



# Implementation of Admission Medication Reconciliation at Two Academic Health Sciences Centres: Challenges and Success Factors

Maitreya Coffey, Patricia Cornish, Tessie Koonthanam, Edward Etchells and Anne Matlow

## Abstract

Admission Medication Reconciliation (Med Rec) is an organizational practice designed to ensure patients' pre-admission medications are ordered correctly upon hospital admission. We describe the implementation of admission Med Rec at two academic health sciences centres, each having designed distinctly different processes.

Common challenges encountered included the multi-step, inter-professional nature of Med Rec, staffing resource and workload concerns and frequent medical staff turnover in a teaching environment. Both teams found that participation in a national safety collaborative enabled the pilot initially; however, they later found the outcome measures suggested by the collaborative less useful and switched to internal compliance measures for establishing maintenance and spread. Common themes were identified among the

critical success factors, with unique variations at each centre. Both teams acknowledged accreditation standards to be a major accelerator of implementation and spread. Using different measures of implementation success at each centre, the majority of patient admissions on the pilot units are complying with admission Med Rec. However, very high levels of compliance remain elusive. At Sunnybrook Health Sciences Centre's pilot unit, 62–77% of patients are being screened by a pharmacist and 65–75% of high-risk patients identified are undergoing Med Rec by a pharmacist. At The Hospital for Sick Children's pilot unit, 72–88% of patients have a physician's primary medication history documented on a Med Rec form and 57–73% of patients are also undergoing Med Rec by a nurse or pharmacist.

## Background

Up to one quarter of adverse events in healthcare are related to medications (Baker et al. 2004; Leape et al. 1991). Approximately 25% of all medication-related injuries are due to medication errors and are thus considered preventable (Aspden et al. 2007).

Recently, the process of admission to hospital has emerged as a key area of vulnerability as up to one half of patients have been found to have at least one error in their hospital admission medication histories (Tam et al. 2005), with a substantial

portion of these errors having the potential to cause adverse events (Cornish et al. 2005).

Medication Reconciliation (Med Rec) at admission is a process whereby the final selection of medications ordered on admission takes all pre-admission medications into account. An accurate list of a patient's current home medications (best possible medication history [BPMH]) is obtained by an interview, a review of medication vials or the patient's personal medication list; contacting the patient's community pharmacy or physician; or reviewing prescription drug database information. The BPMH is compared with the hospital admission medication orders, and any discrepancies between the two are brought to the attention of the prescriber; if appropriate, changes are made to the orders (Rozich and Resar 2001).

Evidence supports the assertion that pharmacists provide the gold standard when compiling the BPMH (Cornish et al. 2005; Tam et al. 2005). When the BPMH is compared with the admission medication orders, two types of discrepancies may be found. If a prescriber has made an intentional change but not documented it, this is referred to as an "undocumented intentional discrepancy." While not an error, this suboptimal documentation could lead to errors at transfer or discharge. The other type, a true error, is called an "unintentional discrepancy." When performing Med Rec, it is essential that the providers involved in the process communicate directly to identify and resolve discrepancies.

Because Med Rec has dramatically reduced discrepancy rates in various settings (Pronovost et al. 2003; Rozich et al. 2004; Whittington and Cohen 2004), it has been endorsed by leading international patient safety organizations (Institute for Healthcare Improvement 2005; Institute for Safe Medication Practices 2005). Both the Institute for Healthcare Improvement in the United States and the Canadian Patient Safety Institute ([www.patientsafetyinstitute.ca](http://www.patientsafetyinstitute.ca)) included Med Rec in their 100,000 Lives and Safer Healthcare Now! ([www.saferhealthcarenow.ca](http://www.saferhealthcarenow.ca)) campaigns, respectively. Further attesting to its importance, Med Rec has been designated a required organizational practice by Accreditation Canada (2008) and the Joint Commission in the United States ([www.jointcommission.org](http://www.jointcommission.org)).

One admission Med Rec strategy is to have a clinical pharmacist obtain a BPMH on every admitted patient. Unfortunately, many units do not have clinical pharmacists, while other units have clinical pharmacists who cannot possibly assess every patient given existing staffing levels and competing duties. Also, it is difficult to justify the broad deployment of clinical pharmacists to obtain BPMHs given that there is insufficient evidence to justify the routine application of Med Rec for all patients in all in-patient settings. Clinical pharmacist assessment can only be justified when the rate of clinically significant unintentional discrepancies is high. Other reasonable implementation strategies include the following:

1. Develop and implement screening criteria. Patients identified as high risk for unintentional discrepancies are seen by a clinical pharmacist for a BPMH.
2. Train additional clinical staff to obtain a BPMH.
3. Focus reconciliation efforts on comparing the primary medication history to medication orders. For example, the unit nurse could compare the admission medication history to the admission medication orders and identify discrepancies. This strategy would detect undocumented intentional discrepancies but would be less likely to detect unintentional discrepancies because no new information would be obtained from the patient. Therefore, any errors in the primary medication history would be unlikely to be corrected. Therefore, its impact on patient safety might be less.

We will not discuss the third option further, but we have observed that many organizations have chosen this approach, and we believe that the potential impact on patient safety is lower. Table 1 lists the relative strengths and weaknesses of these approaches as well as the potential process measures of implementation success.

We describe the implementation of admission Med Rec at two academic health sciences centres, each having designed distinctly different processes. The objectives of this study were (1) to describe admission Med Rec strategies at two academic health sciences centres, (2) to discuss common challenges and success factors and (3) to analyze different measures of implementation success.

### **Implementation Setting and Teams**

Both centres are urban, university-affiliated tertiary care hospitals. Sunnybrook Health Sciences Centre has 649 adult beds, including 94 beds on the general internal medicine unit. The Hospital for Sick Children (SickKids) has 376 pediatric beds, with 60 beds on the pediatric medicine unit. Both units participated in Med Rec pilots as part of Safer Healthcare Now! Participation was voluntary and grew out of grassroots interest in medication safety. At Sunnybrook, members of the general internal medicine team had conducted audits and formal research examining admission medication discrepancies prior to the campaign. At SickKids, a number of pediatric medicine morbidity and mortality reviews involving serious medication errors had stimulated interest in the topic.

Inter-professional teams were formed that included physicians, pharmacists and hospital quality and safety professionals (as well as nurses at SickKids). A generalist/hospitalist with active clinical involvement and professional interest in patient safety became the physician lead at both sites. Sunnybrook's patient safety pharmacist served as the team's pilot project manager, whereas the pilot project manager at SickKids was a

**Table 1. Comparison of Med Rec process strategies**

Strategy	Strengths	Weaknesses	Potential Measures of Implementation
Pharmacist obtains BPMH and resolves discrepancies for all patients	<ul style="list-style-type: none"> <li>• Gold standard, supported by evidence</li> <li>• Correct medication list obtained early in admission</li> <li>• Requires little training resources, pharmacist already skilled</li> </ul>	<ul style="list-style-type: none"> <li>• Pharmacist resources rarely allow for this</li> <li>• May leave gap in Med Rec process for evenings and weekends</li> <li>• Could compromise pharmacist's ability to perform other relevant medication safety activities</li> </ul>	<ul style="list-style-type: none"> <li>• Percentage of patients assessed by a pharmacist (out of total admissions)</li> </ul>
Pharmacist obtains BPMH and resolves discrepancies for selected high-risk patients	<ul style="list-style-type: none"> <li>• Focuses application of scarce resources on highest-risk group/most likely to benefit</li> </ul>	<ul style="list-style-type: none"> <li>• Requires development of screening criteria, determination of who is responsible for screening and a process for doing so</li> </ul>	<ul style="list-style-type: none"> <li>• Percentage of patients screened (out of total admissions)</li> <li>• Percentage with a documented pharmacist BPMH (out of those identified as high risk)</li> </ul>
Other clinical staff (e.g., nurses) obtains BPMH and resolves discrepancies	<ul style="list-style-type: none"> <li>• Provider with most proximity to patient bedside is involved</li> <li>• 24/7 coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Not known how a nurse-obtained BPMH compares with gold standard of a pharmacist-obtained BPMH</li> <li>• Extensive resources required to educate nursing staff</li> <li>• Continued struggle with compliance (not perceived as part of nursing practice)</li> </ul>	<ul style="list-style-type: none"> <li>• Percentage of patients with a documented BPMH (out of total admissions)</li> </ul>
Other clinical staff (e.g., nurses) compare primary history to admission medication orders and resolve discrepancies	<ul style="list-style-type: none"> <li>• Provider with most proximity to patient bedside is involved</li> <li>• 24/7 coverage</li> <li>• Potentially simple to implement</li> </ul>	<ul style="list-style-type: none"> <li>• BPMH not systematically obtained (no additional information from standard physician history); thus, less likely to identify unintentional discrepancies</li> </ul>	<ul style="list-style-type: none"> <li>• Percentage of patients undergoing comparison (out of total admissions)</li> </ul>

BPMH = best possible medication history; Med Rec = Medication Reconciliation.

quality analyst with a nursing background.

### Initial Approach

Both teams began by introducing a Med Rec form to improve the completeness and documentation of the physician's primary medication history. Though neither team expected the form to improve the accuracy of the history, it was hoped that having physicians enter the primary medication history on the form would reduce undocumented intentional discrepancies by prompting them to indicate "continue, stop or change" for each medication. It was assumed that this would make it easier for a second provider to compile the BPMH and correct any unintentional discrepancies.

Prior to the pilot studies, pharmacists had established clinical roles in both centres and performed BPMHs or checked admission medication orders on an ad hoc basis, either at the request of a physician or through informal screening. A prior study at Sunnybrook had shown that this ad hoc system was not working

well as it resulted in over half of patients having at least one unintentional discrepancy (Cornish et al. 2005). Though both teams recognized that pharmacists could provide the gold standard of Med Rec, neither site had adequate pharmacist resources to provide this service for every admission, nor did they believe a pharmacist's expertise was required for every patient. Thus, both teams devised a screening process to identify high-risk patients for the purposes of an independent BPMH creation and reconciliation by a pharmacist.

Sunnybrook had found a high rate of discrepancies for patients on four or more prescription medications (Cornish et al. 2005). This cut-off, as well as the presence of a high-alert medication or an unclear history, was used to define the high-risk patient population. In the adult population at Sunnybrook, approximately three quarters of patients meet this definition of high risk, whereas in the pediatric population at SickKids, only one quarter meets this definition (one half do if over-the-counter medications and supplements are included).

### Early Challenges and Ongoing Implementation

Initially, physician leaders of both teams were present at the beginning of each academic rotation to orient every team to the Med Rec form. Within months, it became clear that this approach would be impossible to sustain in light of the constant turnover of both faculty and trainees. Furthermore, even when physicians agreed with Med Rec in principle, it was extremely difficult to get them to perform it in practice. Reasons included the perception that the form was extra work, difficulty finding the form and not remembering to look for the form. Both teams stocked admission packages, including the Med Rec form, with other essential paperwork in the emergency department (ED), but forms still ended up missing from the chart or being left blank. The teams could not convince physicians to write the medication list on the form instead of in the body of the admission history and physical as was their usual practice, so many physicians were duplicating the history.

The involvement of clinical pharmacists was achieved with far less effort. This is likely because a less-structured version of Med Rec was already part of their practice. Since they felt they did not have the capacity to perform Med Rec for every patient and that their skills were not required for every patient, they supported screening for high-risk patients. In response to the challenge of physician turnover, both centres began to focus on permanent clinical staff. At Sunnybrook, one pharmacist full-time equivalent was added to increase the complement to five clinical pharmacists on the medical wards, in addition to an ED pharmacist. Pharmacists were encouraged to initiate Med Rec as

early in the admission process as was feasible. This could mean obtaining a BPMH in the ED prior to the physician's history and orders. Thus, the initiation of the process was no longer entirely physician dependent, allowing significant gains in Med Rec compliance without dependence on intensive re-education with each rotation.

In contrast, SickKids remained committed to holding physicians accountable for use of the form. Available pharmacist resources allowed them to reconcile only a minority of patients, which led to the decision to involve nurses in the process. Over three months, the unit's entire nursing staff were trained to perform a BPMH and reconciliation, with the expectation that they would complete it for every admission and involve pharmacists only with patients on four or more medications. SickKids was simultaneously conducting a study in which virtually no clinically significant discrepancies were found in patients on less than four medications, supporting this approach. However, the absence of clinically important discrepancies in the low-risk group raised the question of whether any additional staff resources, including nursing, should be applied to this group (Coffey et al. 2008). Advantages and disadvantages of these approaches are outlined in Table 1.

### Evaluation

Both centres established a baseline rate of discrepancies. Sunnybrook used data from their previous study, showing an average of one unintentional discrepancy per patient. SickKids' pre-pilot data showed 1.5 unintentional discrepancies per

**Table 2. Sunnybrook Med Rec data collection summary\***

	May 20–Jun 18, 2007	Sep 17–Oct 5, 2007	Jan 7–25, 2008
Total number of admissions to general medicine	247	163 <sup>†</sup>	166 <sup>‡</sup>
Patients screened by in-patient pharmacist	152 (62%)	118 (73%)	127 (77%)
Medication history form on chart prior to pharmacist review	25 (16%)	25 (21%)	24 (19%)
Patients with ≥1 high-risk criteria	106 (70%)	77 (57%)	86 (68%)
Medication history verified by pharmacist	74 (70%)	50 (65%)	63 (75%)
Medication history not verified by pharmacist and reason documented	12 (11%)	14 (18%)	9 (11%)
Medication history not verified by pharmacist and reason <i>not</i> documented	20 (19%)	13 (17%)	14 (17%)
Patients with ≥1 discrepancy	86 (57%)	60 (51%)	58 (46%)
Mean number of discrepancies per patient (range)	1.5 ± 1.6 (0–7)	1.1 ± 1.5 (0–6)	1.0 ± 1.4 (0–7)
Total number of discrepancies identified	224	125	120

Med Rec = Medication Reconciliation.

\*Note these data are from the study midpoint after several months of implementation work and after pharmacy staffing increases (no performance data prior to this are available).

<sup>†</sup>Includes 12 patients admitted on the weekend and discharged within 72 hours (i.e., no opportunity for pharmacist to review).

<sup>‡</sup>Includes 14 patients admitted on the weekend and discharged within 72 hours (i.e., no opportunity for pharmacist to review).

patient. As participants in Safer Healthcare Now! both centres were encouraged to submit rates of unintentional discrepancies on a sample of 20 charts per month. The teams did not expect a change in the rate of unintentional discrepancies between the primary (physician) history and the admission medication orders over time because neither team focused on changing the primary medication history process. These discrepancies were expected to remain relatively constant as they reflect patient complexity and physician habits and skills related to compiling a primary medication history. Rather, the success of the program was to be measured by the number of patients receiving Med Rec, which would resolve unintentional discrepancies that would not otherwise have been identified.

Sunnybrook performed three one-month audits of consecutive admissions capturing these measures (Table 2). After the January 2008 audit, a pharmacist and a physician reviewed all the unintentional discrepancies and estimated that 50% had the potential to cause patient harm had they not been identified and corrected by the Med Rec program (data not shown).

SickKids' approach to measuring Med Rec implementation success began by monitoring physician compliance with using the Med Rec form (Figure 1). Monthly audits of 30 randomly selected charts were reviewed. Compliance was highly variable (30–80%) over the first nine months, depending on the medical team's interest and the availability of the physician leader. In January 2007, the second step of a nurse-obtained BPMH and reconciliation was introduced. During the first two months, extensive resources were dedicated to a comprehensive educational campaign and frequent compliance spot checks. Fearing a loss of educational momentum, the team advised nurses to proceed with the BPMH even when physicians had not initiated the Med Rec form. This resulted in a precipitous drop in physician compliance, possibly due to physicians leaving the task for the nurses. This problem was compounded by the physician leader's leave of absence followed by a period without project management support, which illustrates the pitfall of making a process too dependent on a particular individual.

In summer 2008, nurses were again advised not to proceed

Figure 1. Pilot unit physician compliance at The Hospital for Sick Children

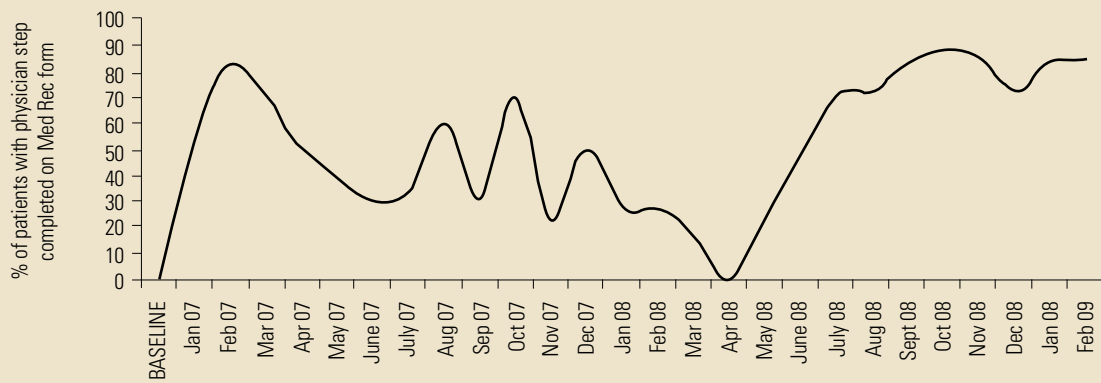
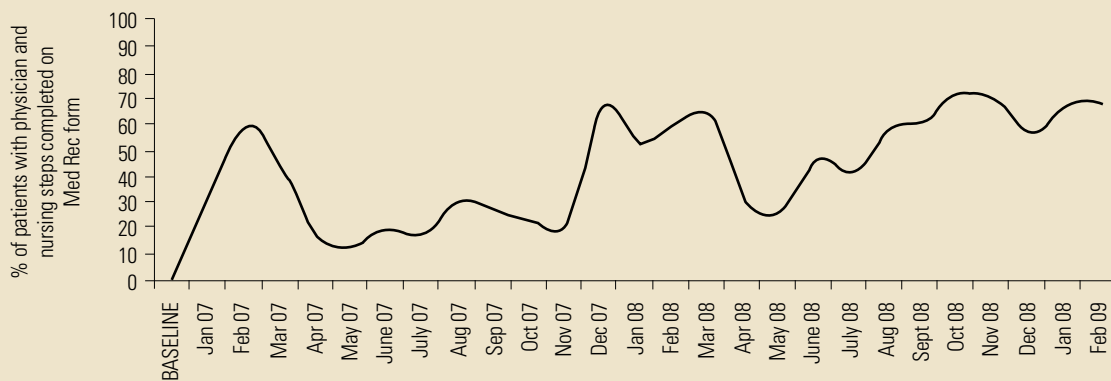


Figure 2. Pilot unit overall compliance at The Hospital for Sick Children



with Med Rec unless the physician initiated the form, and the physician leader and a resident champion relaunched their educational efforts. A scaling-up of project management support allowed weekly audits capturing every admission. Since the fall of 2008, audits of physician-specific compliance have been reported to the physicians, their division head and the executive sponsor. As of January 2009, despite achieving acceptable physician compliance, nursing compliance remains a challenge; so, overall compliance with both steps of Med Rec is currently around 40–60% (Figure 2). Pharmacist performance is not being audited, but spot checks show that they are consistently reconciling approximately 20% of patients, including almost all high-risk patients.

### Challenges, Successes and Lessons Learned

Challenges to both centres implementing admission Med Rec included the following:

- Physicians perceive little value in documenting a medication history on a separate form and are not disposed to abandon the practice of documenting the medication list within the admission history and physical.
- The constant turnover of trainee and staff physicians makes it extremely difficult to educate and convince each new physician to adopt Med Rec processes.
- Workload concerns remain a substantial challenge. In spite of Sunnybrook's increased clinical pharmacist resources, pharmacists are available to do Med Rec only during regular business hours, resulting in the screening of approximately 75% of general medical patients and the reconciliation of about 80% of high-risk patients identified. At SickKids, extensive resources continue to be required for maintaining nursing Med Rec compliance, and Med Rec often competes poorly with other nursing tasks.
- Data collection and management are burdensome. Specifically, the ongoing auditing necessary to achieve current levels of performance is labour intensive and not a long-term solution.

Success factors and variations at each centre are listed in Table 3. Both teams found that their participation in Safer Healthcare Now! assisted the initial launch by providing methodology for data collection, credibility and branding, as well as a forum for discussion with colleagues regionally and nationally. Once the Med Rec process was established, however, both teams turned to process measures to evaluate the proportion of patients undergoing Med Rec. The designation of Med Rec as a Required Organizational Practice by Accreditation Canada was a significant accelerator. At SickKids, for example, a full-time project manager was secured and Med Rec was declared a key corporate performance objective.

### Hospital-Wide Spread

Both teams noted distinct uptake patterns in different clinical areas as the process was spread. At SickKids, cardiology had a high degree of concern for medication risks, an engaged physician leader and a supportive management culture, which led to immediate high levels of Med Rec compliance (Figure 3). On the other hand, more challenges were encountered in the surgical areas, where different admission processes (i.e., pre-admission clinics) and a general discomfort with medication management were unanticipated barriers. With a better understanding of workflow in surgery and a redesign from the initial pilot, compliance is slowly improving. Sunnybrook achieved excellent compliance when a pre-admission Med Rec form was completed by nurses in the preoperative clinic, and surgical residents informally reported a high degree of satisfaction when referring to these forms to create post-operative orders. Both hospitals are considering introducing a clinical pharmacist role in the preoperative clinic setting. At Sunnybrook long-term care, with stable staff and fewer new admissions, pharmacist-initiated Med Rec has been fully implemented with a high degree of reliability.

Lessons learned from preliminary spread results include the following:

- Unit-specific processes taking into account current workflow, staffing resources and patient risk profiles are critical, even within a single institution.
- Shared accountability must include clarity with respect to which team members are accountable for which steps.
- A physician champion who is visible and directly involved with the admission process is key in each clinical area.

### Conclusions: The Future of Med Rec Transfer, Discharge and Beyond

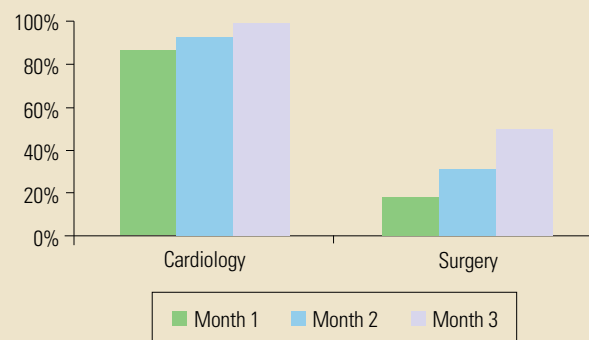
Though most centres have started with a focus on Med Rec at admission, it is also required at transfer and discharge. While this might seem to entail a simple extension of the admission process, there will be significant logistical hurdles to overcome in determining how the original BPMH will be combined with current in-patient medications, how prescriber intent will be documented and how repeated recopying of lists will be avoided. Furthermore, although Med Rec emerged with a focus on in-patient care, medication lists are frequently updated in the ambulatory setting. The fact that medication information is housed in so many different, often inaccessible locations cries out for the creation of federal or provincial repositories of prescription information independent of payment source or physical location. This is relevant to the larger discussion regarding the need for integrated electronic health records. Patient and family involvement is another area for future exploration. Some advocate for patient-held medication lists, which would allow patients and families to have up-to-date informa-

**Table 3. Centre-specific Med Rec success factors**

Critical Success Factor	Sunnybrook Health Sciences Centre	Hospital for Sick Children
Executive support	Strong support from director of pharmacy regarding staffing increases	Physician vice-president of quality and chief nursing executive key in moving physician and nursing roles forward
Pilot unit physician champions	Hospital patient safety leader and active clinician with academic expertise in medication safety	Divisional quality leader and active clinician with improvement expertise, and resident project champion
Investments in personnel resources	Permanent increase in pharmacist FTE	Project management support for pilot, one-year full FTE for hospital-wide spread
Front-line physician communication	Morning rounds, staff meetings, resident lectures	Morbidity and mortality reviews, staff meetings, resident lectures
Redundancy/mutual accountability	Physicians and pharmacists work together to resolve discrepancies, either can initiate	Physicians and nurses are mutually accountable for performing steps in a specific order
Acceptance of a risk-based approach to providing the gold standard	Pharmacists perform all screening and are reconciling a majority of patients	Pharmacists reconcile 20–30% of patients (almost all the high-risk patients)
Local data used to drive change	Three audits over 8 months	Monthly audits over first year, weekly over second year
Individual staff feedback	Clinical pharmacists participate in all audits	>80% physician compliance after individual audit/feedback with group reporting commenced

FTE = full-time equivalent; Med Rec = Medication Reconciliation.

**Figure 3. Initial compliance in clinical areas at The Hospital for Sick Children**



tion for their use and to share with health providers.

**Universal or Risk-Based Med Rec?**

The cases here illustrate two possible approaches to Med Rec. The universal approach is for every patient at every admission,

as is currently required by accreditation bodies. A benefit is that it places pressure on health systems and organizations to invest in applications to facilitate the accessibility of accurate medication information throughout the continuum of care. A disadvantage is that it promotes the widespread dissemination of practices that may fulfill the appearance of compliance without truly improving medication safety.

The risk-based approach involves applying enhanced resources to higher-risk populations. This is better supported by medical evidence and may represent the best investment in terms of avoiding adverse events. The challenge, however, is that the vast array of risk profiles for different populations makes it difficult to evaluate each setting against a common standard.

**Workload and Sustainability**

To ensure the sustainability and expansion of Med Rec, innovative solutions are needed to address the workload issues and inefficiencies in the process. Novel personnel arrangements should be explored, such as pharmacy students or technicians partnering with pharmacists to facilitate Med Rec. Information technology solutions for Med Rec that could be fully integrated

with computerized physician order entry (CPOE) have the potential to create efficiencies. Although obtaining BPMHs at admission will always require an interaction with the patient or caregiver, once this information is collected, it could be entered into an electronic system that would help construct the admission medication orders through CPOE. Having the BPMH in an electronic format accessible through the CPOE system would further facilitate Med Rec at transfer and discharge, and increase information sharing across the clinical disciplines (Poon et al. 2006). Both institutions described are looking into electronic Med Rec applications; however, they acknowledge that starting with a “paper and people” approach has been an asset as an information technology solution can only facilitate, not replace, the complex cognitive and inter-professional aspects of high-quality Med Rec. **HQ**

### Acknowledgments

We would like to acknowledge the following people for their hard work and support during the Med Rec pilot implementation: Teresa Bishara, Sabrina Boodjan, Helene Carating, Sara Compagni, Margot Follett-Rowe, Nancy Fritsch, Bev Hales, Alastair Hodinott, Margaret Keatings, Ron Laxer, Lynn Mack, Romina Marchesano, Rimona Natanson, Patrycja Nedzka, Polly Stevens, Kim Streitenberger, Chris Sulowski, Vince Teo, Jim Tjon and Lisa Zhu. In addition, we would like to thank Christina Stevancec for her assistance with manuscript preparation.

### References

- Accreditation Canada. 2008. *Required Organizational Practices*. Ottawa, ON: Author. Retrieved September 2008. <<http://www.cchsa.ca/default.aspx?page=355&cat=30>>.
- Aspden, P., J.A. Wolcott, J.L. Bootman and L.R. Cronenwett, eds. 2007. *Preventing Medication Errors*. Washington, DC: Institute of Medicine of the National Academies Press.
- Baker, G.R., P.G. Norton, V. Flintoft, R. Blais, A. Brown, J. Cox, E. Etchells, W.A. Ghali, P. Hébert, S.R. Majumdar, M. O’Beirne, L. Palacios-Derflinger, R.J. Reid, S. Sheps and R. Tamblyn. 2004. “The Canadian Adverse Events Study: The Incidence of Adverse Events among Hospital Patients in Canada.” *Canadian Medical Association Journal* 170(11): 1678–86.
- Coffey, M., L. Mack, K. Streitenberger, T. Bishara, L. Defaveri and M. Matlow. 2008. “How Frequent and Clinically Significant are Medication Errors at Admission? [Abstract].” *Paediatrics and Child Health* 13: 46A.
- 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.
- Institute for Healthcare Improvement. 2005. *Prevention of Adverse Drug Events through Medication Reconciliation*. Cambridge, MA: Author. Retrieved October 22, 2008. <<http://www.ihl.org/IHI/Programs/AudioAndWebPrograms/WebandACTIONMedReconciliation.htm>>.
- Institute for Safe Medication Practices. 2005. *Building a Case for Medication Reconciliation*. Horsham, PA: Author. Retrieved

September 2008. <<http://www.ismp.org/Newsletters/acutecare/articles/20050421.asp>>.

Leape, L.L., T.A. Brennan, N. Laird, A.G. Lawthers, A.R. Localio, B.A. Barnes, L. Hebert, J.P. Newhouse, P.C. Weiler and H. Hiatt. 1991. “The Nature of Adverse Events in Hospitalized Patients. Results of the Harvard Medical Practice Study II.” *New England Journal of Medicine* 324(6): 377–84.

Poon, E.G., B. Blumenfeld, C. Hamann, A. Turchin, E. Graydon-Baker, P.C. McCarthy, J. Poikonen, P. Mar, J.L. Schnipper, R.K. Hallisey, S. Smith, C. McCormack, M. Paterno, C.M. Coley, A. Karson, H.C. Chueh, C. Van Putten, S.G. Millar, M. Clapp, I. Bhan, G.S. Meyer, T.K. Gandhi and C.A. Broverman. 2006. “Design and Implementation of an Application and Associated Services to Support Interdisciplinary Medication Reconciliation Efforts at an Integrated Healthcare Delivery Network.” *Journal of the American Medical Informatics Association* 13: 581–92.

Pronovost, P., B. Weast, M. Schwarz, R.M. Wyskiel, D. Prow, S.N. Milanovich, S. Berenholtz, T. Dorman and P. Lipsett P. 2003. “Medication Reconciliation: A Practical Tool to Reduce the Risk of Medication Errors.” *Journal of Critical Care* 18(4): 201–5.

Rozich, J.D., R.J. Howard, J.M. Justeson, P.D. Macken, M.E. Lindsay and R.K. Resar. 2004. “Standardization as a Mechanism to Improve Safety in Health Care.” *Joint Commission Journal of Quality and Safety* 30(1): 5–14.

Rozich, J.D. and R.K. Resar. 2001. “Medication Safety: One Organization’s Approach to the Challenge.” *Journal of Clinical Outcomes and Management* 8: 27–34.

Tam, V.C., S.R. Knowles, P.L. Cornish, N. Fine, R. Marchesano and E.E. Etchells. 2005. “Frequency, Type and Clinical Importance of Medication History Errors at Admission to Hospital: A Systematic Review.” *Canadian Medical Association Journal* 173(5): 510–5.

Whittington, J. and H. Cohen. 2004. “OSF Healthcare’s Journey in Patient Safety.” *Quality Management in Health Care* 13(1): 53–9.

### About the Authors

**Maitreya Coffey**, MD, FAAP, FRCPC, is a pediatrician at The Hospital for Sick Children and an assistant professor of pediatrics in the Division of Paediatric Medicine at the University of Toronto.

**Patricia Cornish**, BScPhm, is the pharmacist with the Patient Safety Service at Sunnybrook Health Sciences Centre, Toronto, ON.

**Tessie Koonthanam**, RN, MN, is project manager for medication reconciliation at The Hospital for Sick Children, Toronto, ON.

**Edward Etchells**, MD, MSc, is an internist in the Division of General Internal Medicine, director of the Patient Safety Service and researcher at the Centre for Health Services Sciences at Sunnybrook Health Sciences Centre, as well as an associate professor of medicine in the Department of Medicine at the University of Toronto.

**Anne Matlow**, MD, FRCPC, is the medical director of patient safety at The Hospital for Sick Children and professor of pediatrics at the University of Toronto.