Medication, Allergy, and Adverse Drug Event Discrepancies in Ambulatory Care

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Background and Objectives: *A first step in reducing medication errors is for health care workers to be aware of a patient's medications, allergies, and any previously documented adverse drug events (ADEs). This study sought to determine the frequency of medication and allergy/ADE-related discrepancies in a family medicine residency clinic.* Methods: *Patients were contacted prior to appointments and asked to bring in prescription and over-the-counter medications. A research assistant interviewed 157 patients and recorded each drug a patient was taking, together with dosage, dosing frequency, known allergies, and demographic information. This information was then compared to similar information in the medical record.* Results: *Overall, 97% of patients had at least one discrepancy between medications listed in the medical record and medications they were taking, and 32% had an allergy/ADE discrepancy. Discrepancies were highest for women, those with cardiovascular disease, and those hospitalized within the last year. Only the total number of medications was predictive of a discrepancy, however, accounting for 25% of the variability.* Conclusions: *A higher medication discrepancy rate existed in this family medicine residency clinic than the 26%–76% rate that is documented in the literature. The results point to a need for better medication, allergy, and ADE awareness.*

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A 1999 Institute of Medicine (IOM) report raised both the medical community's and the public's awareness of the significance of medication errors, with estimates that such mistakes resulted in 7,000 deaths per year in the United States.[1] The focus of the IOM report, and of research and quality improvement efforts related to medication errors, has been on inpatient care. But, most patient care occurs in an outpatient setting, with 75% of office visits resulting in at least one prescription being given to patients.[2]

The number of medication errors in outpatient settings is uncertain but has been estimated to be 350,000 per year in the United States.[3] Others estimate that approximately 3.1%–6.2% of hospital admissions are due to adverse drug events (ADEs) that occur in the outpatient setting.[4] The cost of outpatient medication errors is unknown, but one study using a probability pathway estimated costs secondary to morbidity and mortality to be between $30.1 and $136.8 billion per year.[5] Errors can occur at multiple stages in the patient care process: prescribing of the medication by the health care provider, transcribing and filling the medication in the pharmacy, self-administration by the patient, or in the refill process.[6]

A first step in reducing medication errors is for health care workers to be aware of a patient's medications, allergies, and previously documented ADEs. A study based in a private practice found that 76% of patients' records had discrepancies related to medicines they were taking.[7] In another study, a discrepancy rate of 26% was reported at a residency training site, but only medication refills were examined in that study.[8] Better knowledge of the scope of medication disparity in residency training programs may lead to improvements in the systematic approach to communicating about medications, allergies, and previously experienced ADEs.

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The aims of this study were to determine the frequency of medication and allergy/ADE discrepancies documented in the medical record of patients receiving care in a family medicine residency training site by reviewing medication bottles and asking patients how they take their medications. In addition, patient characteristics potentially associated with medication and allergy/ADE discrepancy, including comorbidities, number of medications, recent hospitalization, age, gender, primary language and education, were collected to identify patients at high risk for discrepancies.

Methods

Participants and Procedures

After obtaining approval by the Institutional Review Board of East Tennessee State University, a research assistant recruited patients from a family medicine residency clinic site in southern Appalachia. The clinic serves primarily Caucasian patients of lower socioeconomic status who are enrolled in Medicaid. The clinic uses paper-based medical records.

During the period from February–June 2005, patients ages 18 years or older who had appointments scheduled at least 24 hours in advance and had at least one prior visit to the clinic were asked to participate. Over the 5-month study period a daily list of all patients scheduled for an office visit was retrieved from the scheduling system and cross-referenced for available telephone numbers. The day before their scheduled appointments, a research assistant attempted to call scheduled patients to remind them of their appointments and to attempt to secure their voluntary participation in the study. The research assistant had no information about the patients other than their name and phone number and stopped making phone calls when the patient list was exhausted or when the research assistant succeeded in securing enough participants to fill the assistant's available interview slots.

Each patient was asked to bring all current medications to the office visit, including prescription medication, over-the-counter (OTC) medications, and herbal supplements.

Due to difficulties recruiting patients by telephone, patients that were not contacted but brought all of their medications with them were also invited to participate. If patients agreed to sign the consent and HIPPA forms, the research assistant met with them in the exam room while they were waiting to see their physician.

Using a structured protocol, the patients were asked demographic questions: race, age, last hospitalization, primary language, insurance status, highest level of education, and presence of cardiovascular disease. Name of medication, dosage, and frequency directions were recorded from the label on each medication bottle. The research assistant also asked patients how they were taking each medication.

A copy of the patient's medication record as it appeared in the chart was copied and placed with the interview form for later review. Immediately after the interview, a copy of the revised medication list was given to the physician before he or she saw the patient for the visit.

Data Analysis

The medications, including dose and frequency of administration, allergies, and ADEs documented in the patients' charts were compared to the patients' self-reported information in conjunction with bottle review. One of the physician investigators (MS) and the pharmacy technician (JB) reviewed the data to determine the frequency of discrepancies. Any disagreement by the two reviewers was resolved by rereview of the medication list in the chart and the patient's self-reported information. Discrepancies were noted and categorized.

A medication discrepancy was defined as a medication listed in a patient's medical record that differed from the medications that the patient reported actually taking. A dosage or frequency discrepancy was defined as a difference between the actual dose or frequency of dosing and the information recorded in the medical record. An allergy discrepancy or ADE discrepancy was defined as a disagreement between known allergies or ADEs and the information documented in the medical record.

Descriptive statistics were compiled to examine the overall frequency of medication, allergy, and ADE discrepancies as recorded on the medical record. These data were then analyzed for relationships with the demographic data using multiple linear regression, independent *t* test, and one-way ANOVA.

Results

A total of 157 patients were interviewed. The majority of participants were female, Caucasian, enrolled in Medicaid, and had less than a high school education. The study sample patients were slightly older and were more often female than the overall patient population seen during the study period (Table 1). Patient interviews averaged 9.25 minutes, with a range of 2 to 25 minutes.

On average, patients were taking 8.44 prescription medications and 1.31 OTCs. Ninety-seven percent of patients had at least one discrepancy related to prescription medications, OTCs, dosage, or frequency (Table 2). These discrepancies included medications listed on the patients' medical records and not taken, as well as medications taken by the patients but not listed in the medical records. Patients had a mean of 2.39 prescription medications and 0.39 OTCs listed on their charts but not taken. Additionally, the patients took an average of 1.61 prescription medications and 0.93 OTCs that were not listed on their charts.

Women were found to have more OTC discrepancies (t=-3.55, P=.001), dosage discrepancies (t=-2.02, P=.045), and more overall medication discrepancies (t=-1.99, P=.049) than men. Patients with cardiovascular disease had more prescription discrepancies (t=-2.58, P=.011) and more overall medication discrepancies (t=-2.42, P=.017) than patients without cardiovascular disease. Finally, high school graduates had more OTC discrepancies than those who did not graduate from high school (t=-3.75, P<.001). A one-way ANOVA revealed differences in prescription medication discrepancies depending on last hospitalization (F=4.38, P=.001). Patients who had been hospitalized less than 1 year ago had significantly more prescription discrepancies than patients who had been hospitalized 2–5 years ago (P=.027), 5–10 years ago (P=.002), or over 10 years ago (P=.007).

The multiple regression model using age, gender, highest level of education achieved, the length of the interview, the presence of cardiovascular disease, the time since last hospitalization, and the total number of medications taken by the patient showed that the total number of medications taken was the only significant predictor of medication discrepancies (t=7.05, P<.001), accounting for 25% of the variability. No other variables were significantly related to the total medication discrepancies.

Table 1

Study Population Demographics

Variable	*Study Sample n=157*	*Clinic Population n=1,976*
Age		
Mean	55.43	48.43
Median	55	49
Range	63 (20–83)	78 (20–98)
Gender		
Male	41 (26.1%)	733 (37.1%)
Female	116 (73.9%)	1,243 (63.7%)
	Study Sample Only	
Variable	*n*	*Percent*
Education level		
Less than high school	83	52.9
High school	58	36.9
College	16	10.2
Race		
White/Caucasian	155	98.7
Non-white	2	1.3
Insurance status		
Insured	153	97.5
Medicaid/TennCare	131	85.6
Other	22	14.4
Uninsured	4	2.5
Primary physician seen		
Yes	114	75.0
No	38	25.0

Table 2

Characteristics of Medication/Allergy/ADE Discrepancies

	n	*Percent*	*Mean ± SD (Range)*
Medications brought by patient	157		
Prescription medications			8.44 ± 4.36 (0–22)
Over-the-counter medications			1.31 ± 2.11 (0–14)
Length of interview (minutes)	154		9.25 ± 4.37 (2–25)
Prescription discrepancies	140	89.2	4.02 ± 3.52 (0–17)
Over-the-counter discrepancies	87	55.4	1.31 ± 1.96 (0–14)
Dosage discrepancies	74	47.1	0.71 ± 0.91 (0–4)
Frequency discrepancies	49	31.2	0.48 ± 1.07 (0–10)
Any medication discrepancy	152	96.8	6.52 ± 4.43 (0–23)
Allergies/ADE discrepancies	50	31.8	0.51 ± 0.89 (0–4)

ADE—adverse drug event

Discussion

In this study in a family medicine residency clinic, we found that 97% of patients interviewed had at least one discrepancy related to prescription or OTC medications. The most significant predictor of medication discrepancies was the number of medications taken.

Compared to the two prior studies in the literature that cite discrepancy rates of 26%–76%, the rate of discrepancies found in this study was much higher.[7,8] Part of the reason may be due to methodological differences. We not only looked at all medication bottles but also asked patients how they were taking their medications. In comparison, one study focused only on medications being refilled,[8] and the other looked at medication bottles but did not ask patients how they were taking their medicines.[7] While there is no accepted standard for reviewing a patient's medications, evidence suggests that direct review of medication bottles with "prompted questioning" of patients or caregivers is the most accurate method.[9]

This study was conducted at a residency training site, which may also help explain the unusually high discrepancy rates. Compared to a private practice clinic setting, a residency training site involves both inexperienced and part-time practitioners. Thus, both discontinuity of care and level of postgraduate training may play a role. All physicians in the practice are expected to review their patient's medications at each visit and update the medication record, but there is no formal way this is monitored and no way to assure that it occurs. We hypothesize

that residents already struggling with time management and unfamiliar with brand and generic names may not take the time to update the medication lists. We also question if residents or faculty are less likely to update the list when "it's not my patient." While patients primarily assigned to faculty were included in the study, due to the size of the study, a difference between the groups may not have been detectable.

Another important factor may be that during the time this study was conducted, our major insurer, TennCare, was undergoing multiple formulary changes. As a result, substitutions were often made after patient visits in response to calls from pharmacies informing physicians a particular medication was no longer covered by TennCare and a substitution was required. No protocol was in place for physicians or staff to change the medication record in response to these calls that occurred both during and after office hours.

While we found associations between the number of medication discrepancies and patient characteristics, in a regression model, only the number of medications taken was predictive, explaining 25% of the variance. Although one of our aims was to find patient characteristics to identify those at higher risk, what emerged was evidence of increased medication use by patients as being the most important risk factor we could identify.

This problem is unlikely to be substantially reduced with the transition to electronic health records alone. While electronic records will eliminate the problem of interpreting poor handwriting in the medical record, studies suggest there is still a high rate of medication discrepancies.[3,8,10]

With the increasing demands placed on physician time, the argument has been made that clinical pharmacists should be more directly involved in patient care to help physicians improve their prescribing practices and that such a measure is cost-effective.[11,12] Interestingly, one study also found that pharmacists were more accurate than physicians when taking a patient's medication history.[12] While many medical schools and residency programs work closely with pharmacists in the clinical setting, linkage between residencies and pharmacists are not a requirement, and many programs do not have such linkages.

Limitations

Our study has several limitations. First, a volunteer sample was used for this study. Perhaps those patients who had concerns about their medication usage were more likely to agree to participate; this factor may have led to an overestimation of the discrepancy rate. Second, because of limited sample size, we were not able to discern whether there is a difference between the discrepancy rates of experienced faculty physicians and resident physicians at various levels of training. Finally, while the results reflect real findings of active patients, the results may not generalize fully to other residency training sites because of the proportion of Medicaid/TennCare patients in this study population.

Conclusions

There is a need to better define the scope of this problem within other family medicine training programs. If our results can be duplicated, then we need to develop systems to increase the accuracy of the documentation of medications, allergies, and ADEs, which likely include making regular structured medication review a part of daily practice. Consideration needs to be given to the cost and staff necessary to implement such a program given the time it takes to conduct interviews such as those undertaken in our study.

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