Medication Allergy Documentation in Ambulatory Care: A Case Report of Errors and Missed Opportunities Quantified during the Unique Transition from Paper Records to Electronic Medical Records

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Abstract
Adverse drug events can occur in the ambulatory clinical setting from errors in medication allergy documentation. This study was conducted to quantify errors in documentation that occur within both paper and electronic medical records (EMR). During a period of transition from paper to EMR, a cross-sectional chart review was conducted in one ambulatory clinic. All patients receiving care on study days were approached for participation. A medication allergy history was obtained from each participant and validated. This medication allergy history was then compared to the medication allergy documented in several areas within the medical records. Eighty-nine patients were recruited. The error rates for nursing notes, the physician dictation, paper, and electronic summary pages were 0%, 14.8%, 11.1% and 15.5%, respectively. Our findings indicate that errors in medication allergy documentation occur frequently and may be increased when summary information is used. Summarized information should not be used clinically prior to validation.

INTRODUCTION
Medical errors are a common source of morbidity and mortality in the modern health care setting. Understanding errors in documentation can lead to improvements in medication management and safer patient care. In particular, adverse drug events are a common clinical problem in both the inpatient and outpatient setting. Lesar et al determined that prescription errors related to missed patient allergies were one of the most common reasons for medication-related errors. Additionally, Jones and Como determined that medication errors involving drug allergies were most commonly caused by a lack of awareness by the prescribing physician. Pau et al also found that 20% of patients had inaccurate hospital admission histories with regard to medication allergies, while other studies have demonstrated that medication allergy documentation needs significant improvement. No study evaluating the accuracy of medication allergy documentation at multiple points in an outpatient encounter and medical record has been described to date. Understanding current practices in documentation could help improve accuracy in the medical record and ultimately patient care and safety.

This study was designed to quantify errors in medication allergy documentation that occur across the medical record. The period of transition from paper to EMR records gives unique opportunity to study the accuracy of this information. Both paper records and an EMR were in use during this study. This study compares documentation of allergy history in an outpatient paper record to documentation in a comprehensive electronic medical record (EMR). In addition, this study was designed to document missed opportunities to update the summary records or problem lists in the paper record and the EMR.

METHODS
STUDY DESIGN AND SETTING
A cross-sectional chart review was conducted in one family practice clinic, a part of the Scott and White Healthcare System. This clinic is also affiliated with the Central Texas Primary Care Research Network (CenTexNet), a primary care practiced-based research network (PBRN) headquartered in Temple, Texas.

Scott & White Healthcare System is an integrated health care network consisting of two large referral hospitals, allied
health services, home health care services, multiple specialty clinics and primary care clinics. It is the primary clinical teaching site for the Texas A&M Health Science Center College of Medicine. At the time of the study, physicians and staff were transitioning from primary dependence on paper records to the exclusive use of an outpatient EMR. The EMR used in the system is available to all practicing physicians within both the inpatient and outpatient facilities within the system. Dictated hospital and outpatient records are stored and accessed via this EMR. Laboratory, radiology and nursing notes are also available in the EMR. In addition, many clinics have historically kept a paper record in the clinic. This paper record is located physically at the clinic site and only contains records of outpatient interactions with the patient at this site. During this transition period, both paper and electronic records were available for study.

Because the EMR and paper record are available at many outpatient facilities, medication allergy histories are documented in a number of places. These include 1) hand-written nursing notes taken on designated arrival sheets, 2) physician dictations, 3) hand-written summary sheets in the paper record, and 4) electronic summary sheets in the EMR. A description of the workflow is included and graphically represented.

Arrival notices are generated upon a patient arrival to the clinic. Nurses use this form to confirm a patient’s chief complaint and to hand-write vital signs and medication allergies. Physicians use this same form to record their notes during the office encounter, which then serves as a memory-aid for their dictated documentation of the office visit. The hand-written summary page is located in the outpatient paper record and is reviewed and updated by physicians and nurses during patient visits. Physicians and staff in the outpatient setting use this summary page to record information that is subject to minimal change over time. Information that is frequently kept on this page include past medical history, surgical history, medication lists, and medication allergies. An inherent problem with the summary page system is that it requires vigilance to maintain its accuracy.

The EMR also contains a summary page and serves a similar purpose as it records information that does not frequently change. The electronic summary page of the EMR receives information from the most recently dictated information. It is automatically updated each time an inpatient or outpatient dictation is done by a physician. Figure 1 summarizes the flow of information that occurs during a routine office visit at this clinic site.

**Figure 1**

**Diagram of Patient Tracking and Information Flow**

**Patient Tracking**

Arrival

Nurse Contact

Physician Visit

Exit

**Information Flow**

Arrival Notice generated

Nursing Notes Added to the Arrival Notice

Physician reviews/updates items in the paper chart including paper summary page

Physician dictates patient note

Physician Dictation added to EMR and paper record

EMR Summary page Electronically updated

**STUDY PARTICIPANTS AND DATA COLLECTION**

IRB approval was obtained before the study was started, and a formal consent procedure was obtained from each study participant. All patients who could communicate an allergy history on study days were approached for voluntary participation. Once the patient agreed to participate in the study, demographic data were recorded and an allergy history was obtained and recorded by a clinical research nurse. Patients were asked to list any medication that had caused an allergic reaction in the past. They also were asked what type of reaction occurred with each medication. Any reaction that was typical of medication side effects rather than true allergies (i.e., gastrointestinal upset from codeine) was re-classified as medication side effect. Only medications associated with a reaction consistent with true medication allergy were included for comparison in this study. Although validated patient histories may have some inherent error, they are a valid tool to study accuracy in documentation. This history is what directs most clinical encounters.
Once a validated medication allergy history was obtained from the patient, this history was compared with the documentation that had been recorded in various areas of the medical record. Any history of medication allergy that was recorded in the nursing notes, physician dictation, and the paper summary page or in the electronic summary page of the EMR was recorded. Any variation in the medical record that deviated in a clinically significant way from the patient history was considered an error.

Missed opportunities to update the summary pages also were noted. A missed opportunity to update the paper summary page was noted if an allergy history documented in the nursing notes or a physician dictation was not transferred to the patient’s paper summary page. A missed opportunity to update the electronic medical summary page was noted if an allergy history was noted in the nursing note or physician dictation, but the allergy was not transferred to the electronic summary page.

**DATA ANALYSIS**

Data analysis was performed using SPSS on a personal computer. Descriptive statistics were performed. The proportions of correct and incorrect documentation of medication allergies were computed for each documentation area – nursing notes written on arrival notices, physician dictations, paper summary sheets, and EMR summary sheet – and compared using the Fisher’s exact test. Statistical significance was set at the p <.05 level.

**RESULTS**

A total of 89 patients were enrolled into the study. One third of the participants were aged between 45 to 64 years and 26% were aged 65 years or older. Approximately two-thirds (65.2%) were female. The majority (84.1%) was white, non-Hispanic, while 11.4% were black (Table 1). The number of charts with medication allergy documentation in the nursing notes, physician dictations, paper summary pages, and electronic summary pages are shown in Table 2, along with the number of charts with errors documented in each of these areas. The electronic summary pages had the highest error rate (15.5%).

Analysis of summary pages from the paper record and EMR revealed an absence of any allergy documentation in 19% (n=17) of the paper summary pages vs. 5% (n=5) of the electronic summary pages. In reviewing these deficient records, a missed opportunity to transfer history to the summary page from the nursing notes or physician dictation was found in 37% of the deficient paper records, while no missed opportunities were found in the electronic medical record.

**DISCUSSION**

The results of this study show that errors in medication allergy documentation do occur. We documented that nursing notes taken on the day of the clinic visit did not show any errors. Physician dictation of medication allergy and medication allergy history documented on the summary pages in the paper record and EMR did not reach this high level of accuracy, however. Reasons for errors in physician dictation could be multiple, but may occur when errors in the summary page are dictated instead of validating a recent history. Physicians may also fail to dictate the allergies written by the nurse in the nursing notes. Although the analysis of the error rate in this small study did not show statistical significance, the absolute number of errors is measurable.

Hand-written paper summary sheet in a paper chart can be updated by multiple medical providers over time. This can lead to transcription errors. Because this sheet must be maintained over time, it may not always be updated if the medication allergies change. It is also available in only one
site rather than across the system. As expected, we found more missed opportunities to complete deficient medication allergy histories in the paper chart. In our study the electronic summary pages within the EMR were automatically updated with information from physician dictation and, as expected, showed fewer deficiencies and missed opportunities for updating the material. Surprisingly, though, the electronically updated EMR summary sheets were not statistically more accurate than the paper summary sheet. These errors may be primarily reflecting inaccurate physician dictation.

This study was done to examine the error rate in the documentation of medication allergy history. Errors in the record were discovered in both the paper record and EMR. Although the analysis of the error rate in this small study did not show statistical significance, the absolute number of errors was measurable. Significant clinical harm can occur from reliance on even a single erroneous record.

Although the use of summary pages is common in the inpatient and outpatient setting, this study shows that any history obtained from these pages needs to be validated by the physician or nurse on the day of visit. This is vitally important if pharmacological therapy is being considered. This study also shows that a system that automatically updates the EMR summary page allows for fewer missed opportunities for data summary. Surprisingly, this automatic system did not improve the accuracy of summarized data.

This study was limited by its small size and use of a single location within a large hospital system. Larger studies are needed to validate these finding and prove possible statistical significance of the error rate. Understanding the process of documentation error can ultimately lead to improvements in medication management and safer care for patients.

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PREVIOUS PRESENTATIONS
Portions of the data were presented at the Agency for Healthcare Research & Quality (AHRQ) National Practice-Based Research Network (PBRN) Research Conference, Bethesda, MD, May 16-18, 2007.

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