

Medication Reconciliation in the Hospital

WHAT, WHY, WHERE, WHEN, WHO AND HOW?

Olavo Fernandes and Kaveh G. Shojania

Abstract

Medication reconciliation arose as the solution to the well-documented patient safety problem of unintentionally introducing changes in patients' medication regimens due to incomplete or inaccurate medication information at transitions in care. Unfortunately, medication reconciliation has often been misperceived as a superficial administrative accounting task with a "pre-occupation with completing forms," resulting in the implementation of ineffective processes. In this article, the authors briefly review the evidence supporting medication reconciliation but focus more on key practical questions regarding the elements of an effective medication reconciliation process: *what* it should consist of, *where* and *when* it should occur, *who* should carry it out and *how* hospitals should implement it. The authors take the *why* of medication reconciliation to consist not just of the professional obligation to avoid causing harm, but also of a rational self-interest on the part of healthcare leaders. The authors argue that, rather than wasting time implementing a nominal reconciliation process, we should invest time and energy in a more robust and effective strategy, and they address specific practical questions that arise in such an effort.

At the monthly management meeting of a large urban hospital, the head of patient safety announces: "We had a critical incident last week. A patient was readmitted two days after discharge with severe hypoglycemia. The treating team discharged the patient on a new insulin regimen without realizing that the patient also had insulin 30/70 at home. The patient continued to take her previous regimen as well as the new one, and was found unresponsive by her husband. She's in the ICU and probably will have permanent neurological deficits." After various sighs and exclamations from the executives around the table, the chief medical officer asks, incredulously, "Why didn't this get picked up by medication reconciliation?" Before anyone can answer, the executive adds: "We had that other case six months ago in which a patient was discharged without restarting his Coumadin, and he ended up having a stroke. We implemented medication reconciliation last year: why is this still happening?"

The answer to this executive's question is that care transitions represent such an error-prone process that, even with robust medication reconciliation, catastrophic cases such as these can still occur. Moreover, the vast majority of hospitals do not have a robust medication reconciliation process in place, so these events can continue to occur with considerable frequency.

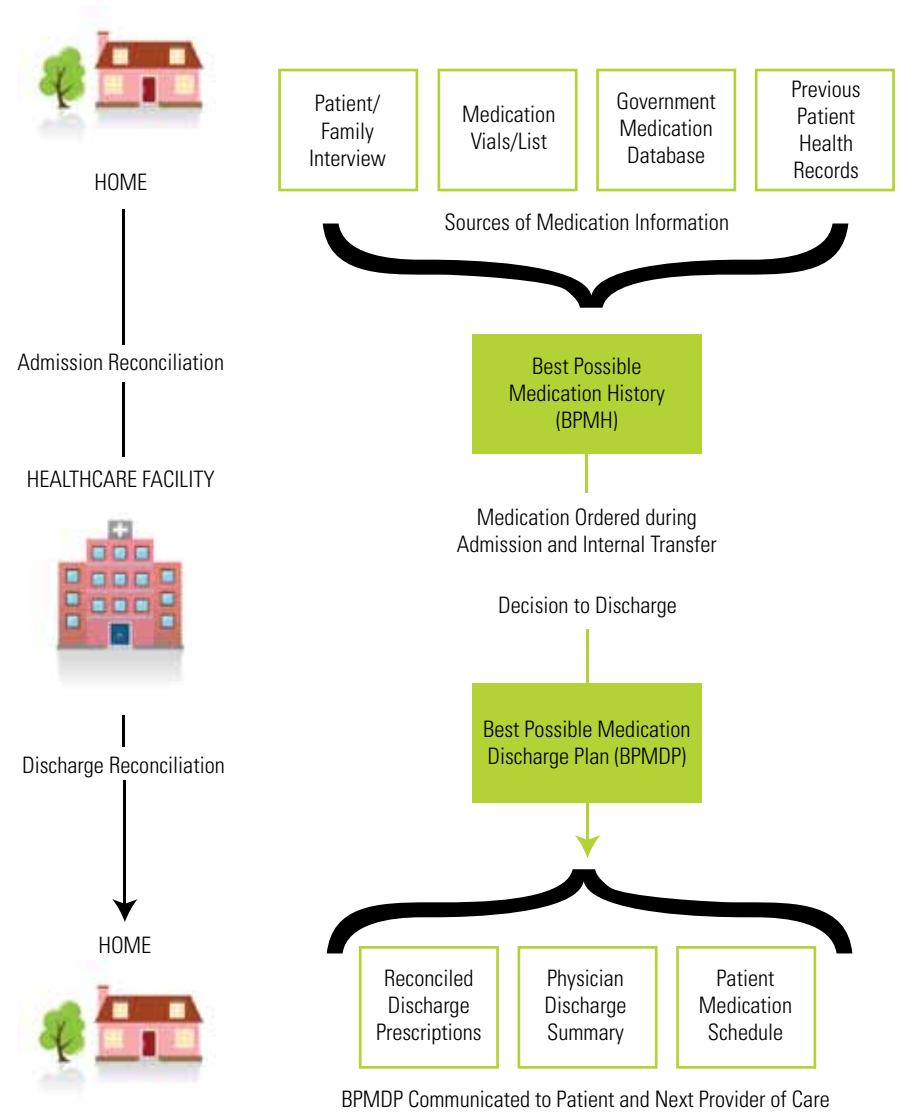
In this article, we use the existing literature, as well as results from our own research and experiences as clinicians, as pharmacist (O.F.) and a physician (K.S.) to address key practical questions regarding effective medication reconciliation: *what* it should consist of, *where* and *when* it should occur, *who* should carry it out and *how* hospitals should implement it. In terms of *why*, we do not formally review the evidence supporting medication reconciliation; however, we do briefly summarize key studies that indicate the likely impact on patient safety.

Why Implement Medication Reconciliation?

Transitions from one health-care setting to another – whether from an intensive care unit to a general ward or from a rehabilitation facility to the patient’s home – increase the risks of adverse drug events and can contribute to avoidable hospital visits (Dedhia et al. 2009; Fernandes 2009; Jack et al. 2009; Ong et al. 2006). For instance, incomplete or inaccurate medication information can introduce changes to patients’ outpatient medication regimens that were not intended by hospital-based physicians. Two common unintended medication changes are omissions – pre-admission medications are omitted from hospital orders and therefore not continued after discharge – and commissions – previous medications that patients discontinued prior to admission are inadvertently re-initiated in the hospital and therefore continued upon discharge (Tam et al. 2005). In one study of 151 hospitalized medical patients (Cornish et al. 2005), 54% of patients had at least one unintended discrepancy between their hospital and outpatient medication regimens, and 39% of these discrepancies

were judged to have the potential to cause moderate to severe discomfort or clinical deterioration. Because many unintended medication discrepancies are relatively minor, the better studies have assessed the likely clinical impact of the discrepancies identified by medication reconciliation (Gleason et al. 2004; Lalonde et al. 2008; Nickerson et al. 2005; Schnipper et al. 2009; Varkey et al. 2007; Vira et al. 2006). Despite varying definitions of *clinical impact*, these studies all identify a category that might be called “clinically important” discrepancies – unintended changes

FIGURE 1.
Overview of medication reconciliation – what, where, when and how



Source: Adapted from *Pharmacy Practice* 2009;25(6):26 with permission.

to patients' medications with a reasonable risk of some harm. Rates for these clinically important unintended discrepancies range from a low of 0.25 per patient to a high of 0.97. The best study to date – the only randomized controlled trial comparing medication reconciliation with usual care with an intervention that involved inter-professional process redesign from admission to discharge (Schnipper et al. 2009) – reported a relative reduction in potential adverse drug events of 28% (95% confidence interval 1.0–48%).

These studies of the impacts of medical reconciliation on clinically significant events all involve key roles for pharmacists. Accreditation standards do not stipulate involvement by pharmacists (Accreditation Canada 2011, Joint Commission 2011), and staffing constraints probably limit the degree to which pharmacists perform medication reconciliation outside academic medical centres. Thus, medication reconciliation as implemented in most hospitals does not correspond to the intervention for which the literature provides support.

What Is Medication Reconciliation?

Initial conceptions of medication reconciliation have evolved into a robust system for reducing potential adverse drug events and risks for unnecessary subsequent care (Figure 1 [High 5s 2009]; Fernandes 2009; World Health Organization 2006). Unfortunately, medication reconciliation has often been misperceived as a superficial administrative accounting task with a “pre-occupation with completing forms” (Boockvar et al. 2011). When conducted as intended, medication reconciliation is a conscientious, patient-centred, inter-professional process that supports optimal medication management (Greenwald et al. 2010).

The best possible medication history (BPMH) provides the cornerstone for medication reconciliation. It differs from a routine medication history in that it involves (1) a systematic

TABLE 1.
Medication reconciliation in varying levels of intensity, as seen in published studies

Level	Key Components	Published Examples
Bronze	BPMH with admission reconciliation	Cornish et al. 2005; Kwan et al. 2007
Silver	Bronze level + reconciliation at discharge by prescriber only ± electronically generated discharge prescription	Schnipper et al. 2009; Wong et al. 2008
Gold	Silver level + discharge reconciliation is inter-professional (e.g., prescribing physician and pharmacist collaboration) + electronically generated discharge prescription	Cesta et al. 2006; Dedhia et al. 2009; Schnipper et al. 2009
Platinum	Gold level + attention to broader medication management issues (e.g., appropriateness of agents, safety and effectiveness assessment) + medication counselling prior to discharge (including discussion of medication changes) + provision of patient-friendly reconciled medication schedules upon discharge	Al-Rashed et al. 2002; Dedhia et al. 2009; Makowsky et al. 2009; Murphy et al. 2009; Nazareth et al. 2001
Diamond	Platinum level + additional elements, such as <ul style="list-style-type: none"> • post-discharge follow-up phone call to patient by hospital clinician (e.g., nurse or pharmacist) • communication of medication changes with rationale directly to community pharmacy and primary care physician 	Gillespie et al. 2009; Jack et al. 2009; Karapinar-Çarkit et al. 2009; Schnipper et al. 2006; Walker et al. 2009)

BPMH = best possible medication history.

process for interviewing the patient (or family) and (2) a review of at least at least one other reliable source of information (e.g., a provincial medication database, an inspection of medication vials or contact with the community pharmacy) to obtain and verify patient medications (prescribed and non-prescribed) (Safer Health Care Now! 2011). In practice, however, medication histories fall short of these recommendations, with clinicians skipping the time-consuming step of actually speaking with the patient to verify medications. Reconciling a suboptimal medication history with medication orders does nothing to improve care and may even “hard-wire” unintentional discrepancies. Finally, efforts to obtain a BPMH face the many challenges associated with patients who maybe unfamiliar with their medications.

The number and intensity of medication reconciliation activities may legitimately vary between hospitals and even clinical areas within a hospital. Table 1 outlines a proposed continuum of varying levels of medication reconciliation intensity, from bronze—just a BPMH and reconciliation, the current national accreditation indicator in Canada (Accreditation Canada. 2011)—through to silver, gold, platinum and diamond. The more advanced levels of medication reconciliation involve progressions in inter-professional collaboration, integration of medication reconciliation into discharge summaries and prescriptions, and the delivery of more comprehensive medication education to patients. In principle, individual patients might appropriately receive different levels of medication reconciliation, from bronze

to platinum, given their different risks for adverse drug events. In practice, hospitals may choose a specific degree of medication reconciliation for all patients in a given clinical area.

Where Should Medication Reconciliation Occur?

Literature on medication reconciliation in ambulatory settings has begun to emerge (Bayoumi et al. 2009; Fernandes 2009; Varkey et al. 2007), but most studies remain focused on the hospital.

Within the in-patient arena, should hospitals target any specific clinical area first? The extent to which patients in some clinical areas benefit more from medication reconciliation than patients in others (e.g., general medicine versus surgery) remains unclear. (Realistically, the potential benefit probably depends on the number and type of medications taken by patients, not the clinical service.) Thus, rather than choosing to focus on clinically defined patient groups, many hospitals choose to target patients admitted through the emergency department and elective patients, typically in surgery. Focusing on elective patients offers the advantage of proactively conducting the BPMH in a controlled setting such as a pre-admission clinic (Kwan 2007). That said, the emergency department represents a much larger gateway for hospitalized patients, and the strategies used for medication reconciliation in a pre-admission clinic may not translate well to the busy, time-pressured setting of the emergency department.

When Should Medication Reconciliation Occur?

Should hospitals first target admission, discharge or internal transfers? Some studies have highlighted serious medication risks at internal transfer points, such as from intensive care to a ward (Santell 2006). Realistically, though, most hospitals initially choose to target medication reconciliation at admission or discharge. Both options involve implementation issues, and determining the optimal choice for a particular hospital is challenging. Ultimately, some form of discharge reconciliation needs to be present – after all, the main purpose of medication reconciliation is to avoid unintended medication errors created by hospitalization. The key challenge faced by discharge reconciliation is integrating it into the general discharge process, which already involves multiple activities on the part of physicians, nurses, pharmacists and other health professionals. It may be tempting to simply provide a medication reconciliation form or letter with a summary of medication changes. However, disconnecting medication reconciliation from related discharge processes, such as preparing discharge summaries and prescriptions, may minimize its full benefit and give rise to the false impression that medication reconciliation is not a clinically relevant process and just adds to clinicians' work.

Reconciliation at admission avoids the complexities of the

discharge process, but the time pressure at admission, especially for acutely ill patients, presents challenges for obtaining a BPMH. In practice, hospitals deal with the time pressure issue by expanding “on admission” to mean within 24–48 hours of admission. This solves the time pressure problem but misses the opportunity to have the medication reconciliation support the process of creating medication orders at admission. As with the discharge process, not integrating medication reconciliation into a relevant clinical process (e.g., creating orders at admission) may foster the misperception of medication reconciliation as extra work that exists for purely administrative reasons.

On balance, starting the medication reconciliation process at or soon after admission may ultimately save time. Even if admission reconciliation does not directly generate admission orders, the discharge process will be more accurate and efficient if a BPMH already exists. Also, the Accreditation Canada indicator, a natural incentive, is currently focused on admission. Importantly, these ideas are not mutually exclusive. A “phased-in” approach that starts on admission, sustains gains throughout hospitalization and finishes at discharge may make the most sense.

The Who's Who of Medication Reconciliation

Should hospitals target all admitted patients or “high-risk” patients only? With limited human resources and hospitals struggling to fully implement medication reconciliation across the continuum, it may seem natural to target patients who will most benefit from medication reconciliation. However, evidence-informed criteria for high-risk patients' medication reconciliation remain unclear at this time. Some authors have suggested that medication reconciliation candidates can be focused by age (over 65 years old) or number of medications (more than four) (Coffey et al. 2009; Gleason et al. 2010). Others have proposed that “high risk criteria” include factors such as frequent hospitalizations, high-alert medications, chronic diseases prone to frequent medication changes and patients with a large number of in-hospital medication changes (Rumball-Smith and Hider 2009). Narrowing the scope of medication reconciliation promises a “quality job” for targeted patients versus a “superficial effort” for all.

Despite the plausibility of this approach, an important practical argument in support of medication reconciliation for *all patients* is that accurately identifying high-risk patients (e.g., based on the number or type of medications) often requires a proper BPMH process. Moreover, in some settings (e.g., medical wards), screening for a high-risk status may not practically eliminate many patients. Finally, patients who are considered low risk at admission may have changes made to their home medication regimens later in their hospitalization that would elevate their risk status. For all these reasons, Accreditation Canada's focus on applying medication reconciliation to all admitted patients seems reasonable. That said, a given hospital may recognize that

certain wards generally treat patients with short medication lists and for whom few changes in pre-hospital medications occur. In such cases, a lower-level version of medication reconciliation (see Table 1) may be justified.

Who should optimally lead medication reconciliation activities? Some argue that, based on their educational training and expertise, hospital pharmacists are uniquely positioned to lead and support patients and inter-professional teams with medication reconciliation (Fernandes and MacKinnon 2008) and that this may result in better accuracy and clinical and economic outcomes (Bond and Raehl 2007; Carter et al. 2006; Coffey et al. 2009; Kaboli et al. 2006; Tam et al. 2005). Karnon et al. (2009) conducted a cost-effectiveness analysis suggesting that pharmacist-led reconciliation yields the highest expected net benefits and a probability of being cost-effective of more than 60% by a quality-adjusted life year value of £10,000.

However, there can be problems with pharmacists leading reconciliation. First, many wards do not have clinical pharmacists, and most hospitals do not have 24/7 pharmacy service or enough pharmacist resources to complete and sustain medication reconciliation at all interfaces. Limited pharmacist resources may thus result in a target of only complex patients. A feasible alternative adopted by some hospitals is the use of pharmacy technicians and students to support medication reconciliation (Lam et al. 2009; Mersfelder and Bicketl 2008; van den Bernt et al. 2009). Regardless of the profession, a key factor is having the clinician receive formal practical training on how to systematically and efficiently conduct a BPMH (Boockvar et al. 2011; Greenwald et al. 2010; Safer Health Care Now! 2011).

Regardless of which professionals carry out medication reconciliation, patients remain essential partners in the process.

Formal BPMH training also promotes professional “trust” in this critical shared information.

Second, if pharmacists lead, there is a danger that other health disciplines will divest themselves of the patient responsibility linked to this critical activity. Interviews with staff at hospitals across Canada as part of an ongoing study conducted by one of us (K.S.) confirmed this concern in some hospitals: the focus on the pharmacists/pharmacy technicians risks losing sight of medication reconciliation as a shared inter-professional accountability. A recent US panel of stakeholders, representing professional, clinical, healthcare quality, consumer and regulatory organizations, achieved consensus that hospital-based medication reconciliation should employ *an inter-professional team approach* as the ideal (Greenwald et al. 2010). Moreover, a coordinated, inter-professional process can improve efficiency

by reducing redundancy in the traditional approach of physicians and nurses all conducting individual medication histories.

Regardless of which professionals carry out medication reconciliation, patients remain essential partners in the process. Even completely perfect reconciliation will serve little purpose if patients do not understand their new medication regimens. Thus, the higher levels of medication reconciliation shown in Table 1 include discharge medication counselling to patients. Other advanced features include the use of patient portals/kiosks to actively engage patients in the BPMH process and support a patient-accessible medication record (Bassi et al. 2010).

How to Implement Medication Reconciliation

One of us (K.S.) has led a study of the experiences of 25 adult and pediatric healthcare institutions across Canada with implementing medication reconciliation. The formal analysis of the interviews with 74 nurses, pharmacists, physicians, patient safety officers, project managers and senior executives has not yet been published, but some key themes are summarized here. First, what counts as medication reconciliation varies widely. Areas of variation included who conducted the medication history and how it was taken, the number of histories completed, the role of the medication order and which patients’ medications were reconciled. Some of this variation reflects understandable decisions in response to local implementation challenges. However, some variation included clearly suboptimal processes, such as the absence of a systematic approach to history taking and obtaining medication information from more than one source.

The focus of this study, however, was on the practical challenges encountered in implementation. These barriers included the following:

- Substantial underestimation of the time and resources required to implement medication reconciliation
- Resistance from front-line staff due to impacts on workload and work flow (physicians sometimes resisted even independent of such impacts)
- A lack of implementation/change management experience
- Turnover on the core implementation team
- Limited resources for ongoing education and support to sustain the implementation
- Too rapid implementation, as a result of pressure due to accreditation, resulting in a poorly configured process

Not surprisingly, interviewees repeatedly identified that real support from senior management in appropriately resourcing teams and implementation efforts was key to success. Other facilitators included having physician “champions,” inter-professional implementation teams and contact with other institutions to share and learn from implementation efforts (e.g., a formal collaborative, such as Safer Healthcare Now!)

TABLE 2.
Summary of pros and cons for key issues in medication reconciliation in acute care

Question and Position Considered	Pros	Cons
<p>Where? Where should hospitals implement medication reconciliation? Position considered: Hospitals should initiate in the ED.</p>	<ul style="list-style-type: none"> • ED is the most common gateway for admissions in most hospitals • Unclear whether one clinical service has clear benefits over another, so makes sense to look at all patients admitted through ED gateway • Absence of published evidence of clear medication reconciliation benefit for non-admitted ED patients over admitted patients 	<ul style="list-style-type: none"> • Starting in surgical pre-admission clinics for elective surgery patients allows for “pro-active” medication reconciliation for most patients (BPMH completed in advance of admission orders) vs. “reactive” medication reconciliation in the ED • May be better to pick a clinical service with a high rate of medication-related readmissions vs. all admitted patients in the ED
<p>When? Which patient transition of care should hospitals target first: admission, discharge or internal transfer? Position considered: Hospitals should target the admission transition first for implementing medication reconciliation.</p>	<ul style="list-style-type: none"> • Prevent discrepancies in hospital and beyond – discrepancies on admission are propagated through hospital stay to discharge so better to correct them from the beginning • Saves time: quality discharge medication reconciliation more efficient and accurate if a BPMH already exists • Accreditation Canada national indicator focuses on admission 	<ul style="list-style-type: none"> • May be better to target select patients at discharge interface rather than all admitted patients • Discharge medication reconciliation may reduce clinically meaningful outcomes such as readmissions • Patients may be at higher risk for adverse events outside the confines of hospital setting • Limited evidence that mortality risk is higher at internal-transfer interface (Santell 2006)
<p>Who? Should hospitals target all admitted patients or “high-risk” patients only? Position considered: Hospitals should aim to complete medication reconciliation for all admitted patients.</p>	<ul style="list-style-type: none"> • Targeting all patients may save time – takes extra time and effort to screen for “high-risk” criteria (time better directed to medication reconciliation care) • Often can only truly ascertain appropriate risk after a proper BPMH (i.e., number of medications or high-alert drugs) • Accreditation Canada’s focus is on “all admitted patients” • Risk stratification point may only account for risk factors on admission, but other important risk factors may occur later (i.e., number of changes in hospital to home regimen) 	<ul style="list-style-type: none"> • With limited resources, better to target medication reconciliation resources to patients who will derive the most benefit • Clear, evidence-informed “high-risk” patient populations for medication reconciliation–related adverse drug events are unclear at this time, but more definitive evidence evolving in this area
<p>Who? Which healthcare discipline should optimally lead medication reconciliation patient activities? Position considered: Hospital pharmacists should lead and perform medication reconciliation activities for the inter-professional team.</p>	<ul style="list-style-type: none"> • Pharmacists may lead admission reconciliation, with prescribers (physicians and nurse practitioners) leading discharge • Limited studies to suggest improved accuracy with pharmacist medication reconciliation 	<ul style="list-style-type: none"> • Danger that if pharmacists lead, other health disciplines divest themselves of the responsibility linked to this critical activity • Not enough pharmacist resources to complete and sustain medication reconciliation – consider nurses or pharmacy technicians or healthcare students • Pharmacists often not available 24/7 • Limited pharmacist expertise should be more appropriately targeted only to complex and high-risk patients
<p>How? Should hospitals use paper-based or electronic-based resources for medication reconciliation? Position considered: Hospitals should use electronic-based platforms to support inter-professional medication reconciliation.</p>	<ul style="list-style-type: none"> • Electronic systems may save clinicians time and lessen tedious work • They allow for quick “conversion” of BPMH to admission orders • Information may pre-populate admission or discharge prescription orders • Easy patient tracking for team regarding who has received medication reconciliation and for monthly hospital reporting • System may facilitate “electronic reconciliation” to trigger identification of discrepancies • Aligns medication lists from different points in time on one screen to visualize together 	<ul style="list-style-type: none"> • Electronic systems often require full CPOE implementation – which most hospitals do not yet have in place • They introduce unique risks and may create a false sense of accuracy – “hard-wire” mistakes • May have to address multiple system integration issues to be effective • May add unnecessary complexity vs. a simple paper form to facilitate medication reconciliation

BPMH = best possible medication history; CPOE = computerized physician order entry; ED = emergency department.

Our interviews also revealed that, despite the accreditation requirement, many hospitals have not yet fully disseminated admission to discharge medication reconciliation beyond one or two pilot units, a finding confirmed anecdotally in discussion with colleagues across the country. Many of these implementation lessons thus remain relevant as hospitals struggle to spread and sustain quality medication reconciliation. Two specific practical decisions related to implementation also merit consideration, namely, whether to turn the medication reconciliation document into the admission orders (or the prescription at the time of discharge) and whether to strive for an electronic process. Table 2 presents some of the pros and cons related to these issues. Overall, hospitals should recognize that the successful implementation and maintenance of high-quality medication reconciliation practices, to the degree that they effectively prevent actual patient adverse events, require careful inter-professional and organizational planning along with effective change leadership. A number of hospitals in North America have published their successful medication reconciliation implementation journeys and valuable practical lessons learned (Coffey et al. 2009; Murphy et al. 2009; Schnipper et al. 2009).

Conclusion

Doing the bare minimum when it comes to medication reconciliation – just putting in place enough of a process to meet accreditation standards – will do little to prevent catastrophic cases, such as the ones described at the outset, from continuing to occur. Moreover, the occurrence of such cases will cause frustration (never mind risk management issues), given that implementing even a fairly superficial medication reconciliation process consumes substantial institutional time and resources. We argue that, rather than wasting time implementing a nominal medication reconciliation process, hospitals should invest additional time and energy in a more robust effective strategy, considering the issues we have outlined with respect to the *what, where, when, who, why and how* of implementing medication reconciliation. **HQ**

Acknowledgement

Our thanks go to Michelle Baker, BScPhm, of the University Health Network, for developing Table 1.

References

Accreditation Canada. 2011. *Required Organizational Practices*. Ottawa, ON: Author. Retrieved October 22, 2011. <<http://www.accreditation.ca/uploadedFiles/ROP%20Handbook.pdf>>.

Al-Rashed, S., D. Wright, N. Roebuck, W. Sunter and H. Chrystyn. 2002. "The Value of Inpatient Pharmaceutical Counselling to Elderly Patients Prior to Discharge." *British Journal of Clinical Pharmacology* 54: 657–64.

Bassi, J., F. Lau and S. Bardal. 2010. "Use of Information Technology in Medication Reconciliation: A Scoping Review." *Annals of Pharmacotherapy* 44: 885–97.

Bayoumi, I., M. Howard, A.M. Holbrook and I. Schabert. 2009. "Interventions to Improve Medication Reconciliation in Primary Care." *Annals of Pharmacotherapy* 43: 1667–75.

Bond, C.A. and C.L. Raehl. 2007. "Clinical Pharmacy Services, Pharmacy Staffing, and Hospital Mortality Rates." *Pharmacotherapy* 27: 481–93.

Boockvar, K.S., S.L. Santos, A. Kushniruk, C. Johnson and J.R. Nebeker. 2011. "Medication Reconciliation: Barriers and Facilitators from the Perspectives of Resident Physicians and Pharmacists." *Journal of Hospital Medicine* 6: 329–37

Carter, M.K., D.M. Allin, L.A. Scott and D. Grauer. 2006. "Pharmacist-Acquired Medication Histories in a University Hospital Emergency Department." *American Journal of Health-System Pharmacists* 63: 2500–3.

Cesta, A., J.M. Bajcar, S.W. Ong and O.A. Fernandes. 2006. "The EMITT Study: Development and Evaluation of a Medication Information Transfer Tool." *Annals of Pharmacotherapy* 40: 1074–81.

Coffey, M., P. Cornish, T. Koonthanam, E. Etchells and A. Matlow. 2009. "Implementation of Admission Medication Reconciliation at Two Academic Health Sciences Centres: Challenges and Success Factors." *Healthcare Quarterly* 12: 102–9.

Cornish, P.L., S.R. Knowles, R. Marchesano, V. Tam, S. Shadowitz, D.N. Juurlink and E.E. Etchells. 2005. "Unintended Medication Discrepancies at the Time of Hospital Admission." *Archives of Internal Medicine* 165(4): 424–9.

Dedhia, P., S. Kravet, J. Bulger, T. Hinson, A. Sridharan, K. Kolodner, S. Wright and E. Howell. 2009. "A Quality Improvement Intervention to Facilitate the Transition of Older Adults from Three Hospitals Back to Their Homes." *Journal of the American Geriatrics Society* 57: 1540–46.

Fernandes, O. 2009. "Medication Reconciliation – Practical Tips, Strategies and Tools for Pharmacists." *Pharmacy Practice* 25(6): 24–32.

Fernandes, O.A. and N.J. MacKinnon. 2008. "Point Counterpoint – The "Pro" Side – Is The Prioritization of Medication Reconciliation as a Critical Activity the Best Use of Pharmacists' Time?" *Canadian Journal of Hospital Pharmacy* 61: 149–50.

Gillespie, U., A. Alassaad, D. Henrohn, H. Garmo, M. Hammarlund-Udenaes, H. Toss et al. 2009. "A Comprehensive Pharmacist Intervention to Reduce Morbidity in Patients 80 Years or Older." *Archives of Internal Medicine* 169(9): 894–990.

Gleason, K.M., J.M. Groszek, C. Sullivan, D. Rooney, C. Barnard and G.A. Noskin. 2004. "Reconciliation of Discrepancies in Medication Histories and Admission Orders of Newly Hospitalized Patients." *American Journal of Health-System Pharmacists* 61(16): 1689–95.

Gleason, K.M., M.R. McDaniel, J. Feinglass, D.W. Baker, L. Lindquist, D. Liss and G.A. Noskin. 2010. "Results of the Medications at Transition and Clinical Handoffs (MATCH) Study: An Analysis of Medication Reconciliation Errors and Risk Factors at Hospital Admission." *Journal of General Internal Medicine* 25(5): 441–47.

Greenwald, J.L., L. Halasyamani, J. Greene, C. LaCivita, E. Stucky, B. Benjamin et al. 2010. "Making Inpatient Medication Reconciliation Patient Centered, Clinically Relevant and Implementable: A Consensus Statement on Key Principles and Necessary First Steps." *Journal of Hospital Medicine* 5: 477–85.

High 5s. 2009. *Assuring Medication Accuracy at Transitions in Care: Medication Reconciliation Getting Started Kit*. Oakbrook Terrace, IL: Author. Retrieved October 22, 2011. <www.high5s.org/pub/Manual/TrainingMaterials/medication_Reconciliation_Getting_Started_Kit.pdf>.

- Jack, B.W., V.K. Chetty, D. Anthony, J.L. Greenwald, G.M. Sanchez, A.E. Johnson et al. 2009. "A Reengineered Hospital Discharge Program to Decrease Rehospitalization." *Annals of Internal Medicine* 150: 178–87.
- Joint Commission. 2011. *2011 National Patient Safety Goals*. Oakbrook Terrace, IL: Author. Retrieved February 12, 2012. <http://www.joint-commission.org/assets/1/6/NPSG_Chapter_Jan2012_HAP.pdf>.
- Kaboli, P.J., A.B. Hoth, B.J. McClimon and J.L. Schnipper. 2006. "Clinical Pharmacists and Inpatient Medical Care." *Archives of Internal Medicine* 166: 955–64.
- Karapinar-Çarkit, F., S. Borgsteede, J. Zoer, H. Smit, A. Egberts and P. van den Bemt. 2009. "Effect of Medication Reconciliation with and without Patient Counseling on the Number of Pharmaceutical Interventions among Patients Discharged from the Hospital." *Annals of Pharmacotherapy* 43(6): 1001–10.
- Karnon, J., F. Campbell and C. Czowski-Murray. 2009. "Model-Based Cost-Effectiveness Analysis of Interventions Aimed at Preventing Medication Error at Hospital Admission (Medicines Reconciliation)." *Journal of Evaluation in Clinical Practice* 15: 299–306.
- Kwan, Y., O.A. Fernandes, J.J. Nagge, G.G. Wong, J. Huh, D.A. Hurn et al. 2007. "Pharmacist Medication Assessments in a Surgical Preadmission Clinic." *Archives of Internal Medicine* 167: 1034–40.
- Lalonde, L., A.M. Lampron, M.C. Vanier, P. Levasseur, R. Khaddag and N. Chaar. 2008. "Effectiveness of a Medication Discharge Plan for Transitions of Care from Hospital to Outpatient Settings." *American Journal of Health-System Pharmacists* 65(15): 1451–57.
- Lam, P., M. Harrison, S. Ingram, J. Volling, M. Wong, J. Huh et al. 2009. "Can Pharmacy Students Effectively Partner with Pharmacists to Support Medication Reconciliation for Patients? [Abstract]." *Canadian Journal of Hospital Pharmacy* 62(Suppl. 1): 62.
- Makowsky, M.J., S.L. Koshman, W.K. Midodcz, R.T. Tsuyuki, W.K. Midodcz and R.T. Tsuyuki. 2009. "Capturing Outcomes of Clinical Activities Performed by a Rounding Pharmacist Practicing in a Team Environment: The COLLABORATE Study." *Medical Care* 47: 642–50.
- Mersfelder, T.L. and R.J. Bicketl. 2008. "Inpatient Medication History Verification by Pharmacy Students." *American Journal of Health-System Pharmacists* 65: 2273–75.
- Murphy, E.M., C.J. Oxencis, J.A. Klauck, D.A. Meyer and J.M. Zimmerman. 2009. "Medication Reconciliation at an Academic Medical Center: Implementation of a Comprehensive Program from Admission to Discharge." *American Journal of Health-System Pharmacists* 66: 2126–31.
- Nazareth, I., A. Burton, S. Shulman, P. Smith, A. Haines and H. Timberall. 2001. "A Pharmacy Discharge Plan for Hospitalized Elderly Patients – A Randomized Controlled Trial." *Age and Ageing* 30: 33–40.
- Nickerson, A., N.J. MacKinnon, N. Roberts and L. Saulnier. 2005. "Drug-Therapy Problems, Inconsistencies and Omissions Identified during a Medication Reconciliation and Seamless Care Service." *Healthcare Quarterly* 8(Special Issue): 65–72.
- Ong, S.W., O.A. Fernandes, A. Cesta and J.M. Bajcar. 2006. "Drug-Related Problems on Hospital Admission: Relationship to Medication Information Transfer." *Annals of Pharmacotherapy* 40: 408–13.
- Rumball-Smith, J. and P. Hider. 2009. "The Validity of Readmission Rate as a Marker of the Quality of Hospital Care, and a Recommendation for Its Definition." *New Zealand Medical Journal* 122(1289): 63–70.
- Safer Health Care Now! Canadian Patient Safety Institute. 2011. *Medication Reconciliation. Prevention of Adverse Drug Events: How-To Guide*. Edmonton, AB: Author. Retrieved January 10, 2012. <[http://www.saferhealthcarenow.ca/EN/Interventions/medication_reconciliation/Documents/Acute%20Care/medicationreconciliation%20\(Acute%20Care\)%20Getting%20Started%20Kit.pdf](http://www.saferhealthcarenow.ca/EN/Interventions/medication_reconciliation/Documents/Acute%20Care/medicationreconciliation%20(Acute%20Care)%20Getting%20Started%20Kit.pdf)>.
- Santell, J.P. 2006. "Reconciliation Failures Lead to Medication Errors." *Joint Commission Journal on Quality and Patient Safety* 32(4): 225–29.
- Schnipper, J.L., C. Hamann, C.D. Ndumele, C.L. Liang, M.G. Carty, A.S. Karson et al. 2009. "Effect of an Electronic Medication Reconciliation Application and Process Redesign on Potential Adverse Drug Events." *Archives of Internal Medicine* 169(8): 771–80.
- Schnipper, J.L., J.L. Kirwin, M.C. Cotugno, S.A. Wahlstrom, B.A. Brown, E. Tarvin et al. 2006. "Role of Pharmacist Counseling in Preventing Adverse Drug Events after Hospitalization." *Archives of Internal Medicine* 166: 565–71.
- Tam, V.C., S.R. Knowles, P.L. Cornish, N. Fine, R. Marchesano and E.E. Erchells. 2005. "Frequency, Type and Clinical Importance of Medication History Errors at Admission to Hospital: A Systematic Review." *Canadian Medical Association Journal* 173(5): 510–15.
- Walker, P.C., S.J. Bernstein, J.N. Tucker Jones, J. Piersma, H. Kim, R.E. Regal et al. 2009. "Impact of a Pharmacist-Facilitated Hospital Discharge Program: A Quasi-experimental Study." *Archives of Internal Medicine* 169(21): 2003–10.
- van den Bernt, P.M.L.A., S. van den Broek, A.K. van Nunen, J.B.M. Harbers and A.W. Lenderink. 2009. "Medication Reconciliation Performed by Pharmacy Technicians at the Time of Preoperative Screening." *Annals of Pharmacotherapy* 43: 868–74.
- Varkey, P., J. Cunningham, J. O'Meara, R. Bonacci, N. Desai and R. Sheeler. 2007. "Multidisciplinary Approach to Inpatient Medication Reconciliation in an Academic Setting." *American Journal of Health-System Pharmacists* 64(8): 850–54.
- Varkey, P., J. Cunningham and S. Bisping. 2007. "Improving Medication Reconciliation in the Outpatient Setting." *Joint Commission Journal on Quality and Client Safety* 33: 286–92.
- Vira, T., M. Colquhoun and E. Etchells. 2006. "Reconcilable Differences: Correcting Medication Errors at Hospital Admission and Discharge." *Quality and Safety in Health Care* 15(2): 122–26.
- Wong, J.D., J.M. Bajcar, G.G. Wong, S. Alibhai, J. Huh, A. Cesta et al. 2008. "Medication Reconciliation at Hospital Discharge: Evaluating Discrepancies." *Annals of Pharmacotherapy* 42(10): 1373–79.
- World Health Organization. 2006. *Action on Patient Safety – High 5s*. Geneva, Switzerland: Author. Retrieved October 22, 2011. <<http://www.who.int/patientsafety/implementation/solutions/high5s/en/index.html>>.

About the Authors

Olavo Fernandes, BScPhm, PharmD, is a member of the Department of Pharmacy, University Health Network, and Leslie Dan Faculty of Pharmacy, University of Toronto; and the University of Toronto Centre for Patient Safety, in Toronto, Ontario. You can contact him at 416-340-4800, ext. 6436, or by e-mail to olavo.fernandes@uhn.ca.

Kaveh G. Shojania, MD, is a member of the University of Toronto Centre for Patient Safety; and the Department of Medicine, Sunnybrook Health Sciences Centre, in Toronto, Ontario.