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Asthma Education Delivered in the Emergency Department: Does it Encourage Asthma Self-management?

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Abstract

Background: The rates of optimal asthma control and compliance to treatment in Israel are reportedly low. We postulated that adults attending our emergency department (ED) with asthma exacerbation were not using self-management strategies optimally.

Objectives: This pilot study aims to: (a) verify the above hypothesis and, if applicable, (b) determine whether an asthma education intervention (AEI) administered in the ED would encourage post-discharge use of a written asthma action plan (AAP).

Methods: Thirty-eight adults (>18 yr.) visiting the ED with asthma exacerbation received a 30-min AEI including a written AAP. Prior asthma education was assessed by questionnaire. Follow-up, carried out by phone ≥ 12 months after discharge, assessed AAP use, asthma control (GINA), and exacerbations in the past year.

Results: At baseline, participants denied previous education on asthma self-management and AAP use. Of 27 patients available for follow-up, only 5 (18.5%) were using the AAP, assisted by their care-provider. Eighteen subjects (66.7%) presented uncontrolled asthma while, as a whole, the group reported significantly more exacerbation episodes than at enrolment (mean (SD)=5.1 (6.5) vs. 2.7 (3.0) (p=0.0498)). Finally, compared with AAP non-users (n=22) AAP users (n=5) tended to have better asthma control (60% vs. 18%) and fewer episodes of exacerbations (mean (SD)=2.8 (2.2) vs 5.9 (6.9)) but the differences did not reach significance.

Conclusion: Delivery to adults of a short AEI in the ED was of limited efficiency in post-discharge boosting of patient/doctor partnership, resulting in sub-optimal AAP use. Feasibility of the AEI in a crowded ED, however, justifies further research on AEI delivery coupled with alternative follow-up strategies targeting patient and doctor perception of AAPs.

Keywords: Asthma; Peak-expiratory flow; Exacerbation; Written action plan; Education

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Introduction

Worldwide, thousands of deaths per year are attributed to asthma and there is evidence that most of these deaths are preventable [1]. In Israel, despite an overall decrease over the past decade [2] asthma mortality in older adults remain high. Indeed, for subjects aged 60 to 80 years the annual mortality rate per 100 000 persons raise from 2.0 to 18.0 in men, and from 2.1 to 32.0 in women [3]. Prompt recognition of symptoms and appropriate medication are key points in treating asthma exacerbations. Patients admitted to hospital may have labile airway obstruction for extended periods following discharge, increasing the risk of readmission [4]. While symptoms are the usual manifestation of exacerbation, and can become severe in a short lapse of time, a decrease in peak expiratory flow (PEF) rate is a useful index of deterioration, especially in low perceivers of obstruction who

notice reduced airflow only when it becomes marked [5,6]. Based on these concepts, PEF meter-based, written asthma action plans (AAPs) were developed and found to improve clinical outcomes in asthma [7,8]. This is all the more important as poor adherence with (or lack of) a written AAP is a recognized risk factor for asthma-related death [9]. However, there appears that action plans are under-provided by doctors, under-used by patients, and not always updated to account for new treatments [10]. In Israel, only a minority of asthmatics admitted to emergency rooms throughout the country performs PEF measurements [11]. Furthermore, only a small proportion of primary care physicians use asthma guidelines to manage asthma [12]. With these facts in mind, we hypothesized that patients attending the emergency room (ER) because of asthma exacerbation might not be using self-management strategies optimally. This pilot study aims: (a) to verify this hypothesis and, if applicable, (b) to determine whether a brief, evidence-based, asthma education intervention (AEI), administered in the ED, would encourage patients and care-providers to collaborate in implementing AAP use. Our hope was that the AEI would result in better compliance to treatment regimen, better asthma control, and a reduction in hospital ED visits and, ultimately, hospital admissions.

Patients and Methods

The study recruited consecutive adult patients (age >18 yr.) visiting the ED of Shaare Zedek Medical Center, Jerusalem, because of asthma exacerbation from August 2013 to April 2016. The hospital's Helsinki Ethical Committee approved the study but an informed consent was not necessary because the intervention was part of the standard care of patients with acute asthma exacerbation.

Initial evaluation

Upon arrival, patients were examined by ED physicians - who provided treatment as usual - then by a pulmonary physician who evaluated demographics, asthma and atopy history, frequency of symptoms, occupational exposure, history of previous ED visits, current asthma treatment and, especially, knowledge and current use of self-management strategies including AAP and PEF measurements. Additional investigation included the number and severity of past episodes of asthma exacerbation. Asthma exacerbation was defined as a progressive increase in shortness of breath, cough, wheezing, or chest tightness, or some combination of these symptoms, necessitating a repetitive administration of rapid-acting inhaled bronchodilators with or without the introduction of systemic corticosteroids either at home or the ED [6]. Finally, subjects were asked whether a general practitioner (GP), an asthma specialist, or both, treated them. Physical examination was then carried out, especial attention being paid to lung and tracheal auscultation. This is useful to rule out the possibility of vocal cord dysfunction mimicking "asthma", in which case wheezing is more prominent over the trachea vs. the chest.

Asthma education intervention: Pulmonary physicians experienced with asthma education delivered the AEI, which was conceived according to the GINA recommendations [6]. The structure of the AEI is briefly described below.

Step 1. Asthma general information: After initial evaluation, patients received targeted information about asthma. The goal was to provide information to encourage partnership with care-provider. Emphasis was given to the inflammatory nature of asthma, symptoms and flare-ups, and recognition of symptom aggravation. Smokers were strongly encouraged to stop smoking immediately and were provided with information about the nature of cigarette smoke-induced airway inflammation.

Step 2. Rationale for medications: Next, patients received information about the anti-inflammatory nature of inhaled corticosteroids used for asthma treatment as opposed to the action of short- and long-acting bronchodilators (i.e., SABAs, LABAs) with emphasis on the risk of SABA overuse.

Step 3. Effective use of inhalers device: At this step, subjects were asked to demonstrate how they used their inhaler device. If necessary, corrections were made. According to the type of inhaler use, the need for spacers was discussed.

Step 4. Adherence to medication: This step emphasized the importance of adherence to medication. Factors of poor adherence were discussed along with strategies to avoid poor adherence.

Step 5. Guided asthma self-management: This step contained three components namely self-monitoring of symptoms and peak-flow, written AAP, and regular review by the care-provider. Peak-expiratory flow (PEF) rates were measured using a portable device used (Mini-Wright Standard Peak Flow Meter, Clement Clarke International Ltd, Essex, UK) which was offered to the patient at no charge at the end of the session. Finally, all subjects received an individualized PEF meter-based AAP, to which a letter addressed to their care-provider was attached with an invitation to assist the patient in implementing the AAP and reinforce the concepts on asthma self-management in follow-up visits. In the letter, care providers were invited to contact us if they felt they needed help in asthma management.

Follow up: Follow-up data were obtained via a phone call conducted by one of the investigators (AB). Follow-up was carried after a minimum period of 12 months after discharge (mean=16.1 months; range=12-36 months). The follow-up questionnaire investigated whether the patients: (a) had transmitted the discharge letter to the healthcare provider; (b) were using the AAP with or without the care provider's assistance; and (c) were using new medications. In addition, questions were asked about the (d) number of episodes of asthma exacerbation experienced in the past year, and about (e) asthma control as per GINA evaluation [6].

Statistical Analysis

Statistical analysis was performed using the Sigma Stat 3.0 software. Baseline and outcome variables are presented as mean values (SD) and percentage estimates, as appropriate. The primary outcome was patient use of the PEF-based AAP. Secondary outcomes were the post-discharge level of asthma control evaluated as per GINA guidelines [6] and the number of episodes of asthma exacerbation after discharge from the ED. The significance of the difference with respect to the baseline

value was ascertained using the Student t test for unpaired comparisons.

Results

Baseline data

A total of 38 patients were enrolled in this pilot study. **Table 1** shows their demographic characteristics and smoking history. Women outnumbered men and, overall, there was a trend toward overweight. While most subjects were lifelong nonsmokers, past-smokers reported an average (SD) cigarette consumption of 33 (44.7) p.y. and current smokers of 24.6 (22.7) p.y.

Asthma-related parameters: Table 2 shows parameters assessed at enrolment. No patient reported previous asthma education on self-management and none had ever used a written AAP. Five subjects (13.2%) reported previous instruction on correct inhaler use. No subject reported a history of occupational exposure. Overall, asthma was diagnosed late in life (average age (SD)=30.5 yr. (20)). Sixteen patients (42%) reported a family history of asthma and allergies. A similar proportion of asthma specialists, primary care physicians (PCP), or both, treated the patients, while a minority of subjects reported no regular care provider. As a whole, the group reported 104 episodes of asthma exacerbation in the previous year (mean (SD)=**2.7 (3.0)**). With regard to regular medication, the great majority of subjects (n=33; 86.8%) was receiving inhaled corticosteroids (ICS) while 5 (13,2%) reported taking a SABA prn alone. Theophylline and ipratropium bromide were included in the therapeutic regimen of one patient, while an additional subject reported no regular treatment. PEF measurements -obtained in 25 subjects who were able to perform a forced expiratory maneuver - showed average values barely exceeding 50% of the predicted.

Follow-up

At follow-up, 5 participants (F=3, M=2; mean age (range)=77.2 yr. (63-90) had deceased of deaths unrelated to asthma (2 of cancer, 1 of septicemia, 1 due to a lymphoma, and 1 due to a multiple myeloma). Additionally, 5 subjects (F=3; M=2; mean age (range)=38.6 yr. (25-59)) defaulted despite several phone calls, while one male subject (age=22) refused to answer to the questionnaire. Thus, 27 subjects (71.0%) were available for analysis.

Table 1 Demographic characteristics (mean (SD)) and smoking history in 38 patients with asthma exacerbation.

Parameter	Value
Male/Female	15/23
Age, yr.	50.6 (20.2)
BMI	27.1 (5.4)
Smoking History	
Current smoker n, (%)	5 (13.2)
Pack/year mean, (SD)	24.6 (22.7)
Ex-smoker n (%)*	7 (18.4)
Pack/year mean, (SD)	33.0 (47.7)
Non-smoker n (%)	26 (68.4)

*1 subject smoked water-pipe

Primary outcome: Table 3 shows that 22 subjects (81.5%) claimed handing the discharge letter and the AAP to their care-provider. Eleven (50%) of 22 care-providers receiving the AAP declared interest on it, but only 5 took steps to implement it; thus, only 5 patients were currently using the AAP. Three additional patients reported using the PEF meter occasionally, without medical supervision, independently from the AAP.

Secondary outcomes: As per GINA questionnaire [6], asthma was controlled in 7 subjects (25.9%), partly controlled in 2 (7.4%) and uncontrolled in 18 (66.7%). Overall, the group reported 137 episodes of asthma exacerbation in the previous year, giving an average (SD) of 5.1 (6.5) episodes per subject, a value significantly greater than that observed at enrolment (p=0.0498).

New medications: Omalizumab (Xolair, Novartis) was added to the therapeutic regimen of 8 subjects, while the combination fluticasone furoate/vilanterol (Relvar; GSK) was added to that of 3. Additionally, 1 patient was started on oral prednisone and 1 patient decided to try homeopathy.

AAP users vs. non-users: Asthma was well controlled in 3 of 5 (60%) AAP users and in 4 of 22 (18%) non-users **(Table 4)**. Incidentally, one AAP user had perennial uncontrolled asthma despite optimal therapy. This patient reported previous instruction on inhaler use and kept track of all used medication over the years. Finally, AAP

Table 2 Asthma related information at enrolment in 38 patients with asthma exacerbation.

Parameter	Value
Occupational exposure n, (%)	0 (0)
Age at asthma diagnosis mean, (SD)	30.5 (20)
Family history of asthma n, (%)	16 (42.1)
History of allergies n, (%)	15 (39.5)
Asthma self-management education n, (%)	0 (0)
Instruction on inhaler use n, (%)	5 (13.2)
Asthma exacerbation (AE) in the past year	
Number of episodes	104
Mean (SD)	2.7 (3.0)
Asthma follow-up	
Asthma specialist n (%)	11 (28.9)
Primary care physician n (%)	12 (31.6)
Asthma specialist + primary care physician n (%)	10 (26.3)
No regular physician n (%)	5 (13.2)
Regular medication	
SABA only n, (%)	5 (13.2)
ICS alone or in combination n (%)	33 (86.8)
Anti-leukotriene n (%)	3 (7.9)
Anti IgE treatment n (%)	3 (7.9)
Oral steroids n (%)	4 (10.5)
Other* n (%)	2 (5.2)
No regular treatment n (%)	1 (2.6)
Peak expiratory flow rate (PEFR) at Emergency Room	
Subjects able to measure peak flow, n (%)	25 (65.8)
PEFR L/min, mean, (SD)	262.4 (146.4)
PEFR% predicted, mean, (SD)	56.1 (25.8)

*Theophylline and ipratropium bromide respectively

Table 3 Impact of the AEI on 27 subjects available for follow-up.

Parameter	Value
1- Handed the action plan to care provider n (%)	22 (81.5)
2- Care provider interested in AAP n, (%)	12 (54.5)
3- Subjects managing asthma by AAP n, (%)	5 (22.7)
4- Satisfaction with action plan n, (%)	5 (22.7)
5- Use of PEF meter only † n (%)	3 (13.6)
6- New medications added to therapeutic regimen	
Omalizumab (Xolair) n (%)	8 (29.6)
Fluticasone furoate/vilanterol (Relvar) n (%)	3 (11.1)
Prednisone, n (%)	1 (0.4)
Homeopathy n (%)	1 (0.4)
7- Asthma exacerbation (AE) in the past year	
Number of episodes	137
Mean (SD)	5.1 (6.5) ¥
Episodes requiring ED visit n (%)	59 (43.1)
8- Asthma control (GINA)	
Controlled n, (%)	7 (25.9)
Partly controlled n, (%)	2 (7.4)
Uncontrolled n, (%)	18 (66.7)

*Unverified; †Sporadic use; no connection with treatment; ¥: p=0.0498 vs. value at enrolment (mean=2.7 (3.0))

Table 4 Asthma control and episodes of exacerbation at follow-up in AAP users and non-users.

Parameter	AAP users (n=5)	AAP non-users (n=22)
Asthma control (GINA [6])		
Controlled, n (%)	3 (60)	4 (18.2)
Partly controlled, n (%)	0 (0)	2 (9.1)
Uncontrolled, n (%)	2 (40)	16 (72.7)
Episodes of exacerbation		
Number of episodes*	14	129
Mean, SD	2.8 (2.2)	5.9 (6.9)
Requiring ED visit, n (%)	7 (50.0)	52 (42.3)

*p=0.3365

users reported 50% less episodes of exacerbation than non-users (mean (SD)=3.5 (1.7) *vs.* 6.8 (6.8)) but the difference did not reach significance (p=0.354).

Discussion

This pilot study showed that none of the adult asthmatics visiting the ED because of asthma exacerbation had received prior education on asthma self-management, including use of a written AAP. Secondly, only a minority of patients receiving asthma education intervention (AEI) in the ED received post-discharge assistance from their care-provider in AAP implementation. Thirdly, at follow-up, the vast majority of patients had uncontrolled asthma (as per GINA guidelines) while the total number of episodes of exacerbation in the past year had increased significantly from baseline. On a more optimistic note, however, compared with non-AAP users AAP users tended to have better asthma control and fewer episodes of exacerbations, although the differences did not reach significance.

Despite the widely known effectiveness of written AAP to improve asthma outcomes, none of our patients visiting the ED reported having one. This finding, which confirm our initial hypothesis, is similar to that reported in a Canadian study, where only 3% of patients presenting to the ED with asthma exacerbation had a written AAP [13]. As discussed in that study, the possibility exists that our patients presenting to the ED may represent a poorly controlled sub-set of the general asthma population.

This study is the first on asthma education in the ED performed in Israel, and one of the few studies on this subject in the literature. A previous study showed that a brief asthma educational intervention resulted in a short-term increase in asthma knowledge and perceived control [14,15]. Another study showed that a self-management education intervention was successfully implemented, but did not provide benefit in terms of quality of life and short-term repeated ED visits outcomes [16]. However, methodological differences, including study design and format of the education intervention prevent direct comparison with our study.

Previous investigations have shown that written AAPs, even when offered as standalone interventions, are effective in improving asthma outcomes [8,10]. By consequence, international guidelines recommend their use as a component of the guided asthma self-management education and skills training [5,6]. However, asthma self-management cannot be implemented without patient's compliance and care-providers' support. Our study shows that a brief intervention administered in the ED motivated only a small number of patients and care providers to collaborate in implementing the AAP. Although a bit disappointing, our results do not constitute an exception. Using a more complex design, Brown et al. [16] showed that a comprehensive asthma education program delivered after an ED visit was ineffective in adult patients, 40% of subjects not complying with any of the planned educational activities. One reason explaining low patient compliance in implementing AAPs is the unwillingness to use PEF meters. In a previous investigation, Cote et al. [17] showed that while short-term compliance with PEF is good, most patients with moderate-to-severe asthma are not interested in measuring PEF regularly over a prolonged period. By consequence, they suggested reserving PEF meters for patients with a significant interest in using the device, poor perceivers of airflow obstruction, and severe asthmatics. Because our intervention lasted only ~30 min, it might have been difficult for the patients to assimilate all the information in such a short lapse of time, and this could have decreased their motivation to use the AAP. However, a longer intervention would have been impractical in the ED setting. On the other hand, we hoped that our writing of the AAP would stimulate care-providers to both assist patients in AAP use and reinforce the educational message in follow-up visits, what did not happen. Finally, our patients might have been influenced by doubts regarding the benefits of the AAP, as well as cultural and literacy factors. However, a thorough investigation of this topic was out of the scope of our study.

Only 5 care providers assisted the patients in implementing the AAP. This finding is in keeping with a previous study showing that one year after the publication of the Israeli Clinical Guidelines

for Asthma Treatment, less than 25% of primary physicians who read the guidelines participated in educational programs on the management of asthma or changed their asthma management strategy [12]. It is also in agreement with the findings of a British study [18] showing that although almost all clinicians were aware of the recommendation to provide self-management AAP, and even agreed that this could lead to better asthma management, only 23% of the patients reporting an asthma exacerbation in the previous 6 months had a written AAP. Several possible explanations exist for the lack of interest of healthcare providers in implementing AAPs. First, many practitioners lack confidence in constructing a plan; however, in our study, our team wrote the AAPs so this factor could not have played a role. Another possibility is that our healthcare providers might have not been convinced that AAPs are useful and relevant, or they may have lacked belief in the patients' ability to self-manage their disease. Finally, a more realistic explanation is lack of time. In our opinion, without adequate incentive it is unlikely that practitioners will make the time necessary to establish an effective collaborative partnership with their patients. A systematic review [10] investigating the best way to encourage health professionals to promote, and asthmatics to use, AAPs concluded that effective promotion of AAPs requires interventions to initiate and sustain their use by both health professionals and asthmatics. The review stresses that a possible way to initiate an AAP is by increasing its distribution during pre-hospital discharge, as we did in this study.

At follow-up, two thirds of patients had uncontrolled asthma as per GINA guidelines [6] despite the fact that almost all subjects were receiving inhaled corticosteroids and, additionally, eight subjects have had omalizumab added to their treatment regimen. This high prevalence of uncontrolled asthma is consistent with previous studies involving different Israeli populations. For instance, one study found that only 7% of asthmatics visiting the pulmonary clinic had optimal asthma control assessed by the asthma control test, while only 2% were compliant to treatment [19]. Poor asthma control was also demonstrated in severe asthma both in the setting of a multicenter observational survey [20] and in a large electronic database analysis of 350 000 people aged 20-70 years [21].

The rate of asthma exacerbation at follow-up was greater than that observed at enrolment, a finding contrary to the goal of asthma management [5,6]. Recently, Kelso et al. [22] examined the evidence of the effectiveness of written AAPs beyond asthma education in children. They found that AAP users had higher rates of hospitalization for asthma, and suggested that "written plans might discourage attendance to the general practitioner or emergency department until the patient has deteriorated to a point where hospitalization is inevitable" [22]. However, observations in children do not necessarily transfer to adults. On the other hand, our patients were not using the AAP so this hypothesis cannot explain our results.

Some innovative aspects of our AEI must be highlighted. First, while most studies delivered AEI at varying periods after discharge from the ED, ours was dispensed in the ED. In fact, education during a visit to the ED has been recommended as an initiative to improve asthma self-management and bring together patients and physicians involved in education, which was one goal of our study [23]. Second, in contrast with programs that are more complex and include several steps, dispensed on various appointments [16] our AEI was delivered in a single session. Furthermore, the session was short, to acknowledge for the stressful situation of patients with acute asthma in the ED. Incidentally, we did our best to deliver our AEI in a relaxed, friendly, and non-judgmental way and, whenever possible, in a good mood. Third, while in other studies non-clinical educators dispensed the AEI [16] pulmonary physicians dispensed ours. In our clinical experience, asthmatic patients feel in security when a specialist is treating them. Fourth, we avoided assigning the education interventions to a single, gifted educator and preferred a more real-word approach i.e., dispensation by different doctors, each with his/her own abilities to carry the same message. Finally, we intentionally avoided scheduling follow-up visits with our team. As has been pointed out previously, patients attending the ED because of acute asthma are usually eager to get back home and get on with their lives, and are not willing to take part in trials [24]. Instead, we encouraged patients to deliver the AAP to their care-provider, hoping to promote patient-doctor partnership.

This pilot study has potential limitations. First, the small sample size prevents generalizing the results. However, due to limited resources, we were unable to include all patients visiting the ED with asthma exacerbation. This was especially true of patients admitted at night shifts - when there is no pulmonary physician on duty - and of those with too mild exacerbations who might have been discharged before the pulmonary physician arrived on the scene. However, there is no a priori reason to believe that night-comers or patients with milder asthma would be more committed to engage in asthma self-management. Second, in retrospect, we acknowledge that in addition to the discharge letter, a phone call from our team could have encouraged the care-providers to assist patients in implementing the written AAP. Finally, with regard to follow-up, 12 months at least were necessary for a meaningful evaluation of asthma exacerbations in the previous year. In fact, a follow-up carried out too soon could have resulted in wrongly confounding the early excitement of novelty (i.e., the AAP) with compliance to self-management. Indeed, many patients told us that soon after discharge from the ED they tried to use the AAP, only to give in as they lacked assistance from the care-providers.

In conclusion, this pilot study showed that the totality of adults visiting the ED because of asthma exacerbation lacked prior education on asthma self-management. Secondly, it showed that a short, evidence-based AEI delivered in the ED was less than optimally efficient in encouraging asthmatics and healthcare providers to engage in self-management strategies. Finally, these mixed results notwithstanding there is reason for optimism. First, the study shows that delivery of an AEI in the setting of a crowded ED is feasible. Second, AAP users tended to have better asthma control and fewer episodes of exacerbations than AAP non-users. Based on our results, further studies examining the efficiency of AEI delivery in combination with follow-up strategies targeting patient and doctor perception of AAPs seems justified. Such studies are warranted because asthma self-management

has the potential to improve asthma control and reduce health expenses resulting from unplanned hospital admissions.

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Author Contributions

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Study Guarantor

Dr. Bohadana is the guarantor of the study and takes responsibility for the integrity and accuracy of the data.

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