    |   |            |        |         |       |         |       |
| Yes                 | 18  | 47.40%     | 21     | 43.80%  | 32    | 38.10%  | 0.596 |
| Inhaled steroid rou | ute   |            |        |         |       |         |       |
| Inhaler             | 14  | 77.80%     | 19     | 90.50%  | 29    | 90.60%  | 0.39  |
| Nebulizer           | 4   | 22.20%     | 2      | 9.50%   | 3     | 9.40%   |       |
| LTRA                |   |            |        |         |       |         |       |
| Yes                 | 6   | 15.80%     | 11     | 22.90%  | 18    | 21.40%  | 0.694 |
| LTRA route          |   |            |        |         |       |         |       |
| Sachet              | 6   | 100.00%    | 9      | 81.80%  | 18    | 100.00% | 0.118 |
| Tablet              | 0   | 0.00%      | 2      | 18.20%  | 0     | 0.00%   |       |

Table 9 Relation between frequency of ER visits during previous 6 months and types, and modes of treatment taking

In our study, we demonstrated that non-compliance to asthma treatment has a statistically significant relation with frequent attendance to ER in the previous 6 months (p value was 0.047).

Our study recorded that the most common causes of non-compliance to asthma treatment are family negligence (34.1%), family illiteracy (34.1%), and financial disability (17.1%).

In support of our study, Chen et al. and Ramkillawan et al. who found out that the education level of the caregivers has been reported as significant factors related to more attendance to ER [13, 14].

This is in contrast to a study by Joy et al. the mothers' educational level did not show any statistically significant association with the asthma control status of participants [15].

This is in concordance with Biagioli et al. study that was enriched on 213 families with 268 children, 150 (56.0%) reported that their household income was low. One hundred six (39.6%) missed at least one health supervision visit, and 85 (31.7%) had at least one ER visit within the past 12 months. Children who were ER users were younger (mean age 6.4 years, P < 01), more likely to live in a low-income household (65.9%, P = 0.03), and more likely to have missed health supervision appointments (65.9% P < 01). Nonadherence to health supervision visits is an independent risk factor and potentially modifiable [16].

Another study of Kheirkhahp et al. demonstrated that low income and non-adherence to health supervision visits are risk factors that increase ER utilization. Providing low-cost, reliable, and accessible continuity of care for children living in poverty, providing appointment reminders, and educating families on the importance of health maintenance visits may optimize health outcomes while decreasing the rates of ER visits [17].

In another study of Anderson et al. on 183 children, they found that under half of parents/carers in their study sample admitted, they do not refer to the prescription of a pediatric individualized asthma action plan (IAAP), as well as compliance with that plan. Plan when their child is having an exacerbation. The self-reported low rates of plan utilization and compliance support this hypothesis [18].

In our study, we demonstrated that the most presenting symptoms of patients attending to ER were cough (100%), then wheezes 88.2%, then dyspnea 85.8%, then chest tightness 21.2%, and only (0.01%) presented by cyanosis.

In support of our study, Mustafa et al. study which was conducted on 60 children attending to ER with acute asthmatic attacks. Forty-five percent of these children presented to the emergency room with cough, while 15% of them presented to the emergency room with wheezes, and only 10% of them presented to the hospital immediately by chest tightness and dyspnea [19].

In our study, regarding precipitating factors of asthma exacerbation, there is a high statistically significant relation between patients who were regularly exposed to irritant inhalers (p value was 0.041) with attending to ER in the previous 6 months.

Another study in support of our observations analyzed the synergy between environmental factors (pollutant, allergenic birch pollen, weather) and its relationship with asthma hospitalization in Montreal, Canada. Moreover, the explained variance of asthma hospitalization due to air pollution rises from about less than 7% to about 28% (R=0.53, p < 0.05). Statistical tests for interaction and overall results point towards a synergy between environmental factors which exacerbated asthma [20].

In our study, there was a statistically significant relation between patients who practiced vigorous physical activities (*P* value was 0.038) and frequency of ER attendance in the previous 6 months.

This is in concordance with Aggarwal et al. study that was enriched in Children with controlled asthma (n=101) underwent characterization and free-running exercise bronchoprovocation at a center in Nigeria. Lung function was measured before, then 5, 10, 15, and 30 min after a 6- to 8-min exercise. The result of this study was 30% had no exercise-induced bronchoconstriction (EIB), and 70% had severe EIB [21].

In our study, there was no statistically significant relation between patients who were exposed to passive smoking (p value was 0.779) and attendance to ER in the previous 6 months.

This is in disagreement with Belvisi and Newman [22] study of 276 children with asthma who were exposed to passive smoking. Belvisi et al. study found that passive smoking was positively associated with ER visits (p < 0.01), but not with hospitalizations or abnormalities in pulmonary function. The frequency of asthma symptoms per month was also directly associated with ER visits (p < 0.02). The estimated mean annual increase

in ER visits is attributable to the presence of one or more smokers in the household [22].

In our study, there was no statistically significant relation between patients who were exposed to certain food (p value was 0.494) and attendance to ER in the previous 6 months.

On the other hand, Julia et al.'s [23] study of 400 children with asthma attending to ER found that there was a strong association between the presence of food sensitization and poor asthma control, including increased asthma-related health-care utilization and emergency medication use. Therefore, besides food allergy (FA) education and management, patients with FA and with asthma should optimize medical therapy for their asthma and receive asthma education [23].

Our study recorded that there was no statistically significant relation between patients exposed to upper respiratory tract infection (p value was 0.795) and attendance to ER in previous 6 months.

This is in disagreement with Jartti et al. [24] study which demonstrated that asthma exacerbation usually occurred in response to a variety of external agents, including respiratory viruses and bacteria. However, it was estimated that up to 85–95% of asthma exacerbations in children were linked to viral infections. Hospital admissions for asthma exacerbations correlated with a seasonal increase of Rhinovirus infections in autumn and in spring [24].

In our study, the majority of patients (96.5%) who could be stabilized with medications were discharged, whereas a merge proportion of critically ill patients (3.5%) required ICU admission. However, no deaths were reported.

This is in contrast to a study by Haselkorn et al. that demonstrated about 1745 ER visits admitted by asthma exacerbation were registered in the considered timeframe. A persistent and significant increase in ER admissions for asthma has been registered from 2013 to 2015, as shown in Fig. 3 [25].

This is in concordance to Gavada et al.'s study that was enriched on 424 children with asthma exacerbation coming to ER. About 80% of them were discharged while 20% were hospitalized [26].

# Conclusion

- The aim of this study was to find the correlation between precipitating factors of acute asthma attack patients attending to the emergency department and different factors such as socioeconomic status (education, occupation), family neglicance, or medication unaffordability and outcome.
- The sociodemographic characters of patients had no statistical significant difference with attendance to ER.



Fig. 3 Persistent and significant increase in ER admissions for asthma has been registered from 2013 to 2015

- There was no statistical difference between patients who had precipitating factors of asthma such as upper respiratory tract infection, passive smoking, and certain food and frequency of ER visits during the previous 6 months.
- There was a statistically significant difference between patients who had precipitating factors of asthma as irritant inhalers, exercise, and non-compliance to asthma treatment and frequency of ER visits during the previous 6 months (*P* value was 0.041, 0.038, and 0.047), respectively.
- Only six patients (3.5%) were hospitalized in ICU with no death while 146 patients (96.5%) were discharged after stabilization of chest condition by medication.

# Recommendations

- 1) Avoidance of exposure to common risk factors that precipitate asthma.
- 2) We should implement of health education about precipitating factors and lines of treatment of asthma.
- 3) Further studies on larger population of asthmatic patients are needed to confirm relation between different precipitating factors and frequency of attendance to emergency room.

#### Abbreviations

| BA    | Bronchial asthma                           |
|-------|--|
| FEV1% | Forced expiratory volume in 1 s percentage |
| FEV1  | Forced expiratory volume in 1 s            |

| GERD  | Gastroesophageal reflux             |
|-------|-------------------------------------|
| GINA  | Global initiative for asthma        |
| HRCT  | High-resolution computed tomography |
| HRV   | Human rhinovirus                    |
| ICS   | Inhaled corticosteroids             |
| IFN-γ | Interferon y                        |
| ILC2  | Interleukins C2                     |
| LABA  | Long-acting beta 2 agonist          |
| LTRA  | Leukotriene receptor antagonist     |
| ocs   | Oral corticosteroids                |
| PFT   | Pulmonary function tests            |
| RSV   | Respiratory syncytial virus         |
| SES   | Socioeconomic status                |
| WHO   | World Health Organization           |
|       |                                     |

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#### Authors' contributions

IA, ST, and AB have designed this study together. ST and HM contributed to the data collection. AB and HM contributed to the data analysis. IA contributed to the data processing. KA was a major contributor in writing the manuscript. The authors read and approved the final manuscript.

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#### Availability of data and materials

All the data within the article. The data supporting the conclusions of this article are available upon reasonable request from the authors.

### Declarations

#### Ethics approval and consent to participate

This study was approved by the Ethical Research Committee of Faculty of Medicine Cairo University in Egypt. The ethics committee reference number is not available.

A verbal consent was taken from the legal guardians of all patients accepting to participate in our research work.

Written approval was taken from ER for asking patients by questionnaire. Also the study was approved by ethics committee of Cairo University Children Hospital.

The study has been performed in accordance with the ethical standards laid down in the Helsinki Declaration of 1975 and its later amendments.

All methods were carried out in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

#### **Consent for publications**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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