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Reconciliation Failures Lead to Medication Errors

Poor communication of medical information at transition points of care has been cited as a cause of many medication errors. It is estimated that 46% of medication errors occur during the patient's admission to or discharge from a clinical unit and/or hospital.¹ Other studies have shown discrepancies in medication orders to be frequent and that as many as half of all hospital medication errors occur at the interfaces of care.^{2,3}

The Joint Commission on Accreditation of Healthcare Organizations, the Institute for Healthcare Improvement, the Massachusetts Coalition for the Prevention of Medical Errors, the Agency for Healthcare Research and Quality, and other organizations have developed varying but similar definitions for medication reconciliation that, in general, describe the activity as follows:

A process for obtaining and documenting a complete and accurate list of a patient's current medications upon admission and comparing this list to the physician's admission, transfer, and/or discharge orders to identify and resolve discrepancies.

Incorporating protocols and processes for reconciling medications at each intersection of a patient's care (that is, admission, transfer, and discharge) has shown to significantly reduce both medication errors and adverse drug events.^{3–5} In addition to the approaches taken by individual hospitals and health systems, a statewide patient safety initiative in Massachusetts was undertaken to specifically target medication reconciliation errors during admission. Details of this initiative, including practice recommendations, sample reconciling medication order forms, and implementation strategies have been recently published.⁶

Findings

Severity of Error in Terms of Patient Outcomes

In September 2004, the United States Pharmacopeia (USP) added three causes of error to its MEDMARX® program* to capture error events involving medication reconciliation failures. During an 11-month period (September 2004–July 2005), 2,022 medication errors that involved a reconciliation issue were reported to USP's MEDMARX® program. Approximately 22% (n = 456) of the reconciliation-related errors occurred during the patient's admission to the facility, 66% (n = 1,329) occurred during the patient's transition/ transfer to another level of care, and 12% (n = 237) occurred at the time of discharge.

The severity of an error submitted to the MEDMARX database is categorized according to the National Coordinating Council for Medication Error Reporting and Prevention category index.^{7,8} The index has nine categories from A through I. Categories B through D include errors that occur but do not cause harm, and categories E through I include harmful or fatal (category I) errors. Errors in categories G through I are sentinel events. For admission and transition reconciliation failures, a little more than 50% of the medication errors were intercepted before reaching the patient (category B; Table 1, below).

Table 1. Distribution of Reconciliation Errors by Error Category*

Error Category	Admission		Transition		Discharge	
	n	%	n	%	n	%
<i>Potential Error</i>						
A	22	5	29	2	8	3
<i>Intercepted Error</i>						
B	231	51	710	53	66	28
<i>Error Reaches Patient, No Harm</i>						
C	167	37	517	39	156	66
D	22	5	58	4	5	2
<i>Error, Harm</i>						
E	10	2	9	1	1	0.42
F	4	1	4	0.3	1	0.42
G	0	0	0	0	0	0
H	0	0	0	0	0	0
<i>Error, Death</i>						
I	0	0	2	0.15	0	0
Total	456	100%	1,329	100%	237	100%

* For complete error category definitions see National Coordinating Council for Medication Error Reporting and Prevention: *Types of Medication Errors*. <http://www.nccmerp.org/medErrorCatIndex.html> (last accessed Feb. 15, 2006).

In contrast, only 28% of discharge reconciliation errors were intercepted. The number of harmful errors (categories E–I) was greater for both admission (n = 14) and transition (n = 15) reconciliation failures. Two fatalities were associated with failures to reconcile medications during a patient’s transition from one level of care to another.

Types of Errors Associated with Reconciliation Failures

When examining the different types of error associated with all reconciliation failures combined (admission, transition, and discharge), just three error types—improper dose/quantity, omission error, and prescribing error—comprised 70% of all types of error selections. The highest percentage of prescribing errors (49%) occurred with admission reconciliation failures. Prescribing errors encompassed situations where the physician’s order was incorrect (for example, a physician writes admitting orders for a psychotropic agent, quetiapine fumarate [Seroquel 250mg], when the patient was actually on Seroquel 25mg at home). Improper dose/quantity and extra dose errors were most often identified with failures in reconciliation during the patient’s transfer to another level of care, and the highest percentage of omission errors (76%) was reported with discharge reconciliation failures (Table 2, below).

**Table 2. Types of Error
for Medication Reconciliation Failures***

Types of Error	Admission	Transition	Discharge
	%	%	%
Improper dose/quantity	55	73	62
Prescribing error	49	36	27
Omission error	35	36	76
Wrong drug	17	22	5
Wrong time	10	17	3
Extra dose	10	21	1
Wrong patient	5	4	0
Mislabeling	<1	3	2
Wrong administration technique	<1	1.4	0
Wrong dosage form	<1	2	0
Deteriorated product	<1	<1	<1
Prepared incorrectly	<1	1	0

* Based on 1,978 records associated with 4,208 selections.

Improper dose/quantity, extra dose, and wrong drug errors can also result from situations in which a patient's chronic medication, for example a nonsteroidal anti-inflammatory drug (NSAID), is switched to the facility's "formulary equivalent" during admission. On discharge, the patient is given a new prescription for the facility's preferred NSAID and unknowingly duplicates their treatment by taking both the "new" and previous NSAID products causing an adverse event.

Causes of Error Associated with Reconciliation Failures

When examining the causes of error associated with all reconciliation failures combined, performance deficit was cited in nearly 88% of the records (Table 3, below).

Table 3. Leading Causes of Error for Medication Reconciliation Failures

Causes of Error	Reconciliation Failures*		% MEDMARX Overall†
	<i>n</i>	%	
Performance deficit	1,610	87.9	41.9
Transcription inaccurate/omitted	1,542	84.2	11.4
Documentation	1,528	83.4	10.1
Communication	1,511	82.5	11.2
Workflow disruption	1,473	80.4	5.6
Monitoring inadequate/lacking	1,154	63.0	3.5
Written order	783	42.7	5.8
Computer entry	748	40.8	12.8
Policy/Procedure not followed	746	25.6	17.8
Information management system	469	22.4	0.7

* Based on 1,832 records and 14,601 selections for the 11-month period September 2004–July 2005.

† Based on 204,109 records and 371,797 selections submitted to MEDMARX for the 11-month period September 2004–July 2005.

Transcription inaccurate/omitted, documentation, and communication were also frequently reported causes of error. Compared with the larger MEDMARX data set, the percentages of the 10 most frequently reported causes of error are much greater for events involving reconciliation failures. This suggests that these leading causes (for example, performance deficit, transcription, documentation, communication) are more frequently associated with medication errors when reconciliation failures occur.

The largest percentage difference between a cause of error in a reconciliation-related event and the larger MEDMARX data set was with workflow disruption (80.4% versus 5.6% respectively). Workflow disruption involved situations where the caregiver was interrupted during the normal, established process of carrying out a task or when barriers were introduced preventing the caregiver from completing the task in a routine manner (for example, medication was not readily available for administration when needed).

Contributing Factors

Although error causes are directly linked to an error event, contributing factors are those situational, environmental, or organizational elements that “influence” the likelihood of an event to occur. Distractions, workload increase, and cross coverage were the three leading contributing factors associated with reconciliation errors (Table 4, below).

Table 4. Leading Contributing Factors for Medication Reconciliation Failures

Contributing Factor	n	%*	% MEDMARX Overall†
Distractions	1,479	83.0	25.1
Workload increase	1,466	82.3	14.9
Cross coverage	766	43.0	3.8
Imprint, identification failure	600	33.7	2.0
Patient transfer	159	8.9	2.6
None	147	8.2	47.6
No access to patient info	41	2.3	1.0
Emergency situation	38	2.1	1.7
Staffing, insufficient	34	1.9	4.3
Staffing, inexperienced	31	1.7	8.3

* Based on 1,782 records.

† Based on 88,667 records.

As a percentage, these three contributing factors, along with imprint (that is, addressograph) failures, were far more frequently associated with reconciliation errors when compared with the overall MEDMARX data set. These data suggest that reconciliation failures are more likely when these leading contributing factors are present.

Case Examples of Admission Reconciliation Failures

- A patient’s home medication was recorded as the hypertensive and heart failure agent, carvedilol (Coreg) 25 mg twice a day on the admission order sheet when the patient was actually only taking 6.25 mg twice a day at home. The patient received four doses of the excessive strength and developed leg edema. A leg ultrasound test was ordered to rule out deep vein thrombosis before the error was discovered.
- A nursing home patient was receiving propranolol 20 mg/5 mL for hypertension twice a day, but the admitting orders were written as propranolol 20 mg/mL give 5 mL (which equates to 100 mg) twice a day. The patient received five doses of the 100-mg strength before the error was discovered.
- A patient was admitted to a hospital from a home health care agency. The list of medications provided by the agency did not completely match the list provided by the patient’s family physician (for example, the antihypertensive agent metoprolol tartrate [Lopressor] was not listed by the agency as one of the medications that the patient was currently taking). Therefore, Lopressor was not initially ordered. The patient developed atrial fibrillation shortly after hospital admission and required a transfer to the intensive care unit. A cardizem (Diltiazem) infusion was started and the patient’s family physician became aware that the patient had not been receiving antihypertensive medication and initiated an order for the Lopressor.

Case Examples of Transition/Transfer Reconciliation Failures

- A patient who had a prior history of several arterial stent replacements was taking aspirin and the blood thinners enoxaparin and clopidogrel. These drugs were placed on hold for a surgical procedure to amputate one of the patient’s toes. Inadvertently, the three drugs were not reordered by the physician postoperatively, and two of the patient’s coronary arteries with stents later became 100% occluded and the patient died.
- A patient who was receiving two intravenous infusions (the blood-thinning agent eptifibatid and normal saline) was temporarily transferred to another service for a procedure. The patient returned to the original primary care unit when it was discovered that the intravenous infusion pump rates for the two products had been inadvertently switched.
- Before transfer from the intensive care unit to a stepdown unit, a patient received morning doses of scheduled medications. The administration of these same medications was incorrectly repeated soon after the patient arrived on the new unit because of unclear documentation and communication.

Case Examples of Discharge Reconciliation Failures

- Discharge orders listed the diabetes agent metformin (Glucophage) 500 mg, one tablet twice a day. A nurse transcribed the order as Glucophage 500 mg daily on the discharge instructions. A home health nurse used the discharge instructions to prepare the patient's medication dispensing box in the home. Several days later, the patient was readmitted to the hospital with a blood sugar level of 387, chest pain, shortness of breath, and atrial fibrillation with a rapid ventricular response. The patient was upset and told hospital staff that the "home health nurse changed my medications." The patient required sub-shock insulin to achieve normal blood glucose levels and was placed back on the twice-a-day dosing schedule.
- After being discharged, the patient returned to the emergency department several days later complaining of shortness of breath. Hospital staff found discharge prescriptions for antibiotics that were left in the chart and never given to the patient.
- A patient's primidone, a barbiturate for epilepsy, was discontinued during the patient's hospitalization and not renewed upon discharge to a skilled nursing facility. The patient later experienced three grand mal seizures while at the skilled nursing facility.

Suggestions for Improving Medication Reconciliation†

1. Develop a formal and systematic approach to reconciling a patient's medications across the continuum of care with multidisciplinary input and representatives from key organizational departments/services (for example, admitting department, emergency department, critical care areas, radiology, perioperative areas, general medical/surgical units, inpatient/outpatient pharmacy, risk management, quality improvement, and related ambulatory clinics).
2. Create policies and procedures that outline the roles, tasks, and steps in the reconciling process.
3. Adopt a standardized form for reconciling medications; place this form in a consistent, highly visible location within the patient's chart.
4. Assign responsibility for resolving variances in medication orders to someone with sufficient expertise. Establish a context for shared accountability; outline how, when, and where the ordering physician, nurse, and pharmacist work together on reconciliation issues.
5. Establish specified time frames within which medications should be reconciled.
6. Provide clinicians ready access to drug information and a pharmacist consult if and when needed.
7. Improve access to complete medication lists at the point of admission; improve outreach and contact information for community pharmacies, physician offices, ambulatory clinics, nursing homes, home health care agencies, assisted living centers, and hospitals.

A recent Joint Commission Sentinel Event Alert summarized the importance of medication reconciliation and provided suggestions for complying with the 2006 National Patient Safety Goal 8 related to this topic.⁹ Additional sources for medication reconciliation improvement strategies can be found at the following Web sites:

- Institute for Healthcare Improvement (<http://www.ihl.org>)
- Institute for Safe Medication Practices (<http://www.ismp.org>)
- Joint Commission (<http://www.jointcommission.org>)
- USP Personal Medication Organizer (<http://www.usp.org/pdf/EN/patientSafety/personalMedOrg.pdf>)

*MEDMARX is an Internet-accessible, voluntary medication error and adverse drug reaction reporting program that incorporates a nationally recognized taxonomy allowing subscribing hospitals and health systems to collect, analyze, and interpret adverse drug events and medication errors.

†Based on strategies published by the Massachusetts Coalition for the Prevention of Medical Errors available at <http://www.macoalition.org/initiatives.shtml> (last accessed Feb. 15, 2006).

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