ASTHMA PROTOCOLS IN AN URBAN EMERGENCY DEPARTMENT

by

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Thesis presented to the Department of Public Health and Preventive Medicine
Oregon Health and Science University, School of Medicine

In partial fulfillment of the requirements for the degree of
Master of Public Health

June 2002

School of Medicine
Oregon Health and Science University

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ACKNOWLEDGEMENTS:

I would like to thank the following people for their support with respect to this project, and for their guidance…

Veronica Fagan Hannah; Ramon Hannah; Derek Lane Merck; William Morton; David Phillips; Gary Sexton; Joseph Piatt; Sherry and Rich Bader; Josh Filner; Cynthia Renee Greenberg; William Gossman; Lori B. Siegel; Katey Riley; Sally Venus; the staff and faculty of Mount Sinai Hospital Medical Center, and the several medical and physicians assistant students who performed data entry. twice.

ABSTRACT:

Compliance with Asthma Protocols in an Urban Emergency Department

Objectives: To assess physician compliance with a charting tool designed to standardize the care of asthma patients in the emergency room setting. Despite advancement in the medical community's understanding of the demographic and physiological risk factors for asthma, the morbidity and mortality associated with the disease have increased over the past decade. This study assesses physician compliance with a new charting tool designed to improve the quality of asthma care provided in a busy urban emergency department [ED]. **Methods:** Physicians at Mount Sinai Hospital Medical Center [MSMC] Chicago, IL, were instructed to fill out one Asthma Assessment Order and Flow Sheet (AFS) for each asthma patient encounter. The AFS is based on the National Asthma Education and Prevention Program's [NAEPP] 1997 guidelines. Data on physician utilization of the AFS, as well as asthma treatment patterns were collected in between 11/1998 and 02/2000. Emergency department physicians at MSMC were required to attended two seminars on the National Asthma Education and Prevention Program guidelines in 10/1999 and 11/1999. Utilization of the charting tool and compliance with national guideline were assessed before and after the educational intervention. **Results:** Data from 834 patient encounters revealed that although utilization of the charting tool did not increase after physician education, compliance with the NAEPP guidelines and actual treatment of patients did change after the protocol seminar. Subsequent to attending the educational seminar, physicians were more likely to document a patient's history of asthma in the emergency room chart ($p<0.025$). These patients were also more likely to receive treatment with steroid medication ($p<0.05$) than the patients in the pre-physician education group. **Conclusions:** Compliance with the treatment guidelines, specifically the utilization of steroids in patients with a history of asthma, increased significantly after physician education on the AFS/NAEPP guidelines. Together, these educational interventions affected physician behavior, without increasing utilization of the AFS. Recommendations for future research are discussed.

Introduction:

The following study assesses physician utilization of a charting tool designed to standardize asthma treatment protocols in an urban emergency department. Despite advancement in the medical community's understanding of the demographic, and physiological risk-factors for asthma, the prevalence, morbidity, and mortality associated with the disease have continued to increase over the past decade [1-6].

Background~ Clinical Presentation:

Asthma is a disease of chronic airway inflammation. Physiologically this is caused by a hyperreactivity of the airway to environmental triggers. Inflammation of the airway is intermittent and clinical symptoms may wax and wane.

Patients with asthma most frequently present to the physician with a chief complaint of wheezing. Other diagnostic criteria include:

-Positive history of asthma

-History of an inciting factor, such as recent upper respiratory infection

-Documented exposure to an environmental trigger, examples of which include: pollen, pet dander, dust mites, cockroaches, rodents, air pollution/tobacco/wood smoke, chemical solvents, or intranasal use of illicit drugs, such as cocaine or heroin. Other irritants may include: cold weather/exercise, aspirin/NSAID exposure, and/or gastroesophageal reflux disease.

-Useful diagnostic tests include: pulse oximetry and pulmonary function tests that might illustrate a decrease in oxygenation and forced expiratory volume

-Chest x-ray to rule out other etiology of respiratory distress

Asthma is a chronic illness, whose symptoms can be controlled through proper medical care [7,8]. However, most asthma patients seek treatment for their disease acutely, in the emergency room setting. Research has indicated that inner city populations of patients have decreased access to consistent health care and drug treatment for asthma [7,9,10]. Our study assesses physician compliance with current asthma protocols in the emergency department of Mount Sinai Hospital Medical Center (MSMC) in Chicago, Illinois, before and after a physician education program.

Asthma presents as an escalating public health and financial crisis in the United States. The disease poses particular threat in large, urban centers, where there is a greater concentration of the medically underserved and high levels of air pollutants. United States prevalence data indicates that asthma effects between 14 and 15 million people annually [11]. Asthma is attributed as Cause of Death for close to 5,000 patients per year, and nationally, results in 450,000 hospitalizations per year [3, 12].

High-risk Populations:

Asthma is more prevalent and associated with greater mortality in low socioeconomic status, inner city populations [8,9,15-18]. Race has also been shown to be associated with asthma mortality, as well as the utilization of emergency health care resources. When compared with the Caucasian population, both Hispanic and African American patients more frequently seek health care for asthma, and have increased asthma associated mortality [18].

One utilization study identified that African Americans seek emergency department care for asthma five times more frequently than the non-African American population. Additionally, the asthma associated mortality in African Americans is 2.5 times greater than the national average. Morbidity, as measured by rate of hospital admission, was more than three times the national average in this population [19]. Factors, such as race, socioeconomic status, literacy, health insurance status, the use of prescribed medication, and general access to care, effect the prevalence of this disease [8,9,15-19]. Education, prevention, and direct treatment protocols have been designed to target asthma care in high-risk, underserved populations of patients.

Researchers have also identified increased morbidity in patient populations who are exposed to environmental pollutants. Individuals in urban communities, who are exposed to air pollution, dust mites, cockroaches, rats, cigarette smoke, and other environmental triggers, have increased rates of hospitalization and experience more symptoms from asthma [20-22].

Asthma Morbidity and Mortality:

Researchers have suggested that in urban centers there is inadequate patient education, decreased patient compliance with treatment, and decreased medication use. Asthma, while otherwise well controlled with proper management, presents itself as a significant source of mortality. Mortality rates from asthma are highest in New York City, followed by Cook County, Illinois [23].

In 1999, approximately 223,000 asthma patients were identified in the 2,800,000 population of Chicago [24]. One cross-sectional assessment of asthma in Illinois high school students, estimated that 12.6% of 2,693 responders were under treatment for asthma [25]. In Harlem, New York, a survey assessing asthma severity in African American patients found that the majority of patients reported having adequate access to a primary care provider; however 69% of these patients preferred to be seen in the emergency department. Eighty-two percent of the 375 patients surveyed reported having sought care in the emergency department several times during the course of the year, with a mean of 8.5 emergency room visits per year [18].

National Guidelines:

In order to address the rising morbidity and mortality of asthma, the National Institute of Health published standard asthma treatment guidelines. The most recent report from the National Asthma Education and Prevention Program (NAEPP) was published in 1997 [2].

This report outlines current standards of care for asthma patients in the emergency department setting, emphasizing four points: the need for immediate assessment of pulmonary function, early treatment with inhaled B2-agonists, treatment with systemic corticosteroids, and if necessary, intubation/hospital admission [2,3]. The NAEPP report also emphasizes the importance of patient education at each encounter. Ideally, these guidelines will increase the accessibility and efficacy of treatment.

Management of chronic asthma is an important component of prevention of disease exacerbation and hospitalization. Three basic characteristics of disease management are emphasized. Patient education, regarding proper use of medication, and recognition/avoidance of environmental triggers is implicit to disease control. Patients should also be taught to monitor the peak expiratory flow rates when there is an exacerbation in symptoms, signifying airway inflammation. The National Institute of Health published recommendations for the medical treatment of asthma which are based on classifications of the disease into three groups of severity. Most frequently, asthma is treated with a daily anti-inflammatory, such as an inhaled corticosteroid, as well as intermittent boosts of a bronchodilator, such as a beta-adrenergic agonist [26].

Utilization of Emergency Services for Asthma:

Allergists and pulmonologists treat asthma as a disease of chronic inflammation of the airway. Medical management of this illness involves patient education, consistent pharmacological management and removal of environmental allergens/triggers.

However, a disparity in the treatment of this disease has developed. Rather than treating asthma as a chronic process, a large proportion of patients in metropolitan regions choose to seek care for asthma for acute exacerbations. Researchers hypothesize that this is due to a lack of utilization of asthma specialists, these resources are less available to low socioeconomic patient populations [27]. One study demonstrated that patients with commercial insurance coverage were treated less frequently in the emergency department than patients with public aid. This study also indicated that self-pay patients in the inner city were significantly more likely to seek asthma care through the emergency department than patients with other types of insurance coverage (OR=4.92) [16]. The researchers attribute this difference in resource utilization to the availability and access of outpatient specialized care [16]. Cross-sectional and cohort data have quantified that between 70%-75.4% of all patients with asthma seek treatment primarily through their local emergency department [27,28].

Smaha, 2001, recommends that patients review the severity of their attack, history of hospitalizations, responsiveness to medications, accessibility of urgent care resources, and accessibility of social support networks prior to activating the emergency system. Smaha summarizes the criteria that a patient should use in evaluating the severity of an asthma attack, prior to initiating the emergency response system [29].

These risk criteria are quoted directly from her study, and listed in Table I below.

Table I. Smaha- Patient self-assessment prior to activating emergency pathway.

Red zone peak flows[1] of less than 50% of the predicted or personal best
Yellow zone peak flows of 50-80% of predicted or personal best; unresponsive to bronchodilator therapy with decline in flow rate
Rapid decline of lung function evidenced by increasing symptoms of uncontrolled cough, breathlessness, or wheezing
Failure of PEF to exceed 60% of predicted or personal best after inhaled bronchdilator therapy has been initiated, or <2hours duration of broncodilation
Suprasternal retraction and/or use of accessory muscles
Cyanosis or pallor of nailbeds and/or mucous membranes
Speaking in words or phrases rather than sentences

peak flows[1]- maximum expiratory flow

In asthma, the severity of symptoms caused by airway inflammation waxes and wanes in between flares. The Centers for Disease Control estimate that over 1.5 million emergency room visits per year are utilized by asthma patients for acute exacerbations of the disease [3,12].

Financial Sequelae of the Disease:

Smith, Malone, Lawson, Okamoto, Battista, and Saunders [14] estimated that total asthma costs in 1994 approached 5.8 billion dollars. Emergency room expenses represented 348.0 million dollars of these costs. Financial and physical morbidity associated with asthma can be reduced by increasing the quality of health care inside and outside of the emergency department, particularly in underserved, urban communities.

National Asthma Education and Prevention Program Guidelines and the Emergency Department:

After the release of the NAEPP guidelines, Emond, Reed, Caitlin, Clark, and Camargo [27] distributed a survey to emergency departments participating in a Multicenter Airway Research Collaboration project (MARC); this research group specifically evaluates asthma education/treatment protocols in emergency departments. One hundred percent (number=77) of the nationally represented sites responded to the questionnaire. However, the researchers concluded that only twelve of the seventy-seven departments currently reported implementing an Asthma Education Program (AEP). Those with such a program were more likely to employ a standard pathway for management of the disease [27].

In 1999, Milks, Oppenheimer, and Bielory completed a retrospective chart review to assess compliance with the NAEPP guidelines in the emergency room. The researchers identified 1858 records of patients treated for asthma. One hundred and eighty-one charts were randomly selected from the pool for the final analysis. Documentation of treatment in this emergency department differed greatly from the guidelines printed by the NAEPP.

Increased use of beta-agonist therapy at home is considered a risk factor for respiratory decompensation in the asthmatic, and current guidelines suggest that such patients receive treatment with steroids upon presentation to the emergency room. However, in this study, the use of beta agonist therapy was only documented in 15% of the adults, 67% of the pediatric patients (aged 6-17 years), and 82% of the infant/toddler population (less than 6 years of age). Ninety-two percent of the patients received inhaled beta agonists in the

emergency department, while steroids were administered to 49% of adults and 83% of children aged 6-17 years [30]. Follow-up care was inconsistently managed. Referral for specialized care, as recommended by the NAEPP, was documented in 4% of the pediatric cases, and 32% of the adult asthmatics [30]. Prescriptions were distributed to 35% of the adult asthmatics, 83% of the children, and 85% of the infants/toddlers. The authors state that standardization of urgent care and availability of specialized outpatient facilities are necessary in decreasing the morbidity associated with asthma.

One group of researchers found that implementing a critical pathway for the treatment of asthma in the emergency department increased efficiency and decreased resource utilization [31]. Patients who were treated under an asthma protocol, were compared to controls drawn from a retrospective chart review. By allocating specific treatment regimens to patients presenting with mild, moderate, or severe respiratory distress, the researchers were able to standardize asthma care in a consistent fashion. The results in this population illustrated: decreased utilization of oxygen ($p=0.001$), decreased intravenous steroid administration ($p=0.034$), and decreased handheld nebulizer treatments ($p=0.001$). Consistent with the NAEPP recommendations, there was an increase in oral steroid administration ($p=0.027$) and use of metered dose inhalers with spacers ($p=0.001$) [31]. Although, follow-up data were limited in this patient population, asthmatics had shorter durations of stay in the emergency room and decreased relapse rates when compared to controls [31].

Asthma Treatment at Mount Sinai Hospital Medical Center, Chicago, Illinois:

This pilot study assesses the utilization of an Asthma Assessment Order and Flow Sheet [AFS] designed to standardize and track the care of asthma patients treated in an urban emergency department in Chicago, Illinois. The AFS was designed by physicians at the Mount Sinai Emergency Department and reflects those guidelines set by the 1997 National Asthma Education Expert Panel Report.

Each emergency medicine physician was familiarized with the AFS and asked to complete the survey for every asthma patient admitted to the emergency department. Completion of the AFS is assessed at two intervals:

1.) Pre-educational seminar: physician compliance with the NAEPP protocol prior to a directed educational intervention

2.) Post-educational seminar: physician compliance after an educational seminar on the NAEPP guidelines.

Completion of the AFS, pharmacotherapy received in the emergency department, and patient disposition are assessed for all asthma encounters.

In urban settings, the morbidity and mortality associated with asthma are complicated by inconsistent medical care and inaccessibility of appropriate treatments. The emergency

department of Mount Sinai Hospital Medical Center in Chicago, Illinois serves a large population of low income, high-risk families. In this environment, the AFS was implemented in an effort to standardize patient care.

Methods:

Hospital:

Mount Sinai Hospital Medical Center (MSMC) in Chicago, Illinois is a tertiary care center located in an underserved region of a large metropolitan city. MSMC is a level-one trauma center. All emergency patients, adult and pediatric, are seen in a central emergency department. By computer census in 1998, physicians at the MSMC emergency department treated 38,612 patients. Asthma patients in this census were identified using diagnosis code. Codes 493-493.9 were included in the assessment (asthma without status asthmaticus-chronic obstructive asthma with status asthmaticus). A total of 1,853 patients seen at the MSMC emergency room were diagnosed with asthma as the primary criteria for treatment in 1998.

For the purpose of this study, cases were identified via individual chart review. Copies of all charts of patients admitted to the emergency room at MSMC are stored in the emergency department for one month after admission. Charts were reviewed on a daily basis, those indicating discharge diagnoses of asthma or respiratory distress were reviewed for inclusion in the study. All patients with a primary diagnosis of asthma were included in the study. Missing data might be attributed to patients presenting with primary complaints of chronic obstructive pulmonary disease, emphysema, or pneumonia. While these patients may have received treatment for an exacerbation of asthma, their primary disease and primary

discharge diagnoses were not asthma; they are therefore not the focus of the study population.

Study Timeline:

Study Period I: all patients treated for asthma in the emergency department of Mount Sinai Medical Center, Chicago, between 11/1998 and 02/1999.

Educational Seminars: seminars on the National Asthma Education and Prevention Program guidelines were presented to the physicians in 10/1999 and 11/1999.

Study Period II: included all asthma encounters in the emergency department collected after the educational seminar, between 10/1999 and 2/2000.

The Asthma Assessment, Order, and Flow Sheet (AFS):

This form was designed by the emergency department physicians at Mount Sinai Medical Center in order to assess and track the treatment of asthma patients in the emergency room (see Appendix i). Physicians were asked to complete one AFS per asthma patient encounter. The AFS is based upon the diagnostic and treatment criteria specified in the NAEPP guidelines, and includes pertinent patient history, physical exam, and treatment information.

The AFS is a one page charting tool designed primarily as a check-list. Sample content is provided in Table II below.

Table II. Examples of Asthma Assessment and Flow Sheet Content

Item:	**Examples:**
Significant medical history of asthma	previous emergency department visits, Intensive Care Unit (ICU) admissions, and best peak flow measurements
Co-morbidity	congestive heart failure; renal disease; and/or chronic obstructive pulmonary disease
Current medications	beta-agonists, steroids, anticholinergics, and/or theophylline
Physical exam findings	vitals, pulse oximetry, chest examination, and peak flow measurements
Treatment	nebulizer, steroid, and/or intubation
Disposition	home, admit, ICU admission, left against medical advice (AMA), transfer from MSMC, and unknown
Discharge	good, fair

In addition to the AFS, patient data were extracted from individual emergency room charts. Each patient admitted to MSMC with the diagnosis of asthma exacerbation was included in the study. Data from both the patient ED chart and the AFS were abstracted into the study database. Patients were enrolled per encounter in the emergency room. A few cases represent a single patient, who returned multiple times to the emergency department. Seven out of the 484 patient encounters in the pre-physician education data set, represented patients who had returned more than once for treatment in the emergency room. Repeated patient visits were not calculated for the post-educational seminar group. The focus of these analyses is to evaluate physician utilization of asthma protocols, therefore all cases (repeat and individual) were included, each representing individual physician-patient encounters.

Patient exclusion criteria included: history of trauma to the chest (gun shot wound, other penetrating injury, or closed chest injury i.e. blunt trauma such as motor vehicle accident); history of pulmonary carcinoma; documented pneumonia; or other non-asthma associated etiology of primary respiratory distress. After retrospective review of the AFS and chart data, all adult and pediatric patients admitted to the emergency department with the primary diagnosis of asthma during the study periods were included in the analyses.

Physician Education Session:

Two informational sessions on the AFS and current NAEPP guidelines were provided for all emergency physicians at MSMC in 10/1999 and 11/1999. Each twenty minute session reviewed the NAEPP guidelines for the assessment and treatment of the asthma patient presenting to the emergency department. Emphasis was placed on the collection of pertinent historical data that have been shown to be associated with outcome. These include: history of asthma; best recorded peak flow; history of repeated use of beta-agonists at home; adequate supply of medication; previous admissions for asthma; admissions to an intensive care unit; previous intubations; race; co-morbidity; and environmental triggers (cocaine, heroin, smoking, pet dander).

Treatment protocols were emphasized for patients presenting with mild, severe, or acutely severe respiratory distress. Patients presenting with mild asthma were defined as clinically symptomatic patients with peak flow measurements greater than or equal to 50% of their personal best. These patients were initially treated with 15 minute albuterol nebulizer

therapy (q20 minutes for one hour), with the addition of oral prednisone (1mg/kg) if symptoms were unresponsive, and supplemental oxygen to achieve a measured oxygen saturation of >90%. Patients who presented to the emergency department after repeated beta-agonist use, or steroid therapy at home were to be treated with prednisone on admission.

Patients with severe asthma were defined as those clinically symptomatic patients with peak flows less than 50% of recorded best effort. Treatment pathway for these patients included: albuterol/ipratropium nebulizer (5mg/0.5mg q 20minutes for one hour) with oral prednisone (1mg/kg), and supplemental oxygen if pulse oximetry was <90% after the first 15 minutes.

Those patients in acute, severe respiratory distress were treated via endotracheal intubation, or a monitored trial of continuous albuterol/ipratropium nebulizer (15mg/1.0mg per hour), 125mg IV solumedrol, supplemental oxygen, and heliox 70/30 administered through a non-rebreather mask at 12-15 L/minute.

Guidelines regarding appropriate discharge from the emergency department were also reviewed. Patients who responded well to treatment in the emergency room were defined as those who exhibited peak flow rates of at least 70% of their baseline, with a resolution of clinical symptoms. After observation in a holding area, these patients were to be released with self-management instructions, appropriate medication, and an appointment for follow-up care. NAEPP guidelines suggest that failure of peak flow to increase above 50% of the predicted value, despite treatment, is criterion for hospitalization. Patients with change in mental status, pCO2 of greater than or equal to 42mmHg, peak flow of less than 30%

predicted value, increased evidence of airway obstruction, or respiratory fatigue should be monitored in the ICU; endotracheal intubation and mechanical ventilation were to be provided as indicated [1-3].

Data Collection:

Prior to the retrospective collection of data at MSMC, both the Institutional Review Boards at the Chicago Medical School and MSMC approved the use of patient and physician data for this project. Data from the AFS and patient charts were extracted into Microsoft Excel (Microsoft Inc., Redmond, WA) in spreadsheet form. Medical students and Physician's Assistant students were responsible for the entry of patient data from the two study periods. Both groups of data technicians were given identical instructions on how to abstract information from the charts. The medical students completed data entry for Study Period I; the Physician's Assistant students completed data entry for Study Period II.

Upon assessment, the coding abstraction of data during the two time periods was consistent with respect to: patient set (pre and post-physician education program); case numbering; completion of AFS; history of asthma, COPD, CHF, or renal disease; triage and discharge times; treating physician; demographics (age, sex, race, zip-code at home address, month and year of treatment); the treatment received in emergency department (steroid or nebulizer therapy); and disposition (home, admit, left against medical advice, transfer, ICU, and unknown). However, a discrepancy in abstraction was identified with respect to patient condition on discharge. Condition on discharge is represented in checklist form at the

bottom of each patient chart. Consistent with this format, patient discharge status is defined as Good, Fair, Poor, or Unknown for the purpose of this study. In the compilation of 150 charts in Study Period II, one coder altered these criteria to represent discharge status classifications of Good, Fair, and Stable. For the purpose of consistency between the analyses, only differences between patients charted with conditions of Good and Fair will be included in the final analyses. Caution will be used when interpreting these results on patient condition at discharge.

Patient data were divided into pre and post physician education groups. Twenty-two variables were included in the final analyses, including data on AFS completion, patient treatment, and disposition on discharge. Data tables were reviewed twice for errors by independent coders within the physician assistant and medical student groups.

Analyses:

Analyses were conducted using SPSS 7.5 graduate pack software, (SPSS Inc, Chicago, IL). Chi^2 and Student's t-test were conducted. Two-tailed P values of less than 0.05 were considered statistically significant. Twenty-two variables were defined as follows:

Table III. Variables and coded information.

Variable	**Code**
Set	1=pre-physician education; 2=post-physician education
Case number	Confidential identification number assigned to each case
Form	1=AFS filled out; 2=blank, AFS not filled out
History of asthma	1=true; 2=not documented
History of COPD[1]	1=1= true; 2=not documented
History of CHF[2]	1=true; 2=not documented
History of renal disease	1=true; 2=not documented
Triage time	time of admission
Discharge time	time of discharge
Stay duration	length of time in emergency department
Provider	treating physician
Date of birth	in year
Sex	male=1; female=2
Race	1=White; 2=Black; 3=Hispanic; 4=Asian
Zipcode	extracted from patient's address
Disposition	1= home; 2=admit; 3=left against medical advice; 4=transfer; 5=unknown; 6=ICU
Diagnosis at discharge	1= good; 2=fair
Steroid treatment	1=yes; 2=no
Nebulizer treatment	1=yes; 2=no
Month	month of admission
Year	year of admission-

[1] COPD= chronic obstructive pulmonary disease; [2] CHF=congestive heart failure

Results:

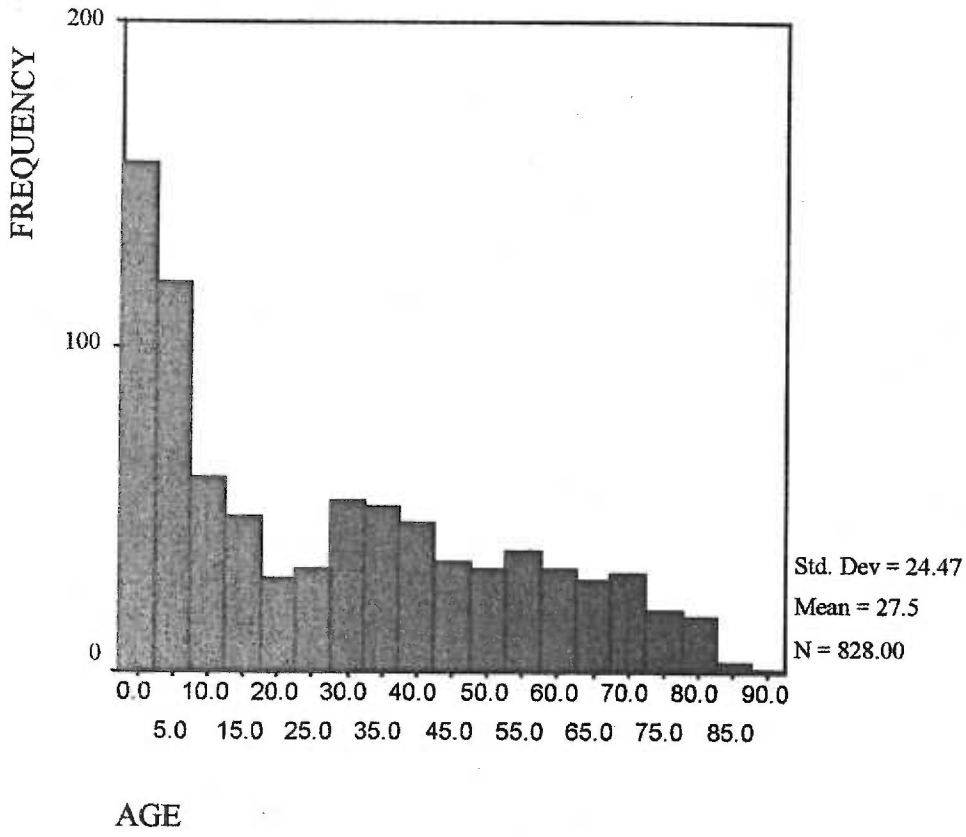
Patient Demographics:

Data were collected on 834 patients. These data were compiled from the AFS form, as well as from the emergency room chart. All emergency room chart data were available. There were 421 completed AFS forms in total; 415 of the patient encounters did not include completion of an AFS.

Compliance with current asthma protocols is assessed at two levels: first, completion of one AFS per patient encounter is calculated. In addition to the AFS, treatment data was extracted from the general chart. In this way, compliance can be evaluated on two levels: 1. completion of the AFS; 2. treatment provided in the emergency room. Descriptive statistics for the case population are presented in the following tables.

The mean age of the studied patient population was 27.50, with a standard deviation of 24.47. Both pediatric and adult data were compiled in the final analyses, age ranged from less than one year to 90 years. The histogram in Figure 1. represents the distribution of age in the study population.

Figure 1. Distribution of Patients' Age for All Study Subjects.



No significant demographic differences were found between patient groups using Chi^2 to compare patient demographics of: age, race, sex, and co-morbidity.

Patient group is defined as: Group 1= patients enrolled prior to the physician educational intervention, number = 484; Group 2= patients enrolled after the physician educational intervention, number =352). Patients whose chief complaint on presentation was not asthma, were not included in the study. This will be discussed in the later sections of the paper.

Forty-seven percent of the patient population was male and fifty-three percent was female. In 1998, the racial demographics of all patients treated in the emergency department at MSMC for all conditions were: African American= 25,261 (65%); Caucasian= 2,126 (6%); Hispanic=10,446 (27%); Asian 144 (0.4%); and Unknown= 635 (2%).

Data on patient racial demographics for the asthma cases are presented below.

Table IV. Racial demographics of patient population

Race	Number	Percent
African American	288	80.5
Caucasian	11	3
Hispanic	57	16
Asian	2	0.5
Total known race	358	43
Total unknown race	470	57

While MSMC serves a large population of minority and immigrant patients, only 43% of the case charts included data indicating patient race. This poses a limitation to our assessment of the role that patient race plays in asthma presentation and treatment.

In order to characterize the social demographic of the patient population, data on zip code were collected. The largest representation by zip-code, was of patients who registered for care at MSMC from the immediate vicinity of the medical center.

The most frequent zip-codes of patients treated in the emergency department for asthma included: 60623, 60624, 60608; 60612. The zip-code of MSMC is 60608. Figure 2. illustrates the four most common zip-codes documenting patient demographics of those patients treated in the emergency department for asthma during the study period. A map generated by the Sinai Health System Planning Department illustrates zip-code distribution with respect to proximity of the medical center in Figure 2.

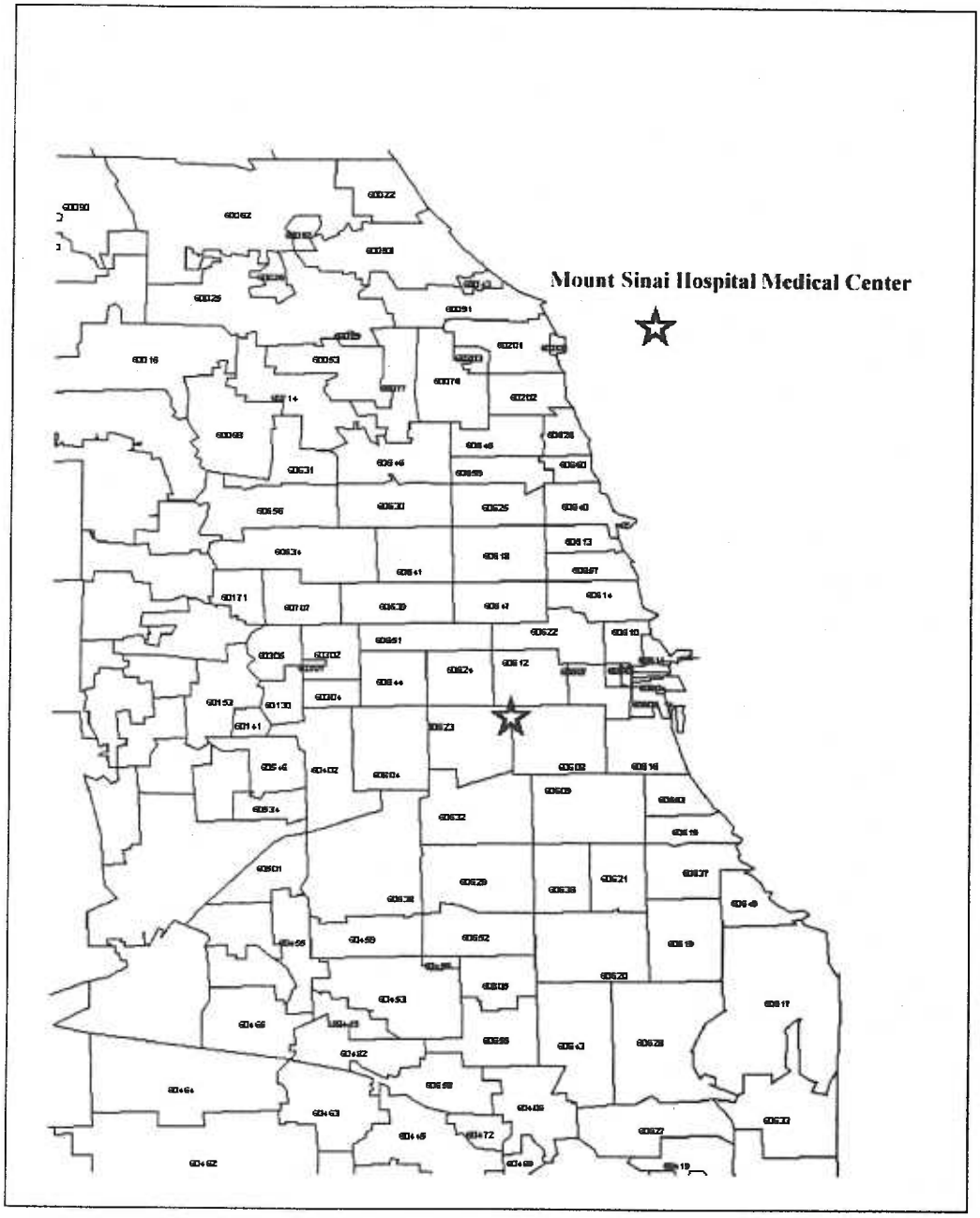
Table V. Percent of most common patient zip-codes

Zip-code	Number	Percent
60623	319	38.2
60624	87	10.4
60608	105	12.6
60612	54	6.5
Missing	11	1.3
Total	825	98.7

The MSMC planning department collects data on all patient admissions from each department in the hospital. A query of patient admission records and zip-code data, indicate that from the four primary geographic regions: 60% of MSMC patients are female, 40% are male; 50% are African American; 44% are Hispanic; 0.09% are Asian;

5% are of unknown race; and 2% are Caucasian. Data from the 1990 Census indicate the following median annual household incomes for the study population: zip-code 60608=$18,803; zip-code 60612=$10,043; zip-code 60623 =$19,462; zip-code 60624=$13,732. A map depicting the primary region of service by zip-code is presented in Figure 2.

Figure 2. Map of zip-codes in Cook County, Illinois



Past Medical History:

Information on pertinent past medical history was also collected using the Asthma Flow Sheet and emergency room chart. Percentages of patients effected with the co-morbidities: chronic obstructive pulmonary disease, congestive heart failure, and renal disease are presented below.

Table VI. Patient characteristics of Treatment Groups 1[a] and 2[b]

Variable	**Group 1[a]**	**Group 2[b]**
Form Complete[c]	50	50
Form Blank[d]	50	50
Male	45	45
Female	51	54
History of asthma	80	87
History CHF[e]	0.6	1
History COPD[f]	1	1
History of renal disease	.02	0
Nebulizer treatment	89	86
Steroid treatment	75	67

[a]Group 1= patients treated in the emergency department prior to the physician education program on asthma protocols; [b]Group 2= patients treated in the emergency department after the physician education program on asthma protocols; [c]Form Complete= cases for which an Asthma Assessment and Flow Sheet were filled out; [d]Form Blank = cases for which no Asthma Assessment and Flow Sheet was filled out, and only data collected from chart are included; [e]CHF= congestive heart failure; [f]COPD= chronic obstructive pulmonary disease

Cross tabulation data in Table VI illustrate that the two treatment groups were similar to each other in demographic characteristics, such as sex, and co-morbidity. However, a significant increase in the frequency of documentation of history of asthma is seen in patient Group 2. Treatment standards were similar between groups, with respect to nebulizer use, but indicated an increase in the prescription of steroids after the educational seminar.

Table VII. Pearson Chi-Square analyses comparing patient Treatment Group[a,b] to demographic and treatment characteristics

Variable	Pearson Chi^2, (2-sided p-value)
Form Complete[c]/Blank[d]	0.971
Sex	0.435
History of asthma	0.025*
History CHF[e]	0.418
History COPD[f]	0.892
History of renal disease	0.393
Nebulizer treatment	0.131
Steroid treatment	0.010*

[a]Set 1= patients treated in the emergency department prior to the physician education program on asthma protocols; [b]Set 2= patients treated in the emergency department after the physician education program on asthma protocols; [c]Form Complete= cases for which an Asthma Assessment and Flow Sheet were filled out; [d]Form Blank = cases for which no Asthma Assessment and Flow Sheet was filled out, and only data collected from chart were included; [e]CHF= congestive heart failure; [f]COPD= chronic obstructive pulmonary disease.
* p value considered significant if <0.05

Table VII. illustrates the significance of differences between the patient groups enrolled during Study Period 1 and 2. No significant differences were identified in the patient populations with respect to Sex, History of CHF, History of COPD, History of renal disease, and use of nebulizer therapy.

Additionally, no significant differences were identified in the physician utilization of the AFS before and after educational seminars on the asthma protocols. Although utilization of the charting tool did not increase after physician education, compliance with NAEPP guidelines and the actual treatment of patients did change after the protocol seminar. After the educational intervention, physicians were more likely to document a patient's history of asthma. These patients were also more likely to receive treatment with steroid medication than the patients in Study Period I ($p<0.05$). After the educational seminar, physician treatment protocols more closely followed the recommendations of the NAEPP.

Demographic and treatment data were assessed to review characteristics of the patient population for which physicians did complete the AFS. These data are compared to patients for whom no AFS was completed and are presented in Table VIII and Table IX.

Table VIII. Physician completion of the Asthma Assessment and Flow Sheet (AFS) versus patient demographic and treatment characteristics.

Variable	Form Complete[a]	Form Blank[b]
Male	46	47
Female	53	52
History of asthma	93	73
History CHF[c]	.4	1
History COPD[d]	1	1
History of renal disease	.02	0
Nebulizer treatment	97	79
Steroid treatment	82	60

[a]Form Complete= cases for which an Asthma Assessment and Flow Sheet was filled out; [b]Form Blank = cases for which no Asthma Assessment and Flow Sheet was filled out, and only data collected from chart are included; [c]CHF= congestive heart failure; [d]COPD= chronic obstructive pulmonary disease.
* p value considered significant if <0.05

Cross-tabulation data do not illustrate significant differences between patient groups with respect to: sex, history of COPD, history of CHF, or history of renal disease.

However, physicians who filled out the AFS had a greater frequency of documenting patient history of asthma. These physicians also exhibited an increased rate of prescription of nebulizer and steroid therapy. While completion of the AFS was not directly associated with participation in the physician education program, completion of the form was significantly related to compliance with three key aspects of the NAEPP guidelines: 1. acquiring a detailed history of the patient's asthma disease; 2. use of beta-agonists for symptomatic patients; 3. early addition of steroid therapy to beta-agonist treatment patients with a history of asthma.

This treatment protocol reflects compliance with the NAEPP guidelines. Both physicians who had participated in the educational seminar, and those who had completed the AFS, utilize these guidelines more frequently than physicians who were assessed prior to the educational seminar and compared to those who do not use the AFS. These data are presented below.

Table IX. Pearson Chi-Square analyses of physician completion of the Asthma Assessment and Flow Sheet (AFS) and patient demographic/treatment characteristics

Variable	**Pearson Chi^2, (2-sided p-value)**
Form Blank/Complete[a,b]	0.971
Sex	0.633
Race	0.634
History of asthma	0.000*
History CHF[c]	0.247
History COPD[d]	0.982
History of renal disease	0.320
Nebulizer treatment	0.000*
Steroid treatment	0.000*

[a]Form Complete= cases for which an Asthma Assessment and Flow Sheet was filled out; [b]Form Blank = cases for which no Asthma Assessment and Flow Sheet was filled out, and only data collected from chart are included; [c]CHF= congestive heart failure; [d]COPD= chronic obstructive pulmonary disease.
* p value considered significant if <0.05

After the educational seminar, physicians were more likely to indicate asthma history on the patient chart ($p<0.01$). Additionally, physicians demonstrated increased rates of prescription of beta-agonists and steroid treatments ($p<0.01$).

Physician completion of the AFS was further compared to patient condition on discharge. All emergency room encounter forms contain a list of discharge criteria at the bottom of the form. Such discharge descriptions that were analyzed here include those of Good and Fair. Comparison of patient status at discharge was conducted, to assess differences between patients for whom an AFS was completed, and those for which no AFS was completed. Data are presented in Table X and Table XI below.

Table X. Completion of Asthma Assessment and Flow Sheet versus discharge condition [a]

Form	Good	Fair	Pearson Chi^2, (2-sided p-value)
Blank	47	27	0.001*
Complete	63	12	

[a] reported in percentage
* p value <0.05

Cross tabulation and Chi-Square analyses illustrate that there are significant differences between the groups. Patients with completed AFS forms were more likely to have a documented discharge status of Good. Patients for whom the condition was listed as Fair, were less likely to have a documented AFS form completed in the chart. This may be attributed to provider allocation of resources/time in the more critical patient populations.

Prioritization of care is a vital component of organization in the emergency room setting. The differences observed may be due to the fact that providers allocate less time to completion of charting tools in the more critical patient, conserving time to provide more complex medical care. A contributing factor might also have been the patient's disposition at discharge from the emergency department. More seriously ill patients are more likely to be

directed towards admission to the hospital. Once a patient was identified as a candidate for admission, the health care provider might have placed more emphasis on completing all charting data in the standard patient chart, which the health care providers in the general hospital are more familiar with than the AFS form.

Physician completion of the AFS was also compared to the documented patient disposition. Patient disposition is listed at the bottom of each emergency room encounter form and represents where the patient is discharged to from the emergency department. The listed dispositions include: Home, Admit, AMA, and Transfer. There is also room to indicate if an admission will be to an ICU department. .

Cross tabulation and Chi-Square data illustrate that there is a significant difference in discharge diagnoses between the group of patients for which an AFS form was completed, and those for which no AFS form was completed. These data are presented in Table XI.

Table XI. Completion of Asthma Assessment and Flow Sheet versus disposition[a]

Form	Home	Admit	AMA[b]	Tran[c]	Unk[d]	ICU[e]	Pearson Chi^2, (2-sided p-value)
Blank	57	28	0.7	5	9	5	0.019*
Complete	66	22	0.7	0.2	10	1	

[a]reported in percentage; [b]AMA=against medical advice; [c]Tran= transfer; [d]Unk= unknown; [e]ICU= Intensive Care Unit
* p value <0.05

The charts of patients who were discharged home were more likely to include a completed AFS form ($p<0.05$). Those patients with more serious asthma exacerbations, including those

who were admitted to the general hospital floors and ICU, were less likely to have an AFS tool completed in the emergency department ($p<0.05$). Once again, patient disposition and discharge were associated with completion of the AFS. Patients with more serious asthma exacerbations were less likely to have a completed AFS. This may be attributed to the allocation of time in the emergency department.

Conclusion/Discussion:

While a large proportion of physicians at MSMC failed to complete the Asthma Assessment and Flow Sheet, even after participating in the educational seminar, our study demonstrates that the educational trial did increase physician partial compliance with the NAEPP guidelines.

After the educational seminar, physicians were more likely to document a patient's past medical history of asthma. Patients with positive histories of asthma were then treated with oral corticosteroids at presentation, rather than after a preliminary trial of beta-agonist nebulizer.

It should be noted that this study assesses the modification of physician behavior after an educational intervention. The measured outcome is the treatment provided as the result of the individual physician-patient interaction. While our study characterizes utilization of the assessment tool, future studies utilizing greater numbers of health care providers, might be able to focus on the intervention's effect on individual provider compliance.

Compliance with the treatment guidelines, specifically the utilization of steroids in patients with history of asthma, increased significantly after physician education on the AFS/NAEPP guidelines. Together, these educational interventions affected physician behavior, without increasing utilization of the AFS.

A hurdle exists in the development of patient charting tools, particularly for use in the already busy emergency room setting. While the content of the AFS represents the NAEPP guidelines, and education on the AFS increased compliance with these guidelines, our attempts to increase utilization of the AFS were not effective.

The implementation of a new charting tool requires adding a step in the work-up of each asthma patient. Each provider must be familiar with the format of the tool, and copies of the AFS must be made accessible to all medical providers. While initially, this might increase the time allotted for charting the status of each asthma patient, the one-page flow sheet provides a paradigm for consistent assessment and treatment of patients. Such a paradigm provides a standardized means of documenting patient historical data and treatment schedules.

After providers become familiar with this tool, such a checklist should decrease the time allocated for interpretation of chart notes. Rather than interpreting the written notes of individual health care providers, physicians will have access to a checklist that outlines care provided. This may save communication time at shift change, when sharing patient information between physicians. Or, may decrease the amount of time needed to share information between different groups of health care providers, such as respiratory therapists and nurses. Although it is encouraging that compliance with the NAEPP guidelines increased after the education seminar, more efforts are needed to increase standardization of asthma care in the emergency department. If physicians could be encouraged to utilize such

a tool as the AFS, it would provide them with a means to consistently track patient care and patient response to treatment.

Limitations of Study:

Retrospective chart review data are subject to human coding errors. While each data set was reviewed twice for error, it is still possible that data were miscoded or excluded when transferred from the AFS/patient chart to the data files.

After assessing physician compliance with the completion of the AFS, all data were extracted from the AFS/patient chart, and were output into a single patient database. Therefore information cannot be distinguished as retrieved specifically from the AFS or the general chart. It is therefore the case that only general conclusions can be made regarding the completeness of treatment and the utilization of the AFS form. Specific information on percent of data extracted from the AFS versus the patient chart cannot be calculated.

Another potential source of error includes the sample of data coders used to enter patient information. Data coding was completed by two different sets of students: medical students were responsible for the input of data for patient Group 1, while physician's assistant students entered data on patient Group 2. Although both groups received identical instructions on the extraction of data, and all primary items to be extracted were listed on the AFS in checklist form, error might have been introduced via abstraction of data by these different coder groups.

Upon review, the majority of data were consistently abstracted from the charts, as discussed in the Methods section. However, an inconsistency in data coding was identified for patient condition at discharge. As a result of this coding inconsistency, only data on patients discharged with conditions listed as Fair or Good were included in the final analyses. Care must be taken when interpreting these results, as only the patients who carried these discharge condition labels are represented in the analyses. All other data demonstrated integrity in its consistency between coder groups.

Additionally, since assessment of patient treatment is based upon extraction of data from the chart, only treatments that were documented in the patient charts are included in the analyses. Additional information regarding environmental triggers would have been useful in our understanding of disease etiology. Data on smoking history, animal dander, exposure to cocaine, and use of heroin were only inconsistently mentioned in the charts, making a valid assessment of these factors impossible using these data.

Another potential source of error is the repeat admission of asthma patients into the emergency department. During the course of the study, a few patients were seen repeated times for asthma treatment at MSMC. The primary criterion for evaluation of the physician education effort was the utilization of one AFS per asthma encounter. We therefore chose to assess each of these encounters as an independent event.

This criterion was independent of the patient's asthma history. However, data on patient asthma history were to be included in the patient's chart, and may have been influenced by

an individual patient's multiple visits to the emergency department. Only seven persons were identified in patient Group 1, as having been admitted multiple times during the study period. Due to this small number, and the nature of the study, it was decided to include all admissions as independent encounters in the analyses.

Despite these potential sources of error, significant differences in pharmacologic treatment and clinical history taking were identified after the education effort.

Like the Ford (2001) study, our cross sectional examination evaluates a primarily homogenous socioeconomic status population within an inner city population. The racial and socioeconomic homogeneity of this population allows us to examine the acute treatment of asthma in a specific group of high-risk patients. This homogeneity decreases confounding that might be attributed to diversity of available resources or social/cultural differences. However, charted data on race and socioeconomic status were limited, and future studies should attempt to more completely characterize this demographic. We must also recognize that the inner city patient population at MSMC is unique, and does not represent a broad patient population.

Recommendations for the Future:

Asthma patient education is vitally important in the treatment and prevention of the disease, however, the role of the emergency department physician in the education of the asthma patients is unclear [27]. A large proportion of asthma patients use the ED as their only

source of health care [27]. It is therefore necessary for emergency departments to provide patient educational services aimed at asthma prevention and maintenance.

The physician educational interventions at Mount Sinai Medical Center did create a significant impact on physician behavior in the emergency department. Physicians collected more patient historical data and changed pharmacotherapy practices. Further research is needed to design a physician accepted charting tool; one that is capable of quantifying severity of disease, as well as response to treatment.

Future efforts to increase utilization by the physician and nursing staff should include increasing the number of sites in the emergency department where the charting tools are located. Intermittent audits of asthma patient charts, to assess physician compliance, might provide relevant feedback when assessing utilization of the new tool. Additionally, the incorporation of a computer interface, which compiles patient information directly into an asthma database, would allow the physicians to generate a log of individual patient records.

Although difficult to conceive, charting tools such as the Asthma Assessment Order and Flow Sheet provide the framework to consolidate multiple provider resources, into the context of a basic treatment protocol. It is encouraging that physicians responded to the educational intervention at Mount Sinai Medical Center. In the future, more effort should be spent streamlining this charting tool, to achieve maximum physician compliance.

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Appendix:

An example of the Asthma Flow Sheet is included on the following page.

Mount [illegible] Hospital Medical [illegible]er
California Avenue at 15th Street
Chicago, Illinois 60608-1797

EMERGENCY DEPARTMENT

ASTHMA ASSESSMENT ORDER AND FLOW SHEET

History of ___ Asthma ___ COPD ___ CHF ___ Renal Disease

Duration of this attack _____ Severity _____

Last visit to ED _____ Last admission _____ ICU admission _____

Intubation _____

Inciting factor: URI ___ Weather ___ Allergy ___ Other _____

Medications: B-agonist _____ Steroid _____ Theophylline _____ Anticholinergic _____ Other _____

Physical: Vital Signs B/P _____ HR _____ RR _____ Temp _____ Pulse Ox _____

Lungs _____ Wheezes _____ Rales _____ Rhonchi _____ Retractions _____ Accessory muscles _____

Poor air movement _____

Mentation: _____ Normal _____ Anxious _____ Altered _____

Orders: ___ Nebulizer 2.5 mg Albuterol in 2.5 cc N/S Q30 min

___ Prednisone _____ mg po (1mg/kg) or ___ Prednisolone ___ mg po (1mg/kg)

___ Repeat nebulized Albuterol 2.5 mg in 2.5 cc N/S Q 30 min

___ Continue nebulized Albuterol 2.5 mg in 2.5 cc N/S Q ___ hour(s)

___ Call x6167 for follow-up teaching. ___ Call x6982 for Peds appointment.

_____
MD Signature

Time	Med	Time Tx	Pulse Ox	Peak Flow	Lung PE	Subjective	Disposition
0-15 min	nebulizer						
0-15 min	steroid						
30 min	nebulizer						
60 min	nebulizer						home
							continue
							admit Rx
90 min	nebulizer						
120 min	nebulizer						
150 min	nebulizer						home
							admit
	nebulizer						
	nebulizer						