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Time to Seeking Emergency Department Care for Asthma: Self-Management, Clinical Features at Presentation, and Hospitalization

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Abstract

Objective—Understanding events preceding emergency department (ED) asthma visits can guide patient education regarding managing exacerbations and seeking timely care. The objectives of this analysis were to assess time to seeking ED care, self-management of asthma exacerbations, and clinical status on presentation.

Methods—296 patients were grouped according to time to seeking ED care: 1 day (22%), 2-5 days (44%), and > 5 days (34%) and were compared for clinical and psychosocial characteristics. Asthma severity at presentation was obtained from patient report with the Asthma Control Questionnaire (ACQ) and the Asthma Quality of Life Questionnaire (AQLQ) and from physicians' ratings using decision to hospitalize as an indicator of worse status.

Results—Mean age was 44 years, 72% were women, 10% had been in the ED in the prior week, and 28% came to the ED by ambulance. Patients who waited longer were more likely to be older, have more depressive symptoms, and to have been in the ED in the prior week. They also were more likely to have taken more medications, but they were not more likely to have visited or consulted their outpatient physicians. Patients who waited longer reported worse ACQ ($p<.0001$) and AQLQ ($p=.0002$) scores, and were more likely to be hospitalized for the current exacerbation (odds ratio 1.9, 95% confidence interval 1.1, 3.2, $p=.03$).

Conclusions—Patients who waited longer to come to the ED had worse asthma on presentation, more functional limitations, and were more likely to be hospitalized. Ability to gauge severity of

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exacerbations and use the ED in a timely manner are important but often overlooked self-management skills that patients should be taught. (*ClinicalTrials.gov* NCT00110409)

Keywords

triggers; ambulance; exacerbation; depressive symptoms; delay

Introduction

Emergency department (ED) visits for asthma exacerbations are common and multiple visits occur frequently in certain patient subgroups, particularly those with lower socioeconomic status and less knowledge of asthma self-management.¹⁻⁴ Two types of exacerbations have been identified. The first is the slow-onset exacerbation in which symptoms worsen over hours to days and airway inflammation is the main pathology.⁵ This type is the most common (80%-90%) and upper respiratory tract infections are frequent triggers. The second type is the sudden-onset exacerbation in which symptoms appear abruptly and progress rapidly over hours.⁵ Airway bronchospasm is the main pathology and there often is a distinct trigger, such as an unanticipated allergen or an environmental irritant.

Regardless of how symptoms start, a major treatment goal is active self-management to arrest exacerbations and avoid the ED. However, effectively self-managing exacerbations can be challenging. Multiple tasks are required, including early recognition of worsening symptoms, monitoring peak flow rates, removing triggers, dosing appropriate rescue medications, and contacting physicians for help. Effective self-management also entails recognizing when the intensive care available in the ED is necessary and obtaining this care expeditiously.

Several studies have characterized patients who present to the ED for asthma.¹⁻³ However, less is known about clinical characteristics leading to ED visits, such as what patients do to self-manage exacerbations and how long they wait before seeking ED care. Understanding these management issues is necessary in order to better educate patients and limit morbidity. There were three objectives of this analysis: 1) to ascertain how long patients waited before coming to the ED and what characteristics were associated with time to seeking ED care; 2) to ascertain how ED patients managed exacerbations; and 3) whether the time to seeking ED care was associated with clinical status on presentation. The hypotheses were that patients presenting to the ED for asthma have sub-optimal self-management skills and longer time to seeking care is associated with worse self-reported and physician-rated clinical status.

Methods

This report is an analysis of baseline data from a randomized trial testing an intervention to improve asthma self-management in patients presenting to the ED for asthma exacerbations (*ClinicalTrials.gov* NCT00110409).⁶ Patients were enrolled from two EDs in New York City – New York Methodist Hospital in Brooklyn and New York Presbyterian Hospital in Manhattan – between 2005 and 2009. The trial was approved by the Institutional Review Board at each institution and all patients provided written informed consent. Patients were eligible if they were 18 years of age or older, were fluent in English, had a known diagnosis of asthma, and came to the ED because of respiratory symptoms. Patients were excluded if they had cognitive deficits, severe medical or psychiatric comorbidity, refused to participate, or did not have a telephone which was required for longitudinal components of the trial.

All 296 patients enrolled in the trial were included in this analysis. At enrollment information about clinical and psychosocial characteristics was obtained from ED

physicians, medical records, and patients. To address the first objective, patients were asked how long they had symptoms before coming to the ED with possible response options of < 1 day, 1 day, 2-5 days, and > 5 days, and whether they consulted their outpatient physician before coming to the ED. To address the second objective, patients were asked open-ended questions about circumstances leading to the ED visit, such as what they thought precipitated the exacerbation and what they did to manage the exacerbation. To address the third objective, patients' assessments of clinical status on presentation were assessed with the Asthma Control Questionnaire (ACQ) and the Asthma Quality of Life Questionnaire (AQLQ). The ACQ is a 7-item scale which incorporates patient-reported recent symptoms and current forced expiratory volume in one second, which was obtained in the ED with a portable spirometer.^{8,9} The AQLQ is a 32-item scale which measures symptoms, function, and effects of emotions and the environment on asthma.^{10,11} The decision to hospitalize was used to indicate physicians' assessments of clinical status and inability to respond to standard ED treatment.

Other patient-derived information included process variables, such as having an outpatient physician for asthma, and prior hospitalization and use of the ED for asthma. Patients were asked how difficult was it to obtain outpatient medical care, with response options ranging from very difficult to very easy on a 5-point scale. Long-term asthma severity was ascertained with the Severity of Asthma Scale, which is composed of 13 questions and asks about symptoms and prior medications and hospitalizations.¹¹ The Asthma Self-Management Questionnaire was used to measure knowledge of self care; this scale is composed of 16 questions and includes several items relating directly to exacerbations, such as managing precipitants and using rescue medications.¹² Major chronic medical comorbidity was assessed with the Charlson Comorbidity Index.¹³ Depressive symptoms were assessed with the 30-item Geriatric Depression scale, which measures psychological and not somatic symptoms of depression that could overlap with asthma.^{14,15}

Data analysis The sample was grouped according to whether patients reported coming to the ED within 1 day, 2-5 days, or more than 5 days. In the first series of analyses, days before coming to the ED was assessed according to demographic and clinical characteristics in bivariate and multivariate analyses. In the second series of analyses, severity of asthma at ED presentation was assessed according to clinical characteristics. Patients' assessments of severity were based on their responses to the ACQ and AQLQ and physicians' assessments of severity were based on the decision to hospitalize. In multivariate linear regression analyses, ACQ score and AQLQ score were dependent variables and days before coming to the ED, age, gender, comorbidity, and prior asthma hospitalizations were independent variables. These same independent variables were used in logistic regression analysis with hospitalization as the dependent variable. Analyses were carried out in SAS.¹⁶

Results

Demographic and clinical characteristics for the entire sample parallel other reports of urban patients with asthma who present to the ED (Table 1).

Time before seeking ED care and associated characteristics

Of the 296 patients, 39 (13%) came to the ED in less than 1 day of symptom onset, 26 (9%) came within 1 day, 129 (44%) came within 2-5 days, and 102 (34%) came after more than 5 days. Because of the potentially imprecise distinction between the first 2 groups, these patients were pooled as < 1 day (65 patients, 22%). Patients who waited longer were more likely to be older, white, and to have less education but there were no differences based on gender, type of insurance, and Latino ethnicity (Table 1). Approximately 70% of patients reported taking maintenance asthma medications with no differences among groups.

Overall, 25% were current smokers and patients who waited longer were more likely to have a history of smoking. Patients who waited longer reported more severe long-term asthma status, but they did not have more knowledge of asthma self-management. Comorbidity was low for the entire sample, 17%, and was mostly due to diabetes mellitus, and did not differ among groups. However, patients who waited longer had more depressive symptoms.

Overall, 18% described difficult access to care and 81% reported having a physician for asthma, (55% were generalists, 24% were pulmonary or allergy specialists, and 2% were other specialists), and there were no differences among groups for these variables. Overall, 33% reported a prior hospitalization and 92% reported ever having been in the ED for asthma. More patients who waited longer reported being in the ED within the previous week.

In multivariate analysis with time to seeking ED care as the dependent variable and demographic characteristics as independent variables, older age (odds ratio 1.04, 95% CI 1.02-1.06, $p=.002$), more depressive symptoms (odds ratio 1.04, 95% CI 1.00-1.09, $p=.04$), and being in the ED within the previous week (odds ratio 2.30, 95% CI 1.02-5.18, $p=.04$) remained associated with waiting longer, but gender, race, and education did not remain associated.

When asked why they came to the ED, most patients (95%) explicitly stated because of asthma. Of the remaining 5%, other reasons were feeling sick, chest pain, and passing out. Most patients (92%) had more than one symptom (Table 2). Although prevalent in all patients, the main symptom was shortness of breath in those who came sooner and wheezing in those who waited longer.

What patients thought precipitated the exacerbation and what they did to manage asthma

Most patients (87%) were able to attribute a primary cause for the exacerbation, including hot or cold weather, change in weather, wind, and environmental irritants, such as strong smells and dust (Table 2). Patients who came sooner more often cited an allergic reaction, including reactions to animals and plants, as well as acute reactions to nonsteroidal anti-inflammatory drugs in 2 patients. Patients who waited longer more often cited an upper respiratory tract infection or bronchitis. Six patients attributed the exacerbation to running out of medications and 18 attributed the exacerbation to anxiety and stress. Approximately 60% cited more than one precipitant. However 13% had no idea what precipitated the exacerbation, and this was more common among patients who waited longer.

Most patients in all groups reported trying some type of self-management, and this most often was using an inhaled beta agonist (Table 2). Patients who waited longer were more likely to use their regular maintenance medications and to try additional medications, such as oral corticosteroids. Patients who waited longer also had tried multiple alternative methods. These included potentially effective treatments, such as removing triggers, as well as ineffective treatments, such as taking cough suppressants and gargling with hydrogen peroxide. Overall, only 4% contacted or visited their outpatient physicians with no differences among groups.

Most patients in all groups came to the ED between 6 AM and 6 PM, about one quarter came at other times, and there were no differences among groups. Overall, 28% came to the ED by ambulance, with rates over 30% in patients who came sooner and in those who waited the longest.

Clinical status on presentation

On arrival to the ED, patients who waited the longest had worse ACQ and AQLQ scores that corresponded to clinically important differences compared to patients who came sooner (Table 3). In multivariate analysis controlling for age, gender, comorbidity, and history of prior asthma hospitalizations, ACQ score ($p<.0001$) and AQLQ score ($p=.0002$) were worse in those who waited longer.

ED physicians' assessments of what caused the exacerbation were recorded from medical records. For 75% of patients, physicians were unable to cite a specific trigger and the cause was listed as unknown. For the remaining patients, the exacerbation was attributed to allergies (3%), infection (19%) including pneumonia or bronchitis (3%) and upper respiratory tract (16%), and other reasons (3%) such as ran out of medications and gastroesophageal reflux. There were no differences among groups for physician-attributed cause. However there were differences in physicians' assessments of severity of condition and response to treatment as indicated by the decision to admit the patient to the hospital. Patients who waited more than 5 days were 28% more likely to be admitted compared to the other 2 groups (Table 3). This difference persisted in multivariate analysis controlling for age, gender, comorbidity, and history of prior asthma hospitalizations (odds ratio 1.9, 95% confidence interval 1.1, 3.2, $p=.03$).

Discussion

In this analysis we found that 34% of patients waited more than 5 days before coming to the ED. Those who waited longer did not have defining demographic characteristics compared to those who came sooner, other than being more likely to have been in the ED for asthma very recently. Those who waited longer also did not report worse process of care characteristics, such as access to outpatient physicians. However, despite more time, they were not more likely to have effectively utilized outpatient care, including consulting outpatient physicians or arranging for non-ambulance transportation to the ED. Those who waited longer had worse asthma status on presentation and were more likely to be admitted to the hospital. These findings represent deficient self-management and sub-optimal utilization of higher levels of care.

Multiple reports have shown that certain demographic characteristics, such as gender, race and insurance status, are associated with more frequent use of the ED.^{4,17-20} We did not find these characteristics to be associated with time to seeking ED care. Instead, clinical characteristics seemed to be more important. For example, although only a small percentage of the overall sample, patients who reported being in the ED for asthma within the past week were particularly more likely to wait longer. This may be because these patients wanted to avoid another ED visit so soon. However, they also may have misjudged symptoms that were slow to resolve with symptoms that represented a persistent or relapsing exacerbation.² It may be useful to provide patients with timelines for how quickly they should expect improvement and when they should consider the episode resolved.

Patients who waited longer were more likely to have tried to control asthma with more medications but they were not more likely to have contacted their outpatient physicians. This is consistent with other reports that attribute delay in seeking care to reliance on self-treatment.²¹ We assigned a time category of > 5 days in order to include weekday access for exacerbations that started on weekends. Because we did not ask patients why they did not consult their outpatient physicians, we cannot comment on whether they perceived access to be an issue.¹⁷ However, patients in our study under utilized out-patient care that was known to them. We also did not specifically ask patients why they used the ambulance to come to the ED. For patients with short symptom duration, this may have been an appropriate

reaction to an acute and quickly deteriorating situation. For patients with longer symptom duration, alternatives probably should have been sought. However, it is also possible that for some patients an ambulance was their only transportation option. In other studies conducted in the UK and Australia, researchers reported comparable or higher rates of ambulance use (26%-58%), and stated that the optimal rate is not known and probably varies depending on assessment of risk and personal attitudes.^{22,23} Thus, costly ambulance use for asthma requires further investigation and is another potential area for patient education.

We found a tendency for patients who waited the longest to have more depressive symptoms. Psychosocial issues are well known to be associated with asthma exacerbations, either as triggers or as covariates of worse outcomes.²⁴⁻²⁷ However, we are not aware of other studies reporting the potential role of depressive symptoms in delaying emergency care. Because we did not query patients about reasons for waiting longer, we cannot conclude that emotional state definitely affected patients' decisions about when to come to the ED. However, it is likely that depressive symptoms confounded the decision process. Possible mechanisms may be lack of motivation to be proactive and misinterpretation of physical symptoms for somatic symptoms of depression. Given the high prevalence of depressive symptoms in asthma, the confounding effect of depression on managing exacerbations merits further investigation and clinical intervention.

Although the majority of our ED physicians did not know what precipitated the exacerbation, most patients readily were able to cite a trigger and often cited multiple triggers. This was encouraging as patients cited plausible causes and were aware that although a single trigger may not precipitate an exacerbation, the confluence of several triggers can. Teaching patients to recognize when converging triggers are about to precipitate an exacerbation also should be part of instructions about seeking timely care.

We also measured self-management knowledge in our study using a validated scale that includes management of exacerbations, and found no differences among groups. Compared to patients with stable asthma in an outpatient setting, our ED patients had lower scores indicating less knowledge.¹² However, knowledge of what to do is not synonymous with being able to act, and ED patients must be taught how to acquire other attributes, such as self-efficacy, in order to thwart an exacerbation.^{3,24,28,29}

Our study confirms categorization of exacerbations into slow progression and sudden progression. Most of our patients had symptoms that appeared gradually, progressed over days, were characterized predominantly by self-reported wheezing, were attributed more often to upper respiratory tract infections, and resulted in more hospitalizations. Fewer patients (22%) had symptoms for 1 day, and they were more likely to attribute exacerbations to allergens and environmental irritants. These patients also were more likely to complain of shortness of breath and to respond quickly to treatment. In future studies it would be interesting to determine whether exacerbation type is consistent within a patient and thus counseling can be tailored to one scenario.

Our study has several limitations. First, all patients were urban dwellers who sought care in high volume EDs and their experiences may not be generalizable to patients in different settings. Second, our hospitalization rate was higher than the approximate 10% reported nationally.⁴ In addition to more severe symptoms that were less responsive to treatment, our higher rate may be partly due to our study design which, because of availability of study personnel, favored enrollment of patients who were hospitalized. Third, we did not ask patients specifically why they did not come to the ED sooner, therefore we cannot conclude whether all patients who waited longer were less able to manage the exacerbation or whether they definitely waited too long. It is possible that for some patients symptoms waxed and

waned in response to their efforts and led them to think they might be able to thwart the exacerbation. Also patients may have had social reasons for not coming to the ED sooner, such as pressing family or work obligations.²¹

Conclusions key findings

Patients who waited longer had worse symptoms and reported greater adverse effects of asthma on quality of life. They also were more likely to be hospitalized, indicating physicians thought they were worse clinically and not responsive to usual ED care. Thus, teaching patients to manage an exacerbation requires instruction in recognizing when emergency care is necessary. Most current self-management education focuses on managing relatively stable daily symptoms and optimizing control. Teaching patients to gauge the severity of an exacerbation and the likelihood of it being thwarted within an expected time period remains a daunting challenge for clinicians and may be a weak link in the current treatment of asthma.

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Table 1
Demographic and clinical characteristics according to days before presenting to ED

	All patients N = 296	1 day n = 65	2 - 5 days n = 129	> 5 days n = 102	p value
Demographic Characteristics					
Age, years (mean±SD)	44±13	41±14	42±13	48±12	.0003
Women	72%	74%	72%	70%	.54
Race					
White	63%	51%	64%	70%	.02
Black	32%	43%	31%	25%	.01
Asian	2%	0%	2%	3%	.21
Mixed	3%	6%	2%	3%	.33
Latino	44%	34%	48%	45%	.22
Insurance					
HMO	34%	35%	31%	37%	.70
Private	24%	22%	28%	20%	.61
Medicare	7%	5%	8%	9%	.33
Medicaid	26%	34%	23%	25%	.24
Self pay	9%	5%	11%	10%	.32
College graduate	26%	35%	25%	22%	.06
Clinical Characteristics					
Duration, years (mean±SD)	24±16	22±16	23±15	25±17	.21
Medications					
None	6%	2%	8%	6%	.33
Only inhaled beta agonist	25%	18%	31%	21%	.98
Any maintenance ^a	69%	80%	61%	73%	.64
Current smoker	25%	20%	26%	28%	.31
Ever smoked	46%	35%	47%	52%	.04
Long-term severity, score (mean±SD) ^b	12±4	12±4	12±4	13±4	.07
Asthma knowledge, score (mean±SD) ^c	58±20	59±18	59±21	56±21	.27

	All patients N = 296	1 day n = 65	2 - 5 days n = 129	> 5 days n = 102	p value
Any medical comorbidity ^d	17%	14%	16%	20%	.15
Depressive symptoms, score (mean±SD) ^e	7.1±6.1	6.8±5.8	6.3±5.7	8.3±6.6	.07
Access to outpatient care difficult	18%	22%	12%	22%	.76
Has physician for asthma	80%	82%	80%	80%	.88
Ever hospitalized for asthma	67%	72%	64%	66%	.44
In ED for asthma ever	92%	99%	88%	92%	.25
in last 3 months	36%	40%	25%	47%	.15
in last week	10%	3%	10%	15%	.02

^a includes long-acting beta agonists, inhaled corticosteroids, leukotriene modifiers, mast cell stabilizers, theophylline, oral corticosteroids

^b Severity of Asthma Scale, possible score range 0 - 28, high is more severe

^c Asthma Self-Management Questionnaire, possible score range 0-100, higher is more knowledge

^d measured by Charlson Comorbidity Index

^e Geriatric Depression Scale, possible score range 0-30, higher is more depressive symptoms

Table 2
Characteristics of exacerbation and self-management methods attempted before presenting to ED

<u>Symptoms^a</u>	All patients N = 296	1 day n = 65	2-5 days n = 129	> 5 days n = 102	p value
Shortness of breath	73%	88%	69%	68%	.009
Cough	47%	40%	50%	48%	.39
Chest tightness	36%	23%	40%	38%	.08
Wheeze	63%	55%	59%	73%	.02
Chest pain	9%	8%	10%	9%	.87
<u>Patients' presumed main cause of exacerbation</u>					
Weather	24%	26%	27%	17%	.15
Infection	30%	20%	31%	35%	.04
Allergy	10%	19%	7%	8%	.05
Environmental irritant	9%	12%	8%	8%	.37
Psychological distress	6%	9%	5%	6%	.46
Ran out of medications	2%	0%	3%	2%	.49
Other causes ^b	6%	5%	7%	7%	.60
No idea	13%	9%	12%	17%	.16
<u>Self-management methods attempted to arrest exacerbation^c</u>					
Did nothing	3%	6%	2%	1%	.05
Used inhaled beta agonist	78%	75%	78%	80%	.45
Took regular asthma medications	22%	11%	25%	27%	.03
Took regular plus more asthma medications	19%	12%	15%	28%	.008
Contacted outpatient physician	4%	3%	4%	6%	.36
Tried other techniques that are:					
potentially effective ^d	9%	14%	9%	4%	.02
known to be ineffective ^e	10%	5%	9%	14%	.05
Tried 2 or more methods	60%	46%	57%	72%	.0008

	All patients N = 296	1 day n = 65	2-5 days n = 129	> 5 days n = 102	p value
<u>Transport to ED</u>					
Came by ambulance	28%	39%	20%	32%	.66
<u>Time of arrival</u>					
6 AM - 12 noon	46%	45%	48%	43%	
12 noon - 6 PM	27%	29%	27%	25%	.68
6 PM - 12 midnight	16%	12%	15%	20%	
12 midnight - 6 AM	11%	14%	10%	12%	

^a most patients had more than 1 symptom

^b exercise, fatigue, gastroesophageal reflux

^c most patients tried more than 1 method to arrest exacerbation

^d removed triggers

^e took aspirin, took cough suppressant

Table 3
Condition on presentation to ED based on patient report and physician rating according to number of days before presenting to ED

Condition on presentation	1 day n = 65	2 - 5 days n = 129	> 5 days n = 102	p value
<u>Patient report</u>				
Asthma Control Questionnaire (ACQ) score, mean $\pm$ SD ^a	3.3 $\pm$ 1.2	3.5 $\pm$ 0.9	4.0 $\pm$ 0.9	<.0001
Asthma Quality of Life Questionnaire (AQLQ) score, mean $\pm$ SD ^b	3.8 $\pm$ 1.2	3.6 $\pm$ 0.9	3.2 $\pm$ 1.0	<.0001
<u>Physician rating</u>				
Admitted to the hospital for asthma	55%	57%	73%	.02

^a ACQ possible score range 0-6, higher is worse condition, 0.5 corresponds to a clinically important difference

^b AQLQ possible score range 1-7, higher is better condition, 0.5 corresponds to a clinically important difference