Using the Electronic Medical Record to Improve Asthma Severity Documentation and Treatment Among Family Medicine Residents

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Background and Objectives: Use of electronic medical records (EMRs) is being advocated to improve quality of care. The objectives of this study were (1) to determine the effect of EMR template use on family medicine residents’ documentation of the severity classification of asthma and (2) to determine if documentation leads to appropriate treatment. Methods: We reviewed the charts of patients with asthma seen by residents in the Center for Family Medicine (CFM) between July 1, 2007, and December 31, 2007. Data gathered from each chart included disease severity classification, medication regimen, and use of the asthma template. In July 2008, efforts at increasing residents’ knowledge of asthma severity classification and documentation via EMR were made. A post-intervention chart review was performed on patients with asthma seen by the residents between July 1, 2008, and December 31, 2008. Results: Documentation of asthma severity increased significantly from 24% in the pre- to 44% in the post-intervention phase. Use of the EMR template significantly increased the rate of inhaled corticosteroid prescriptions, from 36.7% to 71.1%. Conclusions: Use of an asthma template within the EMR improves documentation of asthma severity and appropriate treatment.

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Asthma affects approximately 22 million people in the United States. In 2004, there were 497,000 hospitalizations due to asthma and 14.7 million ambulatory care visits. In 2003, 4,055 people died from asthma. The total estimated cost of asthma in 1994 was $5.8 billion in the United States. Greater than 60% of these costs can be contributed to hospitalizations. Possible explanations include access to care issues, disease severity, and poor management of disease. However, there have been important gains since the release of the first National Asthma Education and Prevention Program (NAEPP) clinical practice guidelines in 1991. For example, the number of deaths due to asthma has declined, even in the face of the increasing prevalence of the disease. Hospitalization rates, though, have remained stable. In August 2007, the NAEPP released the third Expert Panel Report to help health care professionals bridge the gap between current knowledge and clinical practice, thereby improving the quality of care. Four essential components of asthma care were identified and include assessment and monitoring, patient education, control of factors contributing to asthma severity, and pharmacologic treatment. The program emphasizes a severity classification scheme to optimize the use of pharmacologic therapy.

Despite publication of national and international asthma guidelines, physician compliance with these guidelines in clinical practice is poor, and management of chronic asthma remains suboptimal. Of 233 hospital admissions for asthma (144 patients), only 47% of patients were receiving inhaled corticosteroids (ICS) prior to admission, and 25% of patients were not prescribed ICS for maintenance therapy at discharge. In a study of 101 adult patients admitted to the hospital with an asthma exacerbation, less than half had been prescribed inhaled anti-inflammatory therapy as outpatients.

In theory, use of health information technology should help in improving adherence to clinical guide-
lines. Use of electronic medical records (EMR) in primary care settings can help to better organize patient information, provide prompts when chronic diseases are uncontrolled, and make practice guidelines available at the point of care. Hypothetically, their use should improve documentation of asthma severity. Further, if severity is documented, the assumption is made that appropriate pharmacologic treatment is prescribed, thereby improving quality of care. However, there is a paucity of evidence supporting this theory, and existing literature is conflicting. The objectives of this study were (1) to determine the effect of EMR template use on family medicine residents’ documentation of the severity classification of asthma and (2) to determine whether such documentation leads to appropriate treatment.

Methods
Our residency is a community-based 12-12-12 program affiliated with a 580-bed hospital system in the Southeast United States. Residents see their continuity patients in the Center for Family Medicine (CFM), a population of approximately 18,000. The CFM had more than 1,500 asthma-related visits in 2006. The EMR has been in use since October 2002, with the asthma template available in 2005. Interns are trained in the use of the EMR during their first month of residency, including existing templates. The elements of the template are based on the NAEPP Guidelines and include checkboxes for documentation of days per week with symptoms, nights per month with symptoms, range of Forced Expiratory Volume in one second (FEV1), history of exacerbation since the last visit, and use of rescue β2 agonists. Although there is no automatic prompt to the physician to use the template, it is highlighted as a choice if the patient carries a diagnosis of asthma.

Phase I: Pre-intervention Period
We retrospectively reviewed the medical records of 180 patients with asthma seen by the residents in the CFM between July 1, 2007, and December 31, 2007. Charts were identified using an inquiry in the Centricity™ EMR using a search by the active problems: asthma NOS with or without status asthmaticus, chronic asthma, extrinsic asthma, intrinsic asthma, bronchial asthma, and reactive airway disease. Any charts with an additional diagnosis of chronic obstructive pulmonary disease or pulmonary fibrosis were excluded. Prior to study commencement, a pilot study of 10 charts per investigator was performed using the data abstraction form to determine interrater reliability using Cohen’s kappa, which was 96.6%. Data gathered from each chart included, but was not limited to, disease severity classification, medication regimen, and documentation of daytime symptoms, nighttime symptoms, frequency of use of short-acting beta2 agonists, interference with normal activity, forced expiratory volume in 1 second (FEV1), exacerbations requiring oral systemic corticosteroids, and use of the asthma EMR template.

Phase II: Intervention
The intervention involved a noontime lecture in July 2008 to educate the residents on the updated national asthma guidelines. However, the main emphasis of the lecture was use of the asthma template in the EMR for proper documentation of asthma severity and appropriate treatment. Attendance at the lecture was mandatory, and one-on-one tutorials were arranged for residents not in attendance. To stress the importance of use of the asthma template, reminders were posted in patient care areas. Additionally, reminder slides regarding areas of documentation were included in the PowerPoint presentation displayed prior to our daily noon conference.

Phase III: Post-intervention Period
A post-intervention chart review was performed on 180 patients with asthma seen by the residents in the CFM between July 1, 2008, and December 31, 2008. Charts were identified by the same method as in the pre-intervention phase of the study, and identical data were gathered.

Data Analysis
The primary outcome measured was whether residents’ medical records documented the severity classification of asthma. The secondary variable was whether documentation of the asthma severity classification differed when using the EMR asthma template. Pearson’s Chi-Square test was used to determine statistical significance between the pre- and post-intervention phases. The final outcome was the appropriate treatment of asthma based on severity classification, before and after intervention. Specifically, we compared rates of inhaled corticosteroid (ICS) use in patients with documented asthma severity as well as rate of ICS prescriptions with use of template versus no template. We made the assumption that use of the template would increase the rate of ICS use, thus a one-tailed Fisher’s Exact test was used to test this hypothesis. The same two investigators performed the data abstraction in each intervention period (AD and MC). A random number generator was used to select two sets of 180 charts for review in both pre-intervention and post-intervention study phases. The sample size of 180 charts was chosen based on a power of 0.80. Statistical analysis comparing pre-intervention and post-intervention data was performed using the SAS-JMP statistical software package using α=0.05 as the significance level (SAS Institute, Cary, NC, 2007).

This study was approved by the Spartanburg Regional Healthcare System Institutional Review Board.
Results
Demographic characteristics of patients seen during the study periods are shown in Table 1. There were no significant differences in gender, race, or age between patients seen during the two phases of the study.

In the pre-intervention phase, 24% (n=43) of patients’ asthma severity was classified in the medical record. In the post-intervention phase, the percentage of patient visits with a classification of asthma severity was 44% (n=79), a statistically significant improvement (P = .0013). The overall use of the asthma template significantly increased from 13% in the pre-intervention phase to 37% in the post-intervention phase (P<.0001). Inhaled corticosteroid use increased significantly from the pre-intervention phase to the post-intervention phase, 39.4% (n=71) to 51.1% (n=92), respectively (P = .0170) (Figure 1).

Discussion
Appropriate documentation of asthma severity is one of the four areas of chronic asthma management. This study demonstrated that use of existing health information technology via the asthma template within the EMR was associated with a significant increase in the documentation of asthma severity and improved prescribing practices. Continued reminders may have helped to improve the documentation of asthma severity by resident physicians. Review of the asthma management guidelines is less likely to have impacted the results based on published literature demonstrating that didactic conferences do not appear to change physician behavior or performance.10-12

Limitations
Several limitations to this study exist. A class of residents (n=12) from the pre-intervention phase of the study graduated and were not exposed to the focused educational intervention on use of the asthma template. All 36 residents in the post-intervention phase

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![Figure 1](image-url)

Documentation of Asthma Severity and Inhaled Corticosteroid Use
of the study were educated. This may have introduced bias since the resident populations were not identical throughout the study. The pre-/post-study design is not the most rigorous way to show a difference in endpoints. However, it is an accepted method of office-based quality improvement initiatives and used regularly in health care institutions. Nonetheless, due to different patient and physician populations in the two phases of the study, we cannot say with certainty that the intervention itself led to the improvements. Additionally, there is no way to separate the influence of other rotation teaching and clinical experiences on the improvement in guideline compliance. Another limitation of this study was that the office spirometer was unavailable the last 2 months of the post-intervention phase, potentially decreasing proper documentation. Were it available, we may have demonstrated even more improvement in severity documentation. Finally, we did not track hospitalizations or emergency department visits to document whether appropriate documentation and treatment of asthma decreased these important outcomes.

Conclusions

Use of the EMR to improve quality of patient care is being encouraged on a national level. This study demonstrated that increased EMR template use by resident physicians was associated with improvements in documentation of asthma severity and with appropriate pharmacologic treatment. Future research is necessary to explore the correlation of correct classification and treatment with patient hospitalizations and emergency room visits.

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