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Appendix A – What is MedRec and Why is it Important?

Medication reconciliation (MedRec):

- Is a formal process in which healthcare providers work together with patients and families to ensure accurate and comprehensive medication information is communicated consistently across transitions of care. (ISMP Canada, 2013)

- Requires a systematic and comprehensive review of all the medications a patient is taking (known as a BPMH) to ensure that medications being added, changed or discontinued are carefully evaluated (ISMP Canada, 2013).

- Is a component of medication management and will inform and enable prescribers to make the most appropriate prescribing decisions for the patient (ISMP Canada, 2013).

How is MedRec Performed?

Best Possible Medication History (BPMH)

The foundation of the MedRec process is the BPMH.

The first step involves creating a BPMH. ISMP Canada (2012) outlines that a BPMH is created by:

- Using a systematic process of interviewing the patient/family (and other caregivers).

- Reviewing at least one other reliable source of information to obtain and verify all of a patient’s medication uses (prescribed and non-prescribed medications e.g. over-the-counter and vitamin and herbal therapies).

- Ensuring complete documentation of drug name, dosage, route and frequency.

The MedRec Process

Safer Healthcare Now! (September 2011, p. 11) outlined a three-step process for medication reconciliation in acute care:

1. Create a complete and accurate Best Possible Medication History (BPMH) of the patient’s medications including name, dosage, route and frequency. This includes: interviewing patient and families and conducting a review of at least one other reliable source of information;

2. Reconcile Medications: Use the BPMH to create admission orders or compare the BPMH against admission, transfer or discharge medication orders; identify and resolve all differences or discrepancies; and

3. Document and Communicate any resulting changes in medication orders to the patient, family/caregiver and to the next provider of care.
Resources for More Information about MedRec

For those who may not be ready to implement MedRec electronically, or want general background information about MedRec, the following resources may be useful:

**Safer Healthcare Now!** has developed three toolkits for different types of care:

- Medication Reconciliation in Acute Care Getting Started Kit
- Medication Reconciliation in Long Term Care Getting Started Kit
- Medication Reconciliation in Home Care Getting Started Kit

Additional helpful toolkits include:

- Medications at Transitions and Clinical Handoffs (MATCH) Toolkit for Medication Reconciliation

Appendix B – What does eMedRec Look Like?

In this section we will illustrate some examples of eMedRec tools and processes. These examples are from existing eMedRec systems and user interfaces in Canada and internationally.

The following figure shows an eMedRec tool developed for use in Veterans Affairs hospitals. The tool provides a template for showing active and expired medications for in-patient medications, out-patient medications and non-VA medications. The provider who interacts with this tool indicates (by selecting medications and typing) in the template if there are discrepancies in medication lists. Tabs that are linked to a range of reports and electronic notes relevant to the patient’s condition are at the bottom left side of the screen in Figure B1. This shows the capability of integrating eMedRec with other types of HIS, including patient and hospital records and reports to support provider decision-making. This particular eMedRec tool is integrated with one of the most comprehensive and integrated EHR systems in the world.

![Computer screen shot of a medication reconciliation tool showing template for reconciling admission medication list](image)

**Figure B1.** Computer screen shot of a medication reconciliation tool showing template for reconciling admission medication list – used with permission from Boockvar et al. (2011)
In another eMedRec system, the following figures show a sequence of screens that display medications from a variety of electronic sources that are used to create a pre-admission medication lists (a pre-admission list builder). This example illustrates good usability principles by allowing users to simply click a button to move medications from other lists to the pre-admission medication list.

**Figure B2.** Pre-Admission Medication List (PAML) Builder (Reprinted from Studies in health technology and informatics, Vol 129(Pt 2), Turchin, A., Gandhi, T. K., Coley, C. M., Shubina, M., & Broverman, C., The use of electronic medication reconciliation to establish the predictors of validity of computerized medication records, Page 1022, Copyright (2007), with permission from IOS Press.

The following screen (see Figure B3) shows a drug profile where active medications are indicated by a vertical line and the medication history shows information about medications for the past six months (reproduced with permission from Tamblyn et al., 2012). The screens are from a discharge reconciliation and prescription module and they illustrate advanced features that can be integrated into eMedRec (such as a timeline for a medication history):

**Figure B3.** A drug profile
Figure B4 illustrates the discharge reconciliation and prescription module from the same system, containing reconciled medication lists (reproduced with permission from Tamblyn et al., 2012):

![Discharge reconciliation and prescribing module]

**Figure B4. A prescription module**
Figure B5 shows the discharge communication module in an eMedRec system (reproduced with permission from Tamblyn et al., 2012):
Figures B6 and B7 are examples of print-outs that can be automatically generated electronically and given to patients. The reports provide a summary of changes to a patient’s medications as well as a daily medication plan (based on the results of conducting eMedRec).

**Figure B6. A daily medication plan for a patient**
<table>
<thead>
<tr>
<th>What time do I take this?</th>
<th>What does it look like?</th>
<th>What is it called?</th>
<th>How much do I take?</th>
<th>How do I take it?</th>
<th>Why am I taking it?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning / Breakfast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amlodipine (2.5 mg)</td>
<td>1 tablet</td>
<td>By mouth</td>
<td></td>
<td>Blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECAspirin (81 mg)</td>
<td>1 tablet</td>
<td>By mouth</td>
<td></td>
<td>Prevents clots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bupropion SR (150 mg)</td>
<td>1 capsule</td>
<td>By mouth</td>
<td></td>
<td>Depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digoxin (0.0625 mg)</td>
<td>1 tablet</td>
<td>By mouth</td>
<td></td>
<td>Heart Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levothyroxine (0.1 mg)</td>
<td>1 tablet</td>
<td>By mouth</td>
<td></td>
<td>Thyroid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metformin (500 mg)</td>
<td>2 tablets with breakfast</td>
<td>By mouth</td>
<td></td>
<td>Blood sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metoprolol (12.5 mg)</td>
<td>½ tablet</td>
<td>By mouth</td>
<td></td>
<td>Blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rabeprazole (40 mg)</td>
<td>1 tablet</td>
<td>By mouth</td>
<td></td>
<td>Stomach acid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramipril (10 mg)</td>
<td>1 capsule</td>
<td>By mouth</td>
<td></td>
<td>Blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tamsulosin CR (0.4 mg)</td>
<td>1 capsule</td>
<td>By mouth</td>
<td></td>
<td>Urinary flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening / Dinner</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metformin (500 mg)</td>
<td>2 tablets with dinner</td>
<td>By mouth</td>
<td></td>
<td>Blood sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night / Bedtime</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atorvastatin (20 mg)</td>
<td>1 tablet at bedtime</td>
<td>By mouth</td>
<td></td>
<td>Cholesterol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metoprolol (12.5 mg)</td>
<td>½ tablet at bedtime</td>
<td>By mouth</td>
<td></td>
<td>Blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only If You Need It</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salbutamol 100 mcg</td>
<td>1 puff every 4 hours if you are having trouble breathing</td>
<td>Breathe it in</td>
<td>Breathing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lorazepam 0.25 mg</td>
<td>1 tablet at bedtime if you are having trouble sleeping</td>
<td>Under tongue</td>
<td>Sleep</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure B7. A daily medication plan for a patient (continued)
Appendix C – Results of Online Survey and Interviews

In order to inform this reference guide/compendium with the latest information, an online survey was conducted of existing eMedRec processes that sampled facilities across Canada. The survey was conducted from April to May of 2013. 2799 people were sent an invitation to participate in the survey. The survey was sent via email using the list serve at ISMP Canada. 212 people completed the survey. This appendix also includes results from telephone interviews about eMedRec with a subset of the people who completed the survey. The people who completed the survey and interviews included physicians, nurses, pharmacists, healthcare administrators, quality improvement professionals, and health IT professionals.

Current Landscape of MedRec

48 per cent the respondents reported that eMedRec was partially or fully implemented within their facilities, as can be seen in Figure C1.

61 per cent of those who are not currently doing MedRec electronically (n = 123), are considering implementation of eMedRec, and of those respondents, many are planning to implement eMedRec in the next year (31 per cent) or two (19 per cent).

Figure C1. Extent of eMedRec implementation (n = 250)
Type of eMedRec in Use

Respondents who indicated that they used some form of eMedRec also indicated that hybrid, electronic and other mechanisms were used to conduct eMedRec. As can be seen in Figure C2, hybrid eMedRec predominates.

Other included: “cutting and pasting” medications from the EMR, paper MedRec in some departments, hybrid MedRec in smaller community hospitals and eMedRec in large acute hospitals, use of a provincial drug information system program, and not yet implemented.

Where is eMedRec Practiced?

Respondents indicated that eMedRec is practised in a variety of settings in Canada. In addition to admission, transfer and discharge in acute care and long-term care, eMedRec is also practised in ambulatory care, clinic and other settings (e.g., home care, primary care, transitions in outpatient care, rehabilitation, long term care).

eMedRec Functionality

eMedRec functionality available to the respondents of the survey was highly variable. In many cases, survey participants indicated that when eMedRec functions were available many were not using them to their fullest extent.

Resources for Implementing and Sustaining eMedRec

The majority of respondents indicated that no additional resources (e.g., human, financial) were allocated to implementing or sustaining eMedRec. Additionally, very few respondents reported that external financial assistance (e.g., provincial or federal funding) was available to support eMedRec deployment.

Training for eMedRec

The top three methods of training users on eMedRec reported by survey participants were:

1. On-demand one-to-one training with a clinical champion
2. Unit based in-services
3. In-class training with an instructor.
Evaluation of eMedRec

Of the participants who indicated their organization did eMedRec, approximately half of them reported that they were currently or had previously evaluated their eMedRec process. The three most prevalent performance measures that were used include:

1. Number/percentage of patients reconciled
2. Quality of the intervention
3. Frequency of use

Frequencies of planned evaluations varied from monthly, to quarterly to annually.

Perceived Success of eMedRec

Of the participants who implemented eMedRec, many considered the eMedRec implementation to be “successful” to “very successful” (see Figure C3).

![Figure C3. Perceived success of eMedRec implementation (n=81)](image)
Factors That Support Successful eMedRec Implementation

Participants in the online survey outlined a number of factors that motivate eMedRec implementation that are described below.

Factors that Motivate eMedRec Implementation (n = 79)

As can be seen in Figure C4, the highest reported motivators for eMedRec implementation were:

1. Improving safety through health IT
2. That it was the right thing to do
3. Improving MedRec workflow and efficiency

Figure C4. Ranked reported motivators for implementing eMedRec.
Factors that Led To Successful eMedRec Implementation (n = 69)

As can be seen in Figure C5, the highest reported factors that led to successful eMedRec implementation were:

1. Education of staff about MedRec
2. Senior management support
3. Multi-disciplinary implementation team

Other included: consultant support, time and perseverance, re-engagement, performance audits, webinar on primary care clinics and MedRec.

Figure C5. Ranked reported success factors for implementing eMedRec.

Other included: consultant support, time and perseverance, re-engagement, performance audits, webinar on primary care clinics and MedRec.
Factors that Impede Successful Migration to eMedRec

A number of barriers that deterred organizations from transitioning to eMedRec or made this transition more challenging were identified in the online survey.

Deterrents from Transitioning to eMedRec (n = 114)

Many respondents whose facilities had not yet implemented eMedRec were in the process of developing or deploying eMedRec. Below is a summary of the free-text responses outlining the most prevalent themes that emerged preventing the transition to eMedRec:

- Lack of financial and human resources
- Lack of electronic charting, still using paper charts
- Lack of IT infrastructure
- Lack of eMedRec capabilities in health information systems currently implemented
- Lack of interoperability with
  - Other systems within the facility (e.g., eMAR, CPOE)
  - Other facilities within the region
  - Pharmacies
- Lack of strategy and/or higher level motivation for implementation
- Not prudent to upgrade current system because the adoption of a new health information system is planned
- Contract issues with vendor
- Challenges associated with rural site implementations
- Still in the process of rolling out paper MedRec at admission, transfer and discharge
- Time required for electronic documentation.

Factors that Impede eMedRec Implementation (n = 81)

Survey participants reported a number of challenges to eMedRec implementation. As can be seen in Figure C6, the most frequently reported barriers impeding eMedRec implementation were:

1. Lack of integration with provincial drug information systems
2. Lack of integration amongst electronic record systems outside of the institution
3. Lack of pharmacy human resource support.
<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of integration with provincial drug information systems.</td>
<td>67%</td>
</tr>
<tr>
<td>Lack of integration amongst electronic record systems outside of the institution.</td>
<td>67%</td>
</tr>
<tr>
<td>Lack of pharmacy human resource support.</td>
<td>58%</td>
</tr>
<tr>
<td>Incomplete or missing functionality.</td>
<td>54%</td>
</tr>
<tr>
<td>MedRec process takes too long/lack of time.</td>
<td>54%</td>
</tr>
<tr>
<td>Lack of integration amongst electronic record systems within the institution.</td>
<td>53%</td>
</tr>
<tr>
<td>Lack of education among clinicians about the importance of MedRec.</td>
<td>52%</td>
</tr>
<tr>
<td>Cumbersome electronic record systems (e.g., CPOE, eMAR, pharmacy information)</td>
<td>51%</td>
</tr>
<tr>
<td>Lack of training for clinicians about the electronic MedRec process.</td>
<td>47%</td>
</tr>
<tr>
<td>Lack of uptake among end users (e.g. pharmacists, physicians, nurses).</td>
<td>42%</td>
</tr>
<tr>
<td>Medication list not available.</td>
<td>41%</td>
</tr>
<tr>
<td>Poor integration into clinician workflow.</td>
<td>38%</td>
</tr>
<tr>
<td>Poor design of vendor based electronic MedRec systems.</td>
<td>35%</td>
</tr>
<tr>
<td>Lack of health information technology human resource support.</td>
<td>35%</td>
</tr>
<tr>
<td>Inpatient/outpatient formulary differences.</td>
<td>32%</td>
</tr>
<tr>
<td>Lack of job clarity on who does Medrec.</td>
<td>30%</td>
</tr>
<tr>
<td>Poor usability.</td>
<td>22%</td>
</tr>
</tbody>
</table>

**Figure C6.** Ranked reported factors that impede eMedRec.
What Strategies Can Be Used to Facilitate Moving from Paper to eMedRec?

Strategies for Implementation from Canadian Telephone Interviews

The following are different strategies to consider regarding eMedRec Implementation that were identified during the phone interviews:

- Procure solutions that can grow with and adapt to organization.
- Keep the process the same as paper; just change the data entry method.
  - Try to replicate existing processes in eMedRec.
- Invest the time and resources.
- Get early buy-in and support from senior management.
- Secure key stakeholder involvement right from onset of the initiative.
  - Use a team approach, explain rationale and get feedback from all stakeholders.
- Have a strong commitment, be prepared for eMedRec implementation being a lot of work, and persevere.
- Test the software before rolling it out.
  - With simulated cases before piloting.
  - Pilot on one unit (e.g., internal medicine, preoperative admission).
    - Refine the solution based on findings; it may even require iterative piloting.
- Collaboration between information services and pharmacy was key.
- One-on-one sessions with a MedRec nurse and sometimes a clinical analyst to overcome preconceived notions of the complexity and time required to complete MedRec.
- Emphasize that eMedRec can improve efficiency.
  - Transfer and discharge forms could be printed from the system and make the hybrid process more efficient than manual paper processes.
  - Discharge MedRec could be used to generate discharge prescriptions.
- Examine and optimize workflow.
  - Who is currently responsible for what tasks and where could changes be made to improve efficiency.
- Identify early adopters and use them as champions.
- Have a strategic directive (mandate).
- Standardization is challenging but valuable because consistency improves communication as patients transition between organizations and because providers may work at more than one organization.
  - Develop standardized forms for a province
  - Challenges associated with being a large organization (e.g., getting everyone to agree on the form, different facilities using different software or using the same software in different ways)
  - Form and process are standardized but workflows and responsibilities vary from facility to facility and are developed in-house
- eMedRec does not necessarily sustain itself
  - After implementation on three sites, re-evaluation revealed issues with MedRec at admission (e.g., people could not distinguish between BPMH and actual reconciliation)
  - Strategy to overcome low adoption was continuous /ongoing monitoring (evaluation and audits)
Appendix D – Steps for Transitioning to eMedRec

What are the Steps for Transitioning to eMedRec?

The following steps are key to eMedRec implementation:

1. **Secure senior leadership commitment and support**
2. **Form a team or work with an existing team**
3. **Define the project**
   - Set aims, goals and objectives that fit and align with the overall information technology/information management plan for the organization.
   - Identify project scope and timelines.
   - Identify existing and needed resources to implement and maintain eMedRec.

   - Collect data and assess eMedRec readiness:
     - Assess current MedRec practices and rates.
     - Consider existing levels of automation and available access to electronic resources needed before proceeding (e.g., availability of Electronic Health Records (EHRs), CPOE, and other electronic resources and systems).
     - Describe and map current processes (paper-based as well as those processes carried out by other health IT, such as CPOE).
     - Deploy clinician surveys to assess readiness.
     - Conduct interviews with Health IT staff to determine readiness from an IT perspective.

4. **Work with IT staff to:**
   - Understand the organization’s or province’s short and long term plans for health IT implementation to avoid unnecessary rework.
   - Consider whether the eMedRec solution will be purchased from a Health IT vendor or created, programmed or customized by your organization.
   - Consider whether a purchased eMedRec solution will integrate and be interoperable with existing IT systems and infrastructure (e.g., an EHR, CPOE and Decision Support Systems (DSS) that may already exist within the organization).
   - Assess vendor products to see if they match your organizational processes and needs.

5. **Conduct a selection/procurement of needed electronic components to carry out eMedRec**
   - This may involve usability testing and clinical simulation to assess the impact of the technology upon clinician workflow and current practice.

6. **Design a change management and education program**
   - Consider the level of knowledge of eMedRec tools and processes among clinicians.
   - Develop programs that meet educational needs in terms of conceptually understanding eMedRec in addition to using the software to conduct the eMedRec process.
7. **Start with a small pilot project (e.g., on admission to one hospital unit) and build expertise in eMedRec**
   - Evaluate the pilot project with an emphasis on lessons learned and use this new knowledge to modify the eMedRec tool, institutional policies, procedures and training.
   - Encourage healthcare professionals’ feedback.
   - Provide the resources and support that healthcare professionals need to report issues that may influence patient care (e.g., technology-induced errors).
   - Evaluate and implement improvements.

8. **Implement eMedRec in other parts of the organization. Develop a plan to systematically implement eMedRec at admission, transition and discharge across the organization.**
Appendix E – Ideal Features and Functions of eMedRec

Adapted with permission from Marquis Manual (2011, p. 63 – 65)

<table>
<thead>
<tr>
<th>Features</th>
<th>Functions</th>
</tr>
</thead>
</table>
| Access to electronic source of preadmission medication information | • Community pharmacy prescription data  
• Medication lists from ambulatory EMRs in common use among referring providers  
• Discharge medication orders from recent hospitalizations at participating hospitals and/or hospitals in the region  
• Medication lists from patient personal health records (ideally linked to the ambulatory EMR) |
| Facilitates the comparison of various sources of preadmission medication information | • Each medication listed once  
• Ability to:  
  • See the source(s) of that medication information  
  • See differences in doses, frequencies, routes and formulations for each medication  
  • See dates prescribed/ordered as appropriate for each source  
  • Sort medications by medication name, class, date and source |
| Ability to show patient adherence to medications     | • Calculation of medication possession ratio and/or graphs of medication possession time based on pharmacy fill and refill data  
• Access to any documented information from EMRs and PHRs regarding medication adherence, side effects, intolerances etc. |
| Documentation of the Preadmission medication List (PAML) | • Ability to move preadmission medications into the BPMH, with or without changes  
• Ability to add new medications into the BPMH based on other (non-electronic) sources of information  
• Ability to update the BPMH at any time during the hospitalization  
• Audit trail to document changes to the BPMH made during the course of hospitalization, including when and by whom (person and role) |
| Facilitation of BPMH verification                     | • Sign-off that the BPMH is ready for verification  
• Modify the BPMH to resolve any errors in the history-taking process  
• Document verification of BPMH by a second clinician |
| Facilitation of admission order writing based on the PAML | • Document the planned action on admission for each BPMH medication: continue without changes, continue with changes, substituted for a different medication, temporarily hold, discontinue  
• Ability for continued medications to link to the admission order entry process |
<table>
<thead>
<tr>
<th>Features</th>
<th>Functions</th>
</tr>
</thead>
</table>
| Facilitation of reconciliation at admission  | • Flag differences between BPMH and admission orders  
• Document intentional reasons for changes  
• Modify admission orders as needed to resolve unintentional discrepancies  
• Document verification of admission orders by a second clinician                                                                                                                                                                                                       |
| Facilitation of medication ordering at intra-hospital transfer | • Compare BPMH to current (pre-transfer) inpatient medications (e.g., sorted by class, differences in medications, dose, route, frequency of formulation highlighted)  
• Order medications from either list as Transfer Orders with or without further modification  
• Add new medications at transfer (i.e., not on either list)                                                                                                                                                                                                            |
| Facilitation of medication reconciliation at intra-hospital transfer | • Flag differences among BPMH pre-transfer medications and Transfer Orders  
• Document intentional reasons for changes made to Transfer Orders  
• Modify Transfer Orders as needed to resolve unintentional discrepancies  
• Document verification of transfer orders by a second clinician                                                                                                                                                                                                 |
| Facilitation of medication ordering at hospital discharge | • Compare PAML to current (pre-discharge) inpatient medications (e.g., sorted by class, differences in medications, dose, route, frequency or formulation highlighted)  
• Order medications from either list as Discharge Orders, with or without further modification  
• Add new medications at discharge (i.e., not on either list)  
• Print and sign prescriptions at discharge (from ordered medications)                                                                                                                                                                                                 |
| Facilitation of reconciliation at hospital discharge | • Flag differences among BPMH, pre-discharge medications and Discharge Orders  
• Document reasons for intentional changes made to Discharge Orders (e.g., compared with the BPMH)  
• Modify Discharge Orders as needed to resolve unintentional discrepancies  
• Document verification of Discharge Orders by a second clinician                                                                                                                                                                                                       |
| Tools to facilitate patient/caregiver education | • Print a final discharge medication list in patient-friendly language that clearly indicates (with pictures if possible) the indications of each medication, time(s) of day to take it, number of pills/sprays, etc. with each administration, and common side effects to watch for.  
• Print a picture of each medication (pill, inhaler, etc.) taking into account where the prescription will be filled  
• Clearly explain the differences between preadmission and discharge medication regimens, including which medications are new, which have had changes in dose/frequency/route/formulation, which are to be                                                                 |
<table>
<thead>
<tr>
<th>Features</th>
<th>Functions</th>
</tr>
</thead>
</table>
| Tools to facilitate communication with post-discharge providers | • Clear documentation in the discharge paperwork of the discharge medication regimen, include a clear explanation of changes compared with the preadmission medication regimen and reasons for all changes  
• Ability to transmit this information electronically to post-discharge providers (e.g., to their ambulatory EMR, sub-acute facility EMR, via online portal to hospital’s information systems, or through health information exchange program) |
| Tools to facilitate compliance with medication reconciliation process | • Track timing of BPMH documentation and verification to time of admission  
• Provide alerts, reminders and/or hard stops if BPMH not completed in a timely manner |
| Tools to facilitate other quality improvement efforts | • Automatically identify a patient at high risk for medication problems (e.g., based on the number and/or classes of medication in the BPMH, in admission or discharge orders, and/or based on the number of changes from preadmission to discharge medications) so that further action can be taken |
Appendix F – Measuring MedRec

Measuring Outcomes

Outcome measurement is an important part of assessing the success of your eMedRec implementation as it allows your organization to identify areas of success and those that need improvement. To be able to compare the eMedRec solution to your previous MedRec process, it is important to collect baseline data that will allow you to make comparisons pre and post implementation. Here is a list of the four types of measures, as described by SHN with examples generated that are specific to eMedRec:

**Outcome measures** – Answer whether the team is achieving what it is trying to accomplish and articulate the picture of success.

**eMedRec outcome measure example:** If the goal of eMedRec is to reduce unintentional and undocumented intentional discrepancies, the number of these discrepancies should be measured.

**Process measures** – Processes which directly affect the outcome are measured to ensure that all key changes are being implemented to impact the outcome measure.

**eMedRec process measure example:** The timely availability of the BPMH so that eMedRec can be completed.

**Balancing measures** – Measures that focus on whether improvements in one part of the system were made at the expense of other processes in other parts of the system (e.g., changes in the amount of time pharmacists are able to provide for clinical consultations after eMedRec implementation).

**Information measures** – Measures that collect general details relative to the intervention (e.g., the number of medication reconciliations that take place each month).

Baseline data is important to determine the successful outcomes and to identify new opportunities for improvement, by allowing for comparison of performance before and after eMedRec implementation. Thus, before implementing eMedRec, baseline data should be collected for the following measures in the existing MedRec process (i.e., paper moving to hybrid, or hybrid moving to fully electronic, or paper to fully electronic).

These are the outcome measures, goals, and types of measures of MedRec as outlined by SHN. Also, there are measures that are specific to different settings, such as acute care, home care and long-term care. Although these measures are not specific to eMedRec (i.e., whether the process is paper-based, hybrid, or fully electronic), it is recommended that once eMedRec has been implemented, there is a need to continue to monitor to ensure that the implementation of eMedRec is achieving the expected outcomes and goals of the organization.
**SHN Acute Care Measures**

<table>
<thead>
<tr>
<th>Acute Care MedRec Measure</th>
<th>Goal</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mean Number of Undocumented Intentional Discrepancies per Patient</td>
<td>Decrease 75%</td>
<td>Outcome</td>
</tr>
<tr>
<td>2. Mean number of Unintentional Discrepancies per Patient</td>
<td>Decrease 75%</td>
<td>Outcome</td>
</tr>
<tr>
<td>3. Medication Reconciliation at Discharge</td>
<td>100%</td>
<td>Process</td>
</tr>
<tr>
<td>4. Percentage of Patients Reconciled at Admission</td>
<td>100%</td>
<td>Process</td>
</tr>
</tbody>
</table>

(Shn [Medication Reconciliation in Acute Care Getting Started Kit, 2011](https://example.com))

**Supplementary Acute Care MedRec Measures**

In addition to the measures outlined by SHN, collecting data on the following measures may also be valuable:

- Percentage of patients reconciled at transfer
- Average time to collect BPMH
- Number of re-hospitalizations within 30 days of discharge
- Number of potential adverse drug eents

**SHN Home Care Measures**

<table>
<thead>
<tr>
<th>Home Care MedRec Measure</th>
<th>Goal</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percentage of eligible Home Care clients with a Best Possible Medication History (BPMH)</td>
<td>95%</td>
<td>Process</td>
</tr>
<tr>
<td>2. The average time to complete a Best Possible Medication History (BPMH)</td>
<td>Set</td>
<td>Balancing</td>
</tr>
<tr>
<td>3. Percentage of eligible Home Care clients with at least one discrepancy</td>
<td>Set %</td>
<td>Process</td>
</tr>
<tr>
<td>4. Percentage of Medication Discrepancies Identified by Type</td>
<td>100%</td>
<td>Information</td>
</tr>
</tbody>
</table>

**SHN Long-Term Care Measures**

<table>
<thead>
<tr>
<th>Long-Term Care MedRec Measure</th>
<th>Goal</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mean Number of Undocumented Intentional Discrepancies per Resident in Long-Term Care</td>
<td>95%</td>
<td>Process</td>
</tr>
<tr>
<td>2. Mean number of Unintentional Discrepancies per Resident in Long-Term Care</td>
<td>Set</td>
<td>Balancing</td>
</tr>
<tr>
<td>3. Percentage of Long Term Care Residents Reconciled</td>
<td>Set %</td>
<td>Process</td>
</tr>
<tr>
<td>4. Percentage of Medication Discrepancies Identified by Type</td>
<td>100%</td>
<td>Information</td>
</tr>
</tbody>
</table>
How Do You Monitor and Report on eMedRec?

Once implemented, monitoring eMedRec should be easier and more comprehensive than monitoring paper-based MedRec. That is, criteria can be set to generate automatic reports periodically (e.g., once a month). These reports can convey data that can be used to compare performance among individual units (e.g., surgical vs. emergency), or aggregated across all units. This facilitates knowing when eMedRec goals are met, as well as what specific areas are having more challenges meeting the goals.

Given that the data is collected and stored electronically, performance measure data entry error is limited, and the amount of time to collect the data is reduced. Often as a consequence of the time required to parse the charts and collect the data, only a sample of charts were used to provide an estimate of measures when MedRec was a paper process. However, with eMedRec all of the charts can be used to determine the actual values (as opposed to estimates) of the descriptive statistics.

Safer Healthcare Now!, CPSI, and ISMP Canada developed the Patient Safety Metrics system which is an online measurement and data reporting system to monitor MedRec progress. This free tool is available in English and French and can be customized to meet jurisdictional and provincial requirements.

“The Patient Safety Metrics system allows teams to track their individual performance over time, as well as compare their performance against other hospitals in their region, as well as the aggregate performance across the Safer Healthcare Now!. The system also allows teams to monitor other performance indicators such as the number of sites that have reached the benchmark “goal” for a specific intervention and how long they have sustained their goal.”

Use the following link to find more information about the SHN Patient Safety Metrics System:

Description of the Patient Safety Metrics System

How Do You Evaluate eMedRec Uptake and Effectiveness?

Evaluating Uptake (Compliance)

Measuring compliance is facilitated through eMedRec. For every patient the following can be readily determined:

- Was a BPMH collected?
- How much time elapsed between when the patient was admitted and when the BPMH was collected?
- Was eMedRec used as expected? What percentage of medication reconciliations was completed using electronic tools? What electronic data sources were accessed and how frequently? How accurate are the electronic data sources?
- Were the patient’s medications reconciled at admission? Transfer? Discharge?
- Did the patient receive a BPMDP?
  - Were changes in the medication regimen communicated to the patients in consumer friendly language?
  - Were changes in the medication regimen communicated to the next provider (e.g., family physician)?
  - Were changes in the medication regimen and new prescriptions communicated to the community pharmacy?
Evaluating Effectiveness: Patient Safety and Quality of Care

Effectiveness of eMedRec hinges on the quality of MedRec task performance. That is, whether eMedRec is able to achieve the goal of improving patient safety and quality of care by reducing unintentional discrepancies and undocumented intentional discrepancies, relies to a large extent on how comprehensive the BPMH is. Additionally, each interface in care introduces another opportunity for errors to accumulate or for discrepancies to be reconciled.

Given that using multiple sources of information for the BPMH is considered the gold standard to ensure the accuracy of the information, it is ideal if the eMedRec tool identifies the source of the data. Furthermore, if the eMedRec tool identifies the source of the information (e.g., pill bottle, community pharmacy), data can be collected automatically on whether multiple information sources were used in the collection BPMH.

Recent evaluations of eMedRec have indicated that different types of users may approach the process of using eMedRec quite differently, with important impact on the quality of the medication reconciliation. For example, Boockvar and colleagues (2011) found that some users (particularly those who were not properly instructed on the role, importance and impact of using eMedRec) very quickly used electronic templates and expected the process to be more accurate as it now involves technology. In contrast, other users recognized that the eMedRec templates and screens were only there to support their own decision making and used eMedRec to lead to improved safety outcomes. Having an eMedRec solution may give a false impression that the quality of the BPMH is good because it is in the system. That may not necessarily be the case and quality audits are an integral part of checking that the process used to obtain the BPMH is sound. Therefore, measuring the quality of MedRec using eMedRec audit tools in conjunction with observational and cognitive studies is recommended (Boockvar et al., 2011). Here is a quote from the Brookvar study that illustrates the issue of quality from the perspective of a pharmacist user:

Have somebody really look at the quality of the reconciliation and speak to whoever did it, whether it’s done correctly or not correctly. Because I’ve seen too many people just use the template, click, click, and then sign. You can finish the note [in] two minutes, but it’s not going to be accurate and it’s not going to do the patient any good. (Pharmacist quote)

Additionally, the effectiveness of the eMedRec implementation may be determined by comparing the following measures pre- and post-implementation:

- Number of re-hospitalizations within 30 days of discharge
- Number of potential adverse drug events and number of errors in medication reconciliation (based on audits of records).
Appendix G - The Business Case for MedRec

How Do You Estimate the Impact of eMedRec on Organizational Costs?

The primary return on investment (ROI) reaped through the implementation of eMedRec, as with MedRec, is savings as a result of the reduction of ADEs. The estimated cost of an ADE ranges from $4,800 USD (Bates, Spell, & Cullen, 1997) up to $10,375 USD (Jha, Kuperman, Rittenberg, Teich, & Bates, 2001).

Net Annual Savings Model

In the MARQUIS Manual, Meisel generated the following formula to estimate the net cost savings associated with a MedRec (2005, p. 73):

\[
\text{MULTIPLY} \\
\text{Number of discrepancies per patient} \\
x \text{Number of patients per year that one person can reconcile} \\
x \text{Percent of patients with discrepancies that would result in an ADE} \\
x \text{Percent effectiveness of process} \\
x \text{Cost of an average ADE} \\
= \text{GROSS COST SAVINGS}
\]

\[
\text{SUBTRACT} \\
- \text{Resource investment (staff, equipment, IT)}
\]

\[
= \text{NET COST SAVINGS DUE TO MEDREC IMPLEMENTATION}
\]

Meisel’s formula estimated an annual net savings of $146,250 (325 per cent ROI in a new staff member) using data he collected from his own facility.
**Justification for Pharmacist Performed MedRec**

In addition to general net savings, it may be worthwhile to determine whether there is a financial justification for assigning eMedRec tasks exclusively to pharmacists. In the MARQUIS Manual, Rough (2006) provided an estimate of the savings associated with pharmacist-performed MedRec at admission:

![Table: Pharmacist Justification for Medical History Collection and Reconciliation on Admission](image)

However, the estimated time associated with pharmacists performing medication reconciliation may not be the same for eMedRec. Below, the estimated time is decomposed into obtaining the BPMH and reconciliation tasks.

![Table: Time Requirements for Pharmacist-Obtained Medication Histories and Reconciliation](image)

**Other Sources of Financial Savings**

In addition to financial savings associated with prevented ADEs, “cost savings from reduced readmissions, reduced malpractice costs or increases in revenue from increased market share” (MARQUIS Manual, p. 75) may also be considered motivation for implementing eMedRec.