National Patient Safety Goals

Reconciling Medications at Admission:

Safe Practice Recommendations and Implementation Strategies

Gina Rogers
Eric Alper, M.D.
Diane Brunelle, M.S., R.N., C.N.A.A.
Frank Federico, R.Ph.
Clark A. Fenn
Lucian L. Leape, M.D.
Leslie Kirle, M.P.H.
Nancy Ridley, M.S.
Brian R. Clarridge, Ph.D
Dragana Bolcic-Jankovic, M.A.
Paula Griswold, M.S.
Doris Hanna, R.N., C.P.N.P., Sc.D.
Catherine L. Annas, J.D.

Medication errors are one of the leading causes of injury to hospital patients, with approximately two out of every 100 patients admitted to the hospital experiencing a preventable adverse drug event (ADE).[1,2] Patient transition points are especially vulnerable to medication errors.[3] Disparities between the medications patients were taking before admission and those listed in their admission orders ranged from 30% to 70% in a recently published literature review.[4] Moreover, the vulnerability of patients postdischarge is highlighted by data indicating that more than 12% of patients experience an ADE within two weeks of discharge.[5]

The reconciling medications process (See Sidebar 1, page 38) is designed to prevent medication errors at patient transition points. It is a three-step process entailing (1) creating the most complete and accurate list possible of all pre-admission medications for each patient, (2) using that list when writing medication orders, and (3) comparing the list against the physician's admission, transfer, and/or discharge orders, identifying and bringing any discrepancies to the attention of the physician and, if appropriate, making changes to the orders.

Medication errors that can be prevented by adopting the process include inadvertent omission of needed pre-admission medications, failure to restart pre-admission medications following transfer and

Article-at-a-Glance

Background: Fifty hospitals collaborated in a patient safety initiative developed and implemented by the Massachusetts Coalition for the Prevention of Medical Errors and the Massachusetts Hospital Association.

Methods: A consensus group identified safe practices and suggested implementation strategies. Four collaborative learning sessions were offered, and teams monitored their progress and shared successful strategies and lessons learned. Reports from participating teams and an evaluation survey were then used to identify successful techniques for reconciling medications.

Results: For the 50 participating hospitals, implementation strategies most strongly correlated with success included active physician and nursing engagement, having an effective improvement team, using small tests of change, having an actively engaged senior administrator, and sending a team to multiple collaborative sessions.

Discussion: Adoption of the reconciling safe practices proved challenging. The process of writing medication orders at patient transfer points is complex. The hospitals' experiences demonstrated that implementing the proposed safe practices requires a team effort with leadership support and vigilant measurement.

Sidebar 1. Definition

Reconciling medications is a formal process for creating the most complete and accurate list possible of all pre-admission medications for each patient and comparing the physician's admission, transfer, and/or discharge orders against that list. Discrepancies are brought to the attention of the physician and, if appropriate, changes are made to the orders. Any resulting changes in orders are documented.

discharge, duplicate therapy at discharge (the result of brand/generic combinations or formulary substitutions), and errors of incorrect doses or dosage forms, including failures in identifying dosage changes made during the hospitalization.

The reconciling process has been demonstrated to be a powerful strategy to reduce these errors. At Luther Midelfort Hospital, a series of interventions introduced during a seven-month period successfully decreased the rate of medication errors by 70% and reduced adverse drug events by over 15%.[6] In another study, pharmacy technicians obtained medication histories for the scheduled surgical population, reducing potential adverse drug events by 80% within three months of implementation.[7] Another persuasive example of the impact of reconciling in the literature is the intensive care unit (ICU) experience at Johns Hopkins, where an average of 10 orders a week are being changed as a result of the vigilance provided by reconciling.[8] Other case studies show similar effects.[9,10]

A successful reconciling process also reduces work and rework associated with the management of medication orders.[3,7] This article reports on a statewide patient safety initiative to reduce medication errors that was jointly developed by the Massachusetts Coalition for the Prevention of Medical Errors, the Massachusetts Hospital Association (MHA), and the Massachusetts Department of Public Health (MDPH). The objective was to have hospitals throughout Massachusetts adopt a set of safe practices for reconciling medications, focusing initially on reconciling at admission. The program was modeled after the successful MHA *Medication Error Prevention Project*,[11] a statewide voluntary collaborative initiated in 1997 and completed in partnership with the Coalition, as well as subsequent Coalition/MHA patient safety partnerships.

The topic, which addresses a significant hazard encountered in everyday practice and requires solving fundamental issues of communication and teamwork at the interfaces of care, was selected by a multistakeholder advisory group convened in March 2002. A multidisciplinary Consensus Group, with representation from physicians, nurses, pharmacists, and patient safety and quality officers from a cross-section of hospitals, then identified a set of safe practice recommendations and accompanying implementation strategies. Given the complexities of the reconciling process, the Consensus Group limited the project's initial scope to reconciling medications at *admission*—the logical first step, given that reconciling at every stage requires having an accurate preadmission medication list to use in the verification process. This article therefore focuses primarily on the admission stage. However, reconciling at all transfer points is vitally important to patient safety, including the potential for errors with serious harm after discharge, when the patient will likely not be as closely supervised as in the hospital setting.

Leadership support for the project was developed by MHA and a statewide Reconciling Medications Collaborative was convened to promote adoption of the safe practices. Hospitals working on the project met together four times (April and September 2003 and January and October 2004). Participating teams tested implementation strategies, used common measures to monitor their progress, and shared successful strategies and lessons learned in team reports at the collaborative meetings and over a listserv, guided by expert faculty. This article draws on the experiences of participating teams and an evaluation survey to explore the most successful techniques for reconciling medications as well as aspects of a voluntary statewide collaborative.

Safe Practice Recommendations

The goal of the reconciling process at admission is to ensure that every hospitalized patient receives all the medications they have been taking preadmission unless they are specifically held or discontinued by their caregiver(s), and to ensure that they are ordered in the correct dose, route, and frequency. The Safe Practice

Table 1. Summary of Safe Practice Recommendations for Reconciling Medications at Admission*

Collect complete and accurate pre-admission medication lists

1. Collect a complete list of current medications (including dose and frequency) for each patient on admission.
2. Validate the pre-admission medication list with the patient (whenever possible).
3. Assign primary responsibility for collecting the pre-admission list to someone with sufficient expertise, within a context of shared accountability (the ordering prescriber, nurse, and pharmacist must work together to achieve accuracy).

Write accurate admission orders

4. Use the pre-admission medication list when writing orders.
5. Place the reconciling form (see Recommendation 8) in a consistent, highly visible location within the patient chart (easily accessible by clinicians writing orders).

Reconcile all variances

6. Assign responsibility for identifying and reconciling variances between the pre-admission medication list and new orders to someone with sufficient expertise.
7. Reconcile patient medications within specified time frames.

Provide continuing support and maintenance

8. Adopt a standardized form to use for collecting the pre-admission medication list and reconciling the variances (includes both electronic and paper-based forms).
9. Develop clear policies and procedures for each step in the reconciling process.
10. Provide access to drug information and pharmacist advice at each step in the reconciling process.
11. Improve access to complete medication lists at admission.
12. Provide orientation and ongoing education on procedures for reconciling medications to all healthcare providers.
13. Provide feedback and ongoing monitoring (within context of non-punitive learning from mistakes/near misses).

* Although the Safe Practice Recommendations provided here were developed focusing particularly on reconciling medications at admission, the same vigilance must occur at all critical transitions. The reconciling practices also offer significant safety benefits at patient handoffs on transfer between services and at discharge.

Recommendations, as summarized in Table 1 (above), identify key subpractices for each of the three steps in the reconciling process and for support and maintenance.

The foundations of the recommendations are core human factors principles that have been shown to reduce errors:

- Standardize processes
- Make errors more visible
- Build in independent redundancies
- Improve access to information
- Reduce reliance on memory

The hospital teams participating in the Reconciling Medications Collaborative undertook small tests of change to identify the best strategies for employing each of the subpractices at their own organizations. They focused on identifying the roles and responsibilities for all members of the care team as well as developing supporting structures to facilitate the process. Highlights of the lessons learned connected with each are provided.

Collect Complete and Accurate Pre-admission Medication Lists

1. Collect a complete list of current medications (including dose and frequency) for each patient on admission. The goal is to develop the most complete and accurate medication list possible, given available information, while recognizing that aiming to produce a perfect list for every patient is not possible and could diffuse caregivers' ability to focus on actually reconciling the orders against the pre-admission list.

Using a standardized reconciling form for collecting the pre-admission mediation list will help ensure that complete information is collected for each medication (see Recommendation 8 [above] and example in Figure 1 [pages 40–41]). It should include at least the dose (including dosage form and concentration when relevant), frequency, and time of last dose. Other important information generally obtained for each medication includes route,

Example: Reconciling Form That Doubles as an Order Form

UMassMemorial

PREADMISSION MEDICATION LIST VERIFICATION AND ORDER FORM
(Medication Reconciliation)

Allergies:

PATIENT NAME:

UNIT NUMBER:

LIST BELOW ALL OF THE PATIENT'S MEDICATIONS PRIOR TO ADMISSION INCLUDING OTC AND HERBAL MEDS
NEW MEDICATIONS OR MEDICATION CHANGES SHOULD BE WRITTEN ON ADMISSION ORDERS

Source of Medication list: (check all used)

- ❑ Patient medication list
- ❑ Patient/Family recall
- ❑ Pharmacy _____
- ❑ Primary care physician list / PCHIS
- ❑ Previous discharge paperwork
- ❑ Medication Administration Record from facility
- ❑ Other: _____

❑ **CHECK HERE IF THIS IS AN ADDENDUM TO OR REVISION OF PREVIOUSLY COMPLETED MEDICATION LIST**

MEDICATION HISTORY RECORDED/VERIFIED BY: _____
DATE RECORDED: _____

MEDICATION NAME (WRITE LEGIBLY)	DOSE (mg, mcg,)	ROUTE (PO, GT, SC, IV)	FREQUENCY	LAST DOSE DATE/TIME	*CIRCLE C to continue* OR *DC to discontinue* PHYSICIAN ORDER Continue on Admission	PHYSICIAN ORDER Continue on Transfer	COMPLETE on Discharge
1.					C DC	C DC	C DC
2.					C DC	C DC	C DC
3.					C DC	C DC	C DC
4.					C DC	C DC	C DC
5.					C DC	C DC	C DC
6.					C DC	C DC	C DC
7.					C DC	C DC	C DC
8.					C DC	C DC	C DC
9.					C DC	C DC	C DC
10.					C DC	C DC	C DC
11.					C DC	C DC	C DC
12.					C DC	C DC	C DC
13.					C DC	C DC	C DC
14.					C DC	C DC	C DC
15.					C DC	C DC	C DC

Do not scan or take off orders without MD/NP/PA signature

M.D. Signature:_____ ***Print Name:***_____

_____ ***Pager:***_____ ***Date/Time:***_____
Reviewed and Transcribed

Nurse Signature:_____ ***Date/Time:***_____

Scan to Pharmacy. File under Orders with the History and Physical.

Example: Reconciling Form That Doubles as an Order Form *(continued)*

UMassMemorial

Instructions for proper use:

Admission:

1. A nurse, mid-level provider, or physician should take as thorough a medication history as possible. Consultation with the primary care physician, pharmacy, and family members may be necessary to generate the most accurate medication list.
2. Upon admission, the physician/nurse practitioner/physician's assistant responsible for the patient should carefully consider whether to continue (C) or Discontinue (DC) each medication and circle the appropriate letters..
    a. For medications that require dosage changes, the medication should be discontinued on this form, and the new dosage should be written on the admission order sheet.
    b. For medications for which there exists a hospital therapeutic substitution, the medication should be discontinued and the new medication to be substituted should be ordered on the admission order form.
3. Upon completion, the provider should sign and date on the M.D. signature line. This is now treated as a physician's order. The form is scanned to pharmacy and filed in the Orders section of the chart.
4. The nurse confirms the history with the patient and confirms proper transcription to the written Medication Administration record (Kardex) and signs on the Nurse signature line.
5. Admission orders should indicate, "See reconciliation form." All new medications to be started on admission should appear on the admission order form. The History and Physical may indicate "See reconciliation form" in the Medications area.
6. If additional medication history is made available after the form has already been scanned to pharmacy, the medication history may be updated by completing a second reconciliation form noting the addition or changes, and checking the Addendum/Revision box.

Transfer/Discharge:

7. At transfer and discharge, this form should be reviewed together with the Medication Administration Record (Kardex). The provider should carefully consider whether each medication should be continued, resumed, or discontinued after the patient moves to another area within the hospital or is discharged. At transfer, all medications need to be reordered. At discharge, the provider should circle appropriate letter in the "Discharge" column and all medications and instructions should also be recorded on the discharge paperwork.

UMass Memorial Medical Center Prohibited Abbreviations List

Prohibited Abbreviation	Potential Problem	Preferred Term
U (for unit)	Mistaken as zero, four or cc.	Write "unit"
IU (for international unit)	Mistaken as IV (intravenous) or 10 (ten).	Write "international unit" or "unit"
Q.D., Q.O.D. (any form)	Mistaken for each other. The period after the Q can be mistaken for an "I" and the "O" can be mistaken for "I".	Write "daily" and "every other day"
Trailing zero (X.0 mg), Lack of leading zero (.X mg)	Decimal point is missed.	Never write a zero by itself after a decimal point (X mg), and always use a zero before a decimal point (0.X mg)
MS, MSO_4, MgSO4	Confused for one another.	Write "morphine sulfate" or "magnesium sulfate"
µg (for microgram)	Mistaken for mg (milligrams) resulting in one thousand-fold dosing overdose.	Write "mcg"
T.I.W. (for three times a week)	Mistaken for three times a day or twice weekly resulting in an overdose.	Write "3 times weekly" or "three times weekly"
A.S., A.D., A.U. O.S., O.D., O.U.	Mistaken for each other	Write: "left ear," "right ear" or "both ears;" "left eye," "right eye," or "both eyes"

Figure 1. *Use of a two-sided standardized reconciling form for collecting the pre-admission medication list will help ensure that complete information is collected for each medication. Reprinted by permission of the UMass Memorial Medical Center. The back side of the form also provides a list of campus and local pharmacies (with phone numbers). The full form can be found at http://www.macoalition.org/Initiatives/RMToolkit.shtml.*

Sidebar 2. Assigning Responsibility for Reconciling Medications

Safe Practice Recommendations 3 and 6 both call for assigning primary responsibility for specific steps in the reconciling process to someone *with sufficient expertise*, within a context of shared accountability.

For reconciling, final accountability rests with the ordering prescriber, yet supporting team members are integrally involved in the process, with clear roles and responsibilities. Hospitals have flexibility in determining what assignments work best in different units or under different circumstances, but there must always be a clear assignment of responsibility. In practice, hospitals have used a variety of strategies to clearly identify responsibilities. Some have created both primary and back-up assignments for completing the intake history on each unit, so the inpatient or emergency department nurse may, for example, be given primary responsibility, but the physician is the back-up, taking the history when no pre-admission medication list and no reconciling form is in the chart when the admission orders are to be written. In another example, the hospital used a nursing-centric approach for reconciling on most units, but relied on pharmacy to identify variances and reconcile the medications in the ICU.

When multiple physicians are engaged in a patient's care, final accountability still rests with the *ordering prescriber.* The attending of record has ultimate responsibility for ensuring there is a complete pre-admission medication list and that this list is reconciled against the admission orders. Surgeons, for example, will often need to consult a patient's medical specialists, but they remain responsible for ensuring that all the patient's pre-admission medications are appropriately addressed.

purpose/indication, compliance with prescribed doses and frequency, and source of the information.

The medication list should include all current prescription medications as well as any over-the-counter (OTC) medications, such as vitamins and herbal remedies. During the implementation phase, many hospitals focused first on getting accurate information on prescription medications and then later expanded the initiative to include OTCs.

Participating hospitals advised that this step is not completed at one point in time. Multiple sources (for example, patient, family, pill bottles, primary care physician (PCP), retail pharmacy) may need to be consulted, with questions about individual medications often needing to be resolved after the initial patient interview.

2. Validate the pre-admission medication list with the patient (whenever possible). Engaging patients and their families is essential in developing an accurate intake medication history. When patients cannot participate, their families should be asked to provide information. Having patients review and validate the pre-admission medication list, especially having them actually read over the list to review it for accuracy and completeness, is an important step. When many specialists are involved in a patient's care, often the patient is the only one with knowledge of their complete list or who knows about any compliance issues. A checklist of how patients can help was offered in a Wall Street Journal article,[12] and a number of advocacy groups offer resources to support consumer awareness of medication safety issues.*

3. Assign primary responsibility for collecting the pre-admission list to someone with sufficient expertise, within a context of shared accountability (the ordering prescriber, nurse, and pharmacist must work together to achieve accuracy). Providing explicit assignment of the responsibility for collecting the pre-admission medication list is key. Final accountability must rest with the ordering prescriber, but supporting team members are integrally involved in the process (Sidebar 2, left). For the Massachusetts hospital teams, nursing has primarily been assigned responsibility for starting the reconciling process by initiating the patient's medication history on the reconciling form (see detailed survey results on the characteristics of participating teams' reconciling implementations at http://www.macoalition.org). However, many hospitals

* See, for example, the "Speak Up" campaign materials offered by the Joint Commission (www.jcaho.org), "*Educate Before You Medicate*" and related consumer-oriented materials from the National Council on Patient Information and Education (http://www.talkaboutrx.org), and consumer safety tips from the Agency for Healthcare Research and Quality (http://www.ahrq.gov/consumer).

also report that physicians start the process at least some of the time. Active physician engagement in validating the pre-admission list, especially doses and complex medication regimens, is an important part of the strategy.

Having pharmacy complete the intake medication history has been shown to improve accuracy, and adding pharmacy-technician hours to help with the process has been demonstrated to be cost-effective.[7,13] In Massachusetts, however, primary responsibility is only infrequently assigned to the pharmacist. Twelve survey respondents noted that their hospitals had established guidelines for pharmacy consults (including criteria such as high-risk medications or > ten medications, complex patients [for example, chronic renal failure], and incomplete medication histories or questionable doses).

Hospitals have identified successful strategies to assign clear lines of accountability for reconciling that include assigning back-up responsibilities that ensure their care teams work together, such as (1) leveraging the pre-admission testing (PAT) process, (2) having pharmacists available to follow up on any incomplete medication histories, and (3) having physicians start the process when there is no reconciling form in the chart. In all cases, however, hospitals need to ensure accountability for completing the process. Most hospitals include a place for verifier initials or signatures or some other indication of who the historian was on their reconciling form.

Write Accurate Admission Orders

4. Use the pre-admission medication list when writing orders. The recommendation to use the pre-admission list when the admission (and transfer and discharge) orders are written avoids reliance on memory and significantly reduces inadvertent omission of any pre-admission medications and dosing discrepancies. Timing considerations can pose a barrier to realizing this recommendation. An evaluation of workflow patterns is essential to ensure that the pre-admission medication list is available to the ordering prescriber when and where the admission orders are written. Coordinating communication when the pre-admission list is being developed in geographically separate locations (for example, as part of PAT, or in the emergency department [ED]) or when the ordering prescriber is not onsite can add complexities to the problem.

Using the reconciling form as a medication order sheet, as six Massachusetts hospitals have done, offers one strategy for ensuring that this safe practice recommendation is met. Some of the issues connected with the process are highlighted in Sidebar 3 (page 44).

5. Place the reconciling form in a consistent, highly visible location within the patient chart (easily accessible by clinicians writing orders). Adopt a strategy that will reinforce the process of having the nurse and the prescriber reconcile all medication variances by having the reconciling form always in the same place, in a highly visible location. To ensure that the reconciling form is easily accessible when the orders are written, hospitals need to identify the most common place ordering prescribers reference (e.g., first page of doctor's progress notes, first sheet in the chart, stapled on top of the chart). Using a special color for the form is also helpful; hospitals report strong recognition of "that yellow form," for example, reinforcing its use.

Reconcile All Variances

6. Assign responsibility for identifying and reconciling variances between the pre-admission medication list and new orders to someone with sufficient expertise. Completing the reconciling process involves comparing the admission orders to the pre-admission medication list, identifying any variances, and then resolving those variances. The discussion provided under recommendation 3 relative to assigning responsibility again applies. There must be clear accountability regarding who is responsible for reconciling variances to ensure that this step is consistently completed, but a variety of assignments have been found to work effectively.

For Massachusetts hospitals, primary responsibility for comparing the patient's medication history to the admit orders and reconciling differences essentially matched the distribution reported for collecting the pre-admission medication history. Nursing had primary responsibility for 59% of respondents and physicians for 24%. However, 10% of respondents explicitly noted that responsibilities were being shared between the two disciplines.

Sidebar 3. Using the Reconciling Form as an Order Sheet

Using the reconciling form as a medication order sheet ensures that the ordering prescriber reads the pre-admission list when writing orders and eliminates transcription errors from rewriting pre-admission medications onto an order sheet. It also creates significant efficiencies for the ordering prescribers, who find it a time-saving process.

Careful implementation planning is required. Physician buy-in is crucial, and the reconciling process should first be introduced, with multiple tests to ensure that the reconciling process steps and the reconciling form's format work. A positive initial experience with the reconciling process helps gain physician approval for using the reconciling form as an order sheet.

Preprinted multiple-copy forms can be used, with, for example, one copy sent to the pharmacy, one placed in the highly-visible location within the patient chart identified as the best location for the reconciling form, and an additional copy for the physician order section.

Using the reconciling form as an order sheet heightens the importance of collecting an accurate list. The reconciling form must have appropriate signature lines, and the ordering prescriber must consistently sign the form. An addendum page must also be developed to use when additional pre-admission medications are identified. Education of physicians is key, especially to ensure that the medication list on the reconciling sheet retains its validity as the pre-admission list.

Any medications to be ordered that are not on the pre-admission list are written on a regular order sheet, as are any medications where the new orders will not match the pre-admission medication exactly (e.g., different doses, formulary substitutions). A back-up plan must be in place for situations when the physician writes admission orders without using the form.

When the ordering prescriber uses the reconciling form as an order sheet, by definition the pre-admission medications should all have been addressed in the process, either continued or consciously changed, held, or discontinued. However, an independent verification of appropriate reconciliation is an important final safety step.

It is worth repeating that, whatever assignments are made on a given unit, all members of the care team play a role in promoting medication safety, with *final accountability* for ensuring that complete, accurate, and reconciled medication orders are written resting with the *ordering prescriber*.

7. Reconcile patient medications within specified time frames. Most hospitals have established 24 hours as their acceptable time standard for reconciling differences between the pre-admission medication list and the admit orders. Most also include a shorter time frame for high-risk variances, such as inadvertent omissions of critical medications and potentially serious dosage discrepancies with upcoming administration times, specifying "before next therapeutically prescribed dose is due" for those situations.

The hospitals developed clear procedures for contacting the ordering prescriber when a variance is identified, specifying when to stat page the prescriber and when to wait for morning rounds (e.g., no after-hours calls for OTC or other noncritical medications). They also recognized the need to include strategies for handing off any unreconciled medications at shift change.

Provide Continuing Support and Maintenance

8. Adopt a standardized form to use for collecting the pre-admission medication list and reconciling the variances (includes both electronic and paper-based forms). The Reconciling Medications Collaborative strongly promoted the use of a standardized form for reconciling patients' medications. The form consolidates information about a patient's medications that is often dispersed throughout their record and provides a highly visible way to track the status of the reconciliation of each medication.

The reconciling form should have one set of columns for capturing information on the patient's pre-admission medications (dose, frequency, and so on). A set of columns should make the reconciling status of each pre-admission medication highly visible; for example, (1) medication ordered on admission (Y/N), and if not, then (2) ordering prescriber contacted (Y/N) and (3) result of MD contact (some indication of how any variances were resolved). This allows for easy reference at shift change to identify any unreconciled

medications and facilitates data collection, making it easy to tabulate unreconciled medications during a chart abstraction process later on.

The amount of detail and the kinds of supporting information hospitals have included on their reconciling forms varies widely. Checklists for capturing OTCs and herbals, coding for indicating disposition of each pre-admission medication while the patient is in the hospital (for example, continue, hold, discontinue, change, formulary substitution), and indicating the source of the medication history have all been found useful. In addition, reference materials such as lists of local pharmacy phone numbers, the organization's do-not-use abbreviation lists, and sample patient interview questions to promote completeness, as well as instructions for filling out the form are often included on the back. Figure 1 provides an example of a reconciling form that is also used as an order sheet.

9. Develop clear policies and procedures for each step in the reconciling process. Hospitals need to back their new practices with clearly written policies that identify responsibilities for each reconciling step. These policies should cover special situations that arise, such as specifying when to call or stat page a physician to review discrepancies, back-up procedures when the ordering physician is unavailable or for evening/weekend admissions, the process for nurses to pass off non-reconciled meds at shift change for follow-up by next shift, and high-risk situations meriting pharmacy or specialist consultations.

10. Provide access to drug information and pharmacist advice at each step in the reconciling process. Pharmacist involvement in taking the medication history and completing reconciling provides direct pharmacist input to the reconciling process. Ensuring that pharmacy expertise is available 24 hours a day as a resource for clinical personnel (for example, through on-call arrangements such as a pharmacist hotline and satellite pharmacy agreements) is also a safety prerequisite. Having pharmacists participate in clinical rounds with doctors and nurses has demonstrated medication safety benefits; discussions related to reconciling medications can easily be integrated into the rounds. In addition, access to up-to-date resources on new drugs, infrequently used drugs, and non-formulary drugs must be readily available to clinicians at the time when they write orders.

11. Improve access to complete medication lists at admission. Many hospitals have developed medication card campaigns to promote patients carrying up-to-date medication lists. For planned admissions, advising patients to bring a home medication list (along with their insurance card) and using the PAT process to collect the list can promote accuracy and efficiency. Outreach in the community, working through senior centers and disease-specific support groups to offer brown-bag sessions and "File-of-Life" programs can also contribute.

Outreach to ambulatory clinics, primary care physician offices, local skilled nursing facilities, and home care providers has been invaluable. Teams have developed a medication list format for those organizations to use when sending patients to the hospital which closely parallels the hospital's reconciling form. Facilitating pharmacy-to-pharmacy fax transmission of medication regimens at the time of admission has also helped. Ultimately, interconnected electronic patient records that include a complete medication list will substantially shorten the time it takes to reconcile medications in the future. Some hospitals are already able to access their ambulatory clinic data. A Massachusetts pilot project that delivers patient prescription medication history from the pharmacy benefit program databases of multiple health plans to ED physicians also marks an important foray in this arena.[14]

It must be noted, however, that efforts to improve access to medication histories at admission can become quite time-consuming and can divert attention from the focus required on reconciling medications while the patient is in the hospital. Such initiatives should rely on people other than those engaged in actually reconciling, so as not to diffuse the core implementation efforts.

12. Provide orientation and ongoing education. Ensuring that all staff are aware of the important safety tenets underlying the reconciling principles and that they understand how the process will be undertaken at your organization requires consistent education for all caregivers. Hospitals have offered special programs for nursing, pharmacy, and clinical staff separately, as well as offering education through multidisciplinary rounds that bring all members of the team together.

13. Provide feedback and ongoing monitoring. Collecting and using data to ensure that the reconciling practices are consistently followed is fundamental to successfully implementing and then consistently following the reconciling safe practices. The Implementation Strategies section below describes strategies for both staff education and measurement.

Implementation Strategies

Hospitals participating in the Massachusetts Reconciling Medications Collaborative shared their insights on successful strategies and key lessons learned as they worked to implement the safe practice recommendations. Key highlights of their implementation efforts, as provided in the evaluation survey results posted at http://www.macoalition.org, follow.

Leadership Support

Examples of the ways leadership support can be demonstrated included the following:

- Clearly express leadership's goals for the organization, providing both a measurable performance goal and a time frame (e.g., reduce the rate of unreconciled medications at admission by 75% within nine months).
- Appoint an executive sponsor for the safety team, who can represent the CEO in facilitating implementation.
- Provide adequate resources for the effort: allocate sufficient time for team members to work on testing and reflect on the results of those tests, relieving some of their other responsibilities during the testing phase, and make clear assignment for the ongoing data collection effort.
- Review the team's monthly data and timeline regularly; make the initiative part of ongoing quality and safety reporting to leadership, including board-level quality improvement committees and ask about it on executive walkarounds.
- Remove barriers where possible; develop support from groups including information technology, medical records, and staff education, and eliminate need for forms committee approvals during testing.

Implementation Team

Because teamwork and communication lie at the root of a successful reconciling initiative, implementation needs to be directed by a multidisciplinary team. The team should include clinical leadership from all three key stakeholder groups (physicians, nursing, and pharmacy), front-line caregivers, and representatives from patient safety/quality improvement and administration (the executive sponsor). The core reconciling team also needs to be bolstered by mini-teams on each unit where reconciling is being tested; failure to include an active role for the nurse managers on each implementation unit can significantly impede progress.

In our experience, teams led by pharmacy alone struggled more than other teams. Much of reconciling relies on changing nursing and physician workflow patterns, activities that pharmacy generally lacks the power to affect.

Teams shared a range of strategies for involving physicians in the project. Personal appeals from the vice president of medical affairs and/or chiefs of services were important in setting the stage, including citing examples of errors experienced at the organization and as reported in the literature that could have been prevented by reconciling. Getting key clinicians engaged to help lead the project or simply help with the first tests was also important; just asking for physician input on how to design and enhance the reconciling form was found to increase their buy-in to the project. Seeking physician input via "hallway consultations" rather than asking them to attend meetings was well received. One hospital engaged their hospitalists, then identified "ambassadors" from that group who educated others.

Model for Improvement

Participating hospitals were encouraged to use the PDSA (Plan-Do-Study-Act) Model for Improvement,[15] which builds on small tests of change to identify and refine specific implementation approaches that really work at one's own organization. Hospitals noted that the most important thing was to stay focused, start small, and test each step of the process:

- Start with one or two nurses, one patient/one ordering physician, on one unit.
- Test how the reconciling process can be integrated most effectively with current work processes.
- Use an existing reconciling form as a starting point (examples are available at http://www.macoalition.org) and then enhance it based on input from your tests.

- Thoroughly test forms in paper format before automating (Sidebar 4, page 48).
- Don't move too fast to spread change to other areas; ensure that a smooth process is in place on the pilot unit first.

Where to Start

Many organizations participating in the collaborative started with admission of surgery patients, where they could take advantage of the PAT process to develop an accurate pre-admission medication list. Other hospitals chose pilot units that leveraged the expertise of their hospitalists and residents. Although most hospitals started reconciling with the admission phase, several began work in the ICU, bolstered by the experience from Johns Hopkins.[8]

The least successful attempts were experienced by hospitals undertaking early work in the ED. Teams experienced significant resistance, given the need to coordinate responsibilities between the ED and the receiving inpatient unit and also the fact that not all patients will be admitted.

Data Feedback

The Collaborative selected the percent of medications unreconciled* as the core evaluation measure for this project, with teams reviewing 20 charts a month to gauge their progress. Hospitals also captured specific evidence of incidents where the reconciling practices prevented potential medication errors. One hospital created a "*Great Catches*" log—a monthly report listing potential errors identified during the reconciling process, with a description and comments on how it was discovered or intercepted.

Many teams had difficulty collecting and using data effectively and ensuring that the data were regularly shared with leadership. The collaborative provided tools such as clearly defined data definitions and spreadsheets for recording data and automatically generating charts, but resource constraints often resulted in this task getting pushed to the back burner.

* Complete specification of the "*Percent Medications Unreconciled*" core evaluation measure, along with instructions and data collection spreadsheets, are available at http://www.macoalition.org/Initiatives/RMmeasurement.shtml.

Staff Education

During the implementation phase, educating all caregivers about the new process must be a vital component of the implementation plan. Participating Massachusetts hospital teams shared the following insights about activities:

- Hands-on works best; educate by having staff participate in small tests of change.
- Engage front-line staff in collecting the baseline data to convey a sense of urgency behind the need for safer practice.
- Use a physician champion to get the message out to other clinicians.
- Be sure the focus of the education is teaching the process, not just how to fill out the form.
- Identify a designated "expert" available to answer questions from staff.
- Work to build reconciling into standard practice; then reconciling will not be a special topic in either new employee orientation or competency training, but will become part of day-to-day activity.

Summary of Implementation Insights

Teams participating in the Massachusetts Reconciling Medications Collaborative highlighted the following ingredients for success:

1. *Leadership support:* Administrative leadership must be actively engaged, providing expected process goals for reconciling medications and removing barriers.
2. *Multidisciplinary team:* Obtain strong representation from the leadership of the three key stakeholder groups—physicians, nursing, and pharmacy.
3. *Data feedback:* Use data and examples of errors to motivate change and to measure whether changes are leading to improvement.
4. *Start small:* Stay focused, use small tests of the reconciling process to identify what strategies work best at your organization.
5. *Embed into existing workflow:* Make reconciling part of your admission process for every patient.
6. *Don't let perfection be the enemy of the good:* Don't let a focus on getting the perfect medication list keep you from getting to the reconciling step.

Sidebar 4. Automating the Reconciling Process

Automation issues have posed significant challenges to hospitals implementing the reconciling practices, particularly at organizations that are already highly automated. Teams that focused all their efforts on an electronic solution had significantly slower implementation paths, and many missed the opportunity to tackle the parts of the reconciling process that cannot be automated while they were waiting for their technology staff to produce the enhancements. Collecting and verifying medication histories generally necessitates accessing information from multiple sources and requires hands-on vigilance that cannot easily be automated.

The complexity of the reconciling process, which must interface with physician, nursing, and pharmacy activities across the continuum of care, makes the task of automating it particularly difficult. Many hospitals' initial automation attempts met with failure, primarily because their automated nursing assessment modules could not easily integrate with information from other areas, such as their computerized physician order entry (CPOE), medication administration record (MAR), and outpatient clinic data systems. Smaller-scale automation projects (simple report-generators or scanning utilities) generated some important benefits. In addition, enhancements to CPOE have included adding triggers, such as indications when a medication has been held and therefore should be considered for restart and specifically identifying therapeutic interchanges and formulary substitutions to help prevent doubling-up at discharge. Recently, several hospitals have also been investigating ways to print the most recent medications from an on-line MAR onto discharge order sheets to support reconciling on discharge.

As with any automation activity, careful planning is required to avoid potential unintended consequences. Hospitals reported struggling to establish rules for identifying who would be allowed to add and modify the information. Automated solutions that created checklists at transfer that defaulted to continuing medications rather than requiring specific action for each one increased the potential for error.

Adequate testing of the reconciling process is crucial before moving to automation. For a reconciling implementation in the intensive care unit (ICU) at Johns Hopkins, the paper forms were not converted to electronic forms integrated into the ICU's electronic information system until 48 weeks into the process.*

* Pronovost P., et. al.: Medication reconciliation: A practical tool to reduce the risk of medication errors. *J Crit Care* 18:201–205, Dec. 2003.

Results from the Massachusetts Collaborative

The 50 Massachusetts acute care hospitals participating in the Reconciling Medications Collaborative represented more than three-fourths of all Massachusetts hospitals. Their baseline risk assessments highlighted the incomplete and fragmented recording of patient's pre-admission medications in patient charts and the absence of a systematic process to check them against the admit orders. The percent of medications unreconciled averaged 59% for the 20 hospitals submitting baseline data.

Although there was a wide range in team progress in adopting the reconciling practices, approximately 20% of the hospitals demonstrated success in spreading the practices throughout most of their organization within the 18-month time period, and 64% reported on the survey that they did have a standardized reconciling form in use.

Three hospitals that used consistent data definitions and provided data throughout the collaborative recorded reductions in the percent of medications unreconciled, averaging 85% within a 10-month timeframe.

Some selected examples where the reconciling process successfully prevented medication errors follow:

- Admitting physician omitted digoxin order, which was caught because digoxin was on the patient's pre-admission list.
- A missing thyroid medication was picked up on a complex postoperative patient.
- Identified several orders confusing sustained-release and immediate-release formulations.
- Avoided duplication of inhalers at discharge.

Resource Requirements

Most hospitals reported using existing resources to complete the work on reconciling. Direct expenditures were limited to printing forms; information technology expenditures and the costs of medication-card campaigns were also incurred by a few hospitals. Still, implementing the reconciling process was time consuming for existing staff, given the complexity of the process, involving multiple caregivers at multiple points during the inpatient stay. Downstream efficiencies do emerge by eliminating duplication of efforts to collect the medication history.

Successful Implementation Strategies

The survey of hospital teams revealed that having active physician engagement was an implementation strategy strongly associated with hospital team progress, as were an effective implementation team, active nurse involvement, using small tests of change during the implementation process, and an actively engaged senior administrator. Finally, teams that sent more members to collaborative learning sessions were more successful.

Discussion

This study offered an important opportunity to investigate the critical success factors for reconciling medications. The barriers identified and lessons learned provide important guidance into the difficult task of effecting system change aimed at improving coordination among caregivers. Leadership support, vigilant measurement, and a focused implementation process that leverages small tests of change are all required for success. Yet even successful teams struggled to sustain their reconciling activities over time, demonstrating the need for better strategies for integrating the standardized reconciling process into workflow patterns and ongoing measurement that is consistently reviewed by leadership.

Our results highlight the importance of developing future initiatives across the continuum of care. Strategies to improve the accuracy and availability of patients' medication lists at admission, which may involve outreach with primary care physicians or interoperable electronic medical records, will greatly improve the success of reconciling programs.

Similarly, given the evidence on the number and seriousness of adverse drug events occurring in the first two to four weeks following discharge, activities to support reconciling medications at discharge are also vitally important. Strategies to promote patient education such as providing instructions at reasonable reading levels and clear communication of what medications not to take, although outside the scope of this project, are essential to successfully ensuring patient safety.

Reconciling of medications must also be carried over to the next level of care. After the discharge medication list is provided to the patient and to the next site of care, there is a continuing need to update and reconcile the list, as the patient receives care at rehabilitation or skilled nursing facilities and during future visits to the primary care physician and specialists.

Finally, it is crucial to recognize that the adoption of safety practices that require system change, such as the reconciling practices, takes time. The process for writing medication orders at the interfaces of care is complex. Standardizing processes is difficult and requires effective teamwork, communication, and care coordination. Sustained cooperative effort is needed for success, but the rewards in safety for our patients are great. J

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Gina Rogers is Consultant, Massachusetts Coalition for the Prevention of Medical Errors, Burlington, Massachusetts. **Eric Alper, M.D.,** is Hospitalist and Patient Safety Officer, UMass Memorial Medical Center, Worcester, Massachusetts. **Diane Brunelle, M.S., R.N., C.N.A.A.,** is Emergency Department Nurse Manager, Franklin Medical Center, Franklin, Massachusetts. **Frank Federico, R.Ph.,** formerly Loss Prevention/Patient Safety Specialist, Risk Management Foundation, Cambridge, Massachusetts, is Director, Institute for Healthcare Improvement, Cambridge. **Clark A. Fenn** is Vice President, Inpatient Services, Holyoke Medical Center, Holyoke, Massachusetts. **Lucian L. Leape, M.D.,** is Adjunct Professor of Health Policy, Harvard School of Public Health, Boston. **Leslie Kirle, M.P.H.,** is Senior Director, Clinical Policy and Patient Advocacy, Massachusetts Hospital Association, Burlington. **Nancy Ridley, M.S.,** is Associate Commissioner, Massachusetts Department of Public Health, Boston. **Brian R. Clarridge, Ph.D.,** is Senior Research Fellow, Center for Survey Research, University of Massachusetts Boston. **Dragana Bolcic-Jankovic, M.A.,** is Assistant Study Director, Center for Survey Research, University of Massachusetts Boston. **Paula Griswold, M.S.,** is Executive Director, Massachusetts Coalition for the Prevention of Medical Errors. **Doris Hanna, R.N., C.P.N.P., Sc.D.,** formerly Consultant, Massachusetts Coalition for the Prevention of Medical Errors, is Director, The National Initiative for Children's Healthcare Quality, Boston. **Catherine L. Annas, J.D.,** is Director of Patient Safety, Massachusetts Department of Public Health. Please address reprint requests to Gina Rogers, gina-rogers@comcast.net.

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