

Quality Improvement

Decreasing Medication Discrepancies Between Outpatient and Inpatient Care Through the Use of Computerized Pharmacy Data

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Abstract

Context: The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) instituted a new regulation in 2006 to improve patient safety by decreasing medication errors. This requires a process for obtaining and documenting a complete list of each patient's current medications at hospital admission and communicating this list to the next clinician ("Medication Reconciliation").

Objective: We sought to determine whether medication discrepancies between outpatient and inpatient care can be decreased through the use of computerized pharmacy data.

Method: We evaluated outpatient medication prescriptions in 2000 and 2004 using computer-generated data for patients admitted from an Emergency Department to a medical ward. The hospital records and pharmacy data were reviewed to determine which ambulatory medications were ordered at admission, continued as an outpatient, and refilled three months after discharge. In 2004 additional computerized pharmacy data were provided to attending physicians. Ambulatory care "essential prescription medication groups" (cardiac, chronic obstructive pulmonary disease, asthma, diabetes, and neurologic) were also evaluated. Medication discrepancies for the years 2000 and 2004 were compared in several categories.

Results: Medication discrepancies were found in all evaluated categories in 2000. The follow-up study showed a decrease in discrepancies for nearly all categories.

Conclusion: Results show that use of outpatient pharmacy data can decrease medication discrepancies in compliance with current JCAHO requirements.

Introduction

As noted in the Institute of Medicine report, *To Err is Human*, medication errors have been a major cause of morbidity and mortality in the United States. Studies of hospitalized patients have estimated that medication errors have caused approximately 40,000 deaths annually.¹ The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) issued a new regulation in 2006 intended to improve patient safety by decreasing medication errors. Called "Medication Reconciliation," it requires health care organizations to develop a process for obtaining and documenting a complete list of the patient's current medications at admission to the hospital and communicating this list to the next clinician.² The Kaiser Permanente (KP) Fontana Medical Center performed an initial medication discrepancy (medication error) study in 2000 and a follow-up study in 2004, prior to the JCAHO regulation of medication reconciliation. The goals were to show the scope of medication discrepancies and the improvements with use of computerized medication information. These studies were approved by the institutional review board of Kaiser Permanente Southern California.

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Methods

The Fontana Medical Center had 422 licensed beds during the study years. The major variable used for study of medication discrepancies was outpatient prescription medications. This was obtained from a computerized data system, the KP Patient Data System (KPDS), available to clinicians in the years 2000 and 2004. Hospital

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admissions from the Emergency Department (ED) to a specific general medical ward were reviewed to compare prescribed medications at admission with prior outpatient medications. Outpatient medical records were not reviewed for these studies. Ambulatory care “essential prescription medication groups” (cardiac, chronic obstructive pulmonary disease, asthma, diabetes, and neurologic) were also evaluated.

The follow-up study in 2004 provided admitting physicians with additional computerized pharmaceutical data. These were from an outpatient data system called Care Management System (CMS), which used KPDS pharmacy data (Figure 1). The hospital medical records were reviewed to determine which ambulatory medications were ordered at the time of admission, continued as discharge medications, and refilled three months after discharge. Nursing-home patients were excluded from this study. The term *medication discrepancies* was used rather than *medication errors* because outpatient medication records were not reviewed to determine whether a dosage or medication was changed. When these data were collected, 90% of KP patients used KP pharmacies for their outpatient medications. Only the hospital-discharged patient records that contained a CMS sheet were included for this study. The use of the com-

puterized CMS sheets was an option for the admitting and attending physicians. There were no preceding e-mailed instructions or in-service programs prior to availability of the CMS sheets in the ED.

Results

The data from the tabulations before and after providing CMS sheets (Table 1) show improvement in all categories: 1) admission orders, 2) discharge summaries, and 3) three-month prescription refills. The largest medication discrepancy noted was an omission of the patient's previous ambulatory medication. There were discrepancies in both essential and nonessential medications. Statistical evaluation of the data by the *z* test showed that *p* was < 0.05 for all categories tested except for admission orders of essential medications (Table 2). Figure 2 shows the improvements in graphic form.

Discussion

There are relatively few reports in the literature about medication discrepancies. Most studies were conducted by pharmacists and focused primarily on admission medication orders compared with previous outpatient

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Table 1. Medication discrepancy* percentages in 2000 and 2004

Category	2000 (KPDS only; n = 198 prescriptions)	2004 (KPDS and CMS; n = 212 prescriptions)	2000 “essential Rx”* (KPDS only; n = 88 prescriptions)	2004 “essential Rx”* (KPDS and CMS; n = 88 prescriptions)
Admission orders	38%	25% ^a	34%	22%
Discharge summary	50%	16% ^b	47%	20% ^b
Three-month prescription refills	53%	29% ^b	55%	19% ^b

^a *p* < 0.01.

^b *p* < 0.001.

* See text for definitions.

CMS = Care Management System; KPDS = Kaiser Permanente Patient Data System; Rx = prescriptions.

Table 2. Z-testing of differences between baseline and follow-up studies

All prescription medications				
	Baseline 2000 n = 198 prescriptions	With CMS sheet 2004 n = 212 prescriptions	Percentage difference	<i>p</i> value
Admission orders	38%	25%	13	0.006
Discharge summary	50%	16%	34	0.000
Three-month prescription refills	53%	29%	24	0.000
All essential medications				
	Baseline 2000 n = 88 prescriptions	With CMS sheet 2004 n = 86 prescriptions	Percentage difference	<i>p</i> value
Admission orders	34%	22%	12	<0.111 (NS)
Discharge summary	47%	20%	27	0.000

CMS = Care Management System; NS = not significant.

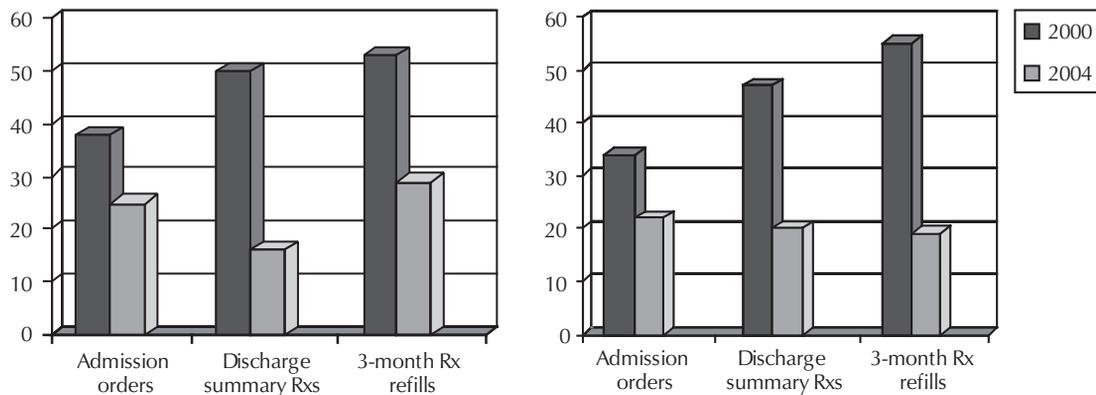


Figure 2. Percentage of medication discrepancies: all medication and essential medication

Left panel: percentages of outpatient medications in a computerized database (see text for description of Kaiser Permanente Patient Data System, or KPDS) prescribed at hospital admission, discharge, and three months (three-month prescription refills) after discharge. Lighter bars are percentages before availability of additional outpatient data (Care Management System, or CMS); darker bars are after the CMS was available. Right panel: similar data for "essential prescription medication groups" (see text for definition). Rx = prescription.

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medication. The admission medication discrepancy ranged from 11% to 46%.^{3,4} A report from the Kaiser Foundation Health Plan of Colorado⁵ focused on outpatient medication discrepancies (range, 14%–83%) and found that poor handwriting was the most frequent culprit. That report showed a higher readmission rate at 30 days for patients with medication discrepancies.⁵ A Dutch study used computerized outpatient pharmacy data similar to ours and showed that computerized outpatient pharmacy data were more accurate than physician-obtained medication histories.⁶

Conclusion

Our study demonstrates the value of providing pharmaceutical computerized data to clinicians to decrease medication discrepancies. The data supports the 2006 JCAHO regulations to decrease medication errors by using a medication reconciliation process. Having pharmaceutical data available to clinicians is not sufficient to improve medication discrepancies. The information should be printed and automatically provided to admitting and attending physicians. ♦

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References

1. Institute of Medicine, Committee on Quality of Health Care in America. Kohn LT, Corrigan JM, Donaldson MS, editors. To err is human: building a safer health system [monograph on the Internet]. Washington (DC): National Academic Press; 2000 [cited 2006 Dec 19]. Available from: www.nap.edu/openbook/0309068371/html/.
2. Joint Commission on Accreditation of Healthcare Organizations. 2005 National Patient Safety Goals [Web site on the Internet]. Oakbrook Terrace (IL): Joint Commission on Accreditation of Healthcare Organizations; 2005 [cited 2006 Dec 19]. Available from: www.jointcommission.org/GeneralPublic/NPSG/o6_gp_npsg.htm.
3. Badowski SA, Rosenbloom D, Dawson P. Clinical importance of pharmacist-obtained medication histories using a validated questionnaire. *Am J Hosp Pharm* 1984 Apr;41(4):731–2.
4. Cornish PL, Nowles SR, Marchesan R, et al. Unintended medication discrepancies at the time of hospital admission. *Arch Intern Med* 2005 Feb 28;165(4):424–9.
5. Coleman EA, Smith JD, Raha D, Min SJ. Posthospital medication discrepancies. *Arch Intern Med* 2005 Sep 12;165(16):1842–7.
6. Beers MH, Munekata M, Storrie M. The accuracy of medication histories in the hospital medication records of elderly persons. *J Am Geriatr Soc* 1990 Nov;38(11):1183–7.