Risk factors of hospital admissions and recurrent emergency department visits among pediatric asthma patients

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ABSTRACT

Asthma is considered to be a prevalent disease that often goes undetected in the primary-care setting. Particularly among children, it is observed that the asthma occurrence is rising globally. Among Saudi children, the prevalence differs from one area to another in the same country. In Al Hofuf, it was reported the highest prevalence (33.7%), while the lowest was reported in Abha (9%). The asthmatic patients admitted to emergency departments (ED) failed to manage their disease, suffering critical breathing difficulties, and are repeatedly admitted to the hospital. However, one visit is not satisfactory; there are more severe cases that frequently visit the ED. A web-based literature search using the advanced features of various databases, such as PubMed, Scopus, Embase, Google Scholar, Directory of Open Access Journals, and Cochrane electronic databases was carried out. Our study recognized many factors that increase the risk of repeated ED visits for the crisis-oriented care of asthma.

Keywords: Risk factors, hospital admissions, emergency department visits, pediatric, asthma.

Introduction

Asthma is a chronic inflammatory airway disorder distinguished by reversible obstruction of airflow, hyper-responsiveness, and inflammation of the airways [1]. Among childhood, asthma is one of the most prevalent chronic diseases with a high socioeconomic cost [2] and has considered for much of the current increase in disability [3]. Expanding in the hospital admissions rates and the emergency department (ED) visits are well-known outcomes, reflecting the severity degree of asthma [4]. Among children less than 15-year old, asthma is the most common hospitalization cause than other diseases [5].

Several factors influence ED visits, including improper use of inhalers, asthma severity, medication cost, poor adherence, comorbidities, the use of short-acting bronchodilators, pollution, and weather changes, level of education, and low socioeconomic status are the most commonly reported factors [6–13].

Decreasing the ED visits for asthmatic patients is a principal goal of asthma control that is suggested by all the guidelines [14]. In our society, the reasons for frequent visits of asthmatic patients to ED are not clear. Understanding the factors correlated with reducing the use of ED resources for asthma treatment is also a critical factor in reducing ED visits of asthmatic patients. The factors that influence the patients to visit ED may differ from one society to another. Therefore, it is necessary to recognize the features of the patients and needs, which caused poor asthma management and frequent visits to the ED. We conducted this study is to estimate the significant risk factors correlated with hospital admissions and recurrent ED visits in pediatric asthma patients.

Methods of Literature Search

Web-based literature research applying the advanced search features of several databases, such as Scopus, PubMed, Google Scholar, Cochrane electronic databases,
and Embase was carried out. The keywords, such as risk factors of hospital admissions and recurrent ED, asthma severity, and admission to ED, the correlation between education and readmission to ED in asthmatic patients, etc were used to explore the databases. The search included articles issued from 1995 to 2020 and published in the English language (Table 1).

**Prevalence of Asthma**

During the last decades, the prevalence of asthma increased due to increase in industrialization and modernization. WHO stated that all over the world, there are 235 million asthmatic patients, with about 383 thousand deaths in 2015. Notwithstanding the progress in medicine, 40%–70% of asthmatic patients remain uncontrolled [15]. In Saudi, asthma attacks about 2 million, and modern research studies propose that most patients were uncontrolled, where their quality of life was negatively affected. Depending on the Saudi Ministry of Health, the asthma prevalence varies from 15% to 25% [15]. The prevalence of asthma among Saudi children changes from one region to another in the same country [16], with the highest prevalence in Al Hofuf (33.7%) and the lowest in Abha (9%) [17].

**Risk Factors for Readmission to ED**

Many factors lead patients to visit the ED. The most commonly reported factors include improper use of inhalers, asthma severity, education, and environmental factors.

**Improper use of inhaler devices**

The treatment of asthma by using inhaled corticosteroids is the optimal way for suitable drug delivery for bronchial asthma treatment and could decrease hospitalizations by 80% [18]. The inhaled therapy has the advantage of localized delivery of a high drug concentration to the airways with insignificant side effects [19]. Nevertheless, improper use of inhaler devices is the most popular reason that hinders more regular asthma control [20,21]. Some research studies have investigated that the improper use of inhaler devices diminishes patient regimen adherence, drug delivery, and drug effectiveness presents uncontrolled asthma and repetitive ED visits [18–21]. A study conducted by Al-Muhsen et al. [7] stated that asthmatic patients who misused inhaler devices were at higher probabilities of visiting the ED, compared to those with appropriate technique. Consistent with these findings, a study on Saudi adult asthmatics concluded that a higher frequency of ED visits was correlated with improper use of asthma inhaler devices [6].

**Asthma severity**

Comparable to adults, children were classified into four groups depending on disease severity: mild intermittent, moderate persistent, mild persistent, and severe persistent, with extra instructions to start daily treatment in children consistently demanding symptomatic treatment more than two times per week and in those with episodes of severe exacerbations occurring <6 weeks apart [22]. According to clinical phenotypes, patients with fixed airflow obstruction (FAO), difficult-to-treat asthma, or who were in the critical obstructive asthma cluster had significantly higher healthcare use, reconfirming that earlier recognized signs representing poor asthma control were significantly correlated with higher healthcare use [23]. In a cohort study, the number of outpatient visits was higher. Systemic corticosteroids were more frequently used. When patients with FAO dropped out of the cohort, they directed to require more visits to ED with using systemic corticosteroids. Generally, these outcomes recommend that more severe asthmatic patients were more likely to stay in ED and that visiting tertiary hospitals might be more useful for asthma control in patients with FAO [24].

**Asthma education**

The patient's education about controlling the symptoms of asthma at home is required to minimize ED visits and using its resources while managing the patient to a primary care facility. [25]. On the other hand, securing a routine follow-up appointment with the primary care physician or pediatrician can also reduce repetitive ED visits in the future and enhance medication compliance [25]. Al-Muhsen et al. [7] showed out that factors regarding both “education about asthma” and “education about medication” influenced significantly on their decision to go to the ED. A majority of patients admitted not having received education about asthma as a disease and had not discussed any ideas with their physician on ways to prevent, to treat, and to manage symptoms at home. Also, a significant proportion of patients recognized not having received professional advice on the use of medication, and about a quarter of this cohort failed to show the correct use of the inhaler device. A federal certification program for the Certified Asthma Educator designation incorporating standards for guideline-based program content [26] and specific training for staff. Basic points of asthma education included diagnosis, inhaler devices, signs of worsening asthma, prevention of symptoms and attacks, medications, monitoring asthma control, and need for medical attention [27]. However, clinical investigations have revealed asthma education to be efficient in improving disease control and reducing patients’ admission to ED [28,29].

**Environmental factors**

Numerous adolescents with asthma are more likely to infect with asthma in their environments that worsen their asthma symptoms. The susceptibility to poor air quality (tobacco-smoke) [30], traffic-related air pollution [31], animal dander, dust parasites, reek, and a deficiency of air-conditioning are the most common asthma environmental risk factors. The environmental factors, in addition to the weather variations [32], enhance the severity and
Table 1. Studies included in the review.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>City</th>
<th>Title</th>
<th>Objectives</th>
<th>Study design</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamdan et al. [6]</td>
<td>2013</td>
<td>Saudi Arabia</td>
<td>Improper inhaler technique is associated with poor asthma control and frequent emergency department visits</td>
<td>To estimate the inhaler technique among ED asthmatic patients, and to study the features of these patients and factors correlated with inappropriate use of inhaler devices and its relationship with controlling asthma ED visits.</td>
<td>Cross-sectional</td>
<td>Improper use of asthma inhaler devices is associated with reduced asthma control and more frequent ED visits. We also identified several risk factors that causing the improper use of inhaler devices among asthma patients visiting the ED.</td>
</tr>
<tr>
<td>Al-Muhsen et al. [7]</td>
<td>2015</td>
<td>Saudi Arabia</td>
<td>Poor asthma medication compliance and education are associated with increased ED visits by asthmatic children</td>
<td>Identification risk factors associated with visits to ED by asthmatic children.</td>
<td>A cross sectional</td>
<td>Most cases had poor knowledge about asthma and were using medications poorly, thus suggesting the inefficient application of the management action plan. Frequent visits to the ED for asthma care were associated with poor education about asthma and medication use.</td>
</tr>
<tr>
<td>Al Zabadi et al. [11]</td>
<td>2007</td>
<td>Palestine</td>
<td>Factors correlated with frequent ED attendance by asthmatic patients</td>
<td>To study the role of asthma severity, health services utilization, and medication use in frequent ER attendance for asthmatics in Palestine.</td>
<td>Cross-sectional</td>
<td>Lack of proper use of inhalers and an over-reliance on reliever therapy contributes to asthma morbidity in Palestine. We recommend an intervention program at the professional and patient levels.</td>
</tr>
<tr>
<td>Dales et al. [11]</td>
<td>1997</td>
<td>Ottawa, Canada</td>
<td>To investigate the reasons for multiple emergency visits for asthma.</td>
<td>To investigate the reasons for multiple emergency visits</td>
<td>Cross-sectional</td>
<td>The number of visits was correlated with nocturnal asthma regularly, work and school absenteeism, regular visits to their physician, and frequent entrances to the hospital. Visits were not associated with psychological health, environmental allergens/irritants, or lack of perceived asthma severity.</td>
</tr>
<tr>
<td>Newman et al. [31]</td>
<td>2014</td>
<td>Washington</td>
<td>Traffic-Related Air Pollution (TRAP) and Asthma Hospital Readmission in Children: A Longitudinal Cohort Study</td>
<td>Examining the association between exposure to traffic-related air pollution (TRAP) and hospital readmission for asthma or bronchodilator-responsive.</td>
<td>Longitudinal Cohort Study</td>
<td>TRAP exposure is correlated with increased odds of hospital readmission in white infants, but not in African American ones.</td>
</tr>
</tbody>
</table>
recurrence of ED admission. The indoor air condition has a critical effect on asthma signs. Some origins of indoor heat provide gases and particulate matter, which causing airway irritation. The central air conditioner has a high-efficiency particulate-arresting filter that helps to decrease air pollutants. Maintaining low humidity levels (<50%) helps to limit parasite growth. Preserving the liquid tanks clean in any air-circulation equipment is necessary for limiting the growth of the organism [33]. The beginning and continued use of home-based health initiatives can improve identification exposure issues and work toward improving patients' home environments [34].

The cost of medication

In the United States (US), the effect of asthma on economy has been reported to be 5.8 billion [35]. Primary costs represent most of the total cost, accounting for 88% of it [36]. Asthma hospitalization represents the greatest single element of direct costs, accounting for over 50% of such costs [35]. ED visits also is an important cost class, with previous reports evaluating ED visits to endure 7% to 18% of direct costs [35,36]. Although these two classes are the major contributors to the cost of asthma, little is known about the specific resources consumed and associated costs of an ED visit or hospital stay for asthma [36]. This high cost may be one of the reasons why patients are readmitted to ED.

Conclusion

Our study has recognized many factors that increase the risk of repeated ED visits for the crisis-oriented care of asthma; these factors, including; improper use of inhalers, asthma severity, Education, and environmental factors.

List of Abbreviations

ED emergency department
FAO fixed airflow obstruction

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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