Effect of an educational intervention on surgical house staff’s medication reconciliation knowledge and practices

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Abstract

**Background:** Medication reconciliation is recognized as an important medication safety initiative. It is acknowledged that a comprehensive education program incorporating new staff training and ongoing instruction is a key success factor for medication reconciliation programs. Despite this, the impact of education on medication reconciliation practices is not well described. Currently, formal medication reconciliation training for physicians at Kingston General Hospital (KGH) is comprised of only a brief overview for new medical house staff during hospital orientation.

**Objectives:** To develop and deliver a medication reconciliation educational intervention within the surgical services at KGH and to evaluate the effect on medication reconciliation compliance, quality, and knowledge.

**Methods:** An educational intervention was developed and delivered to 24 general surgery, orthopaedic surgery, and urology residents. Medical records data were used to measure compliance. Patient charts with a documented Best Possible Medication History (BPMH) by both a pharmacist and a physician who attended the educational intervention were used to measure quality. A total of 20 charts pre-education and 20 charts post-education were randomly selected to evaluate the mean number of discrepancies/number of medications/patient, and their potential clinical significance. Pre-education and post-education tests were administered to measure knowledge.

**Results:** Post-education medication reconciliation compliance significantly increased from 53.8% to 69.8% (P < 0.001). The mean number of BPMH discrepancies/number of medications/patient was significantly reduced (0.72 pre-education versus 0.52 post-education, P < 0.001). There was no difference in the relative distribution of discrepancy clinical significance classes (P = 0.191). No difference in test scores was noted among residents who completed the knowledge tests (57.8% pre-education versus 64.4% post-education, P = 0.317).

**Conclusion:** A medication reconciliation educational intervention delivered to KGH surgical house staff significantly improved compliance with and quality of medication reconciliation documentation. This supports implementation of hospital-wide formal physician education due to the potential patient safety implications.

**Key words:** Medication reconciliation, education, quality

**Word count = 300 words; Manuscript text = 3,496**
**Background:**

Medication related errors are a common occurrence at transitions of care with the potential to result in patient harm. A systematic review of 22 studies was published comparing medication histories obtained by physicians to comprehensive medication histories completed by pharmacists at the time of hospital admission. [1] The investigators found that errors in medication history documentation occurred in up to 67% of cases, with 11% to 59% of these errors considered clinically important.

Medication reconciliation is defined by the World Health Organization (WHO) as “…the formal process in which health care professionals partner with patients to ensure accurate and complete medication information transfer at interfaces of care.” [2] Medication reconciliation has become widely recognized in recent years for its potential benefits to patient safety, including reduction in medication errors and adverse drug events. [3-6] Increased awareness of these benefits has resulted in the WHO including medication reconciliation in the Action on Patient Safety (“High5s”) initiative and the addition of medication reconciliation to the Required Organizational Practices for Canadian hospitals set by Accreditation Canada. [2, 7]

In order to align with medication reconciliation expectations on both the national and global level, Kingston General Hospital (KGH) incorporated medication reconciliation into its 2014-2015 Quality Improvement Plan, with a goal of 100% of patients receiving medication reconciliation on admission by March 31, 2015. [8] The fiscal 2014-2015 report indicated a hospital-wide compliance of only 79% in the final quarter. [9] Evaluation of compliance data by medical service indicates that the surgical services’ compliance is consistently below average, despite development of pre-printed admission orders that incorporate the medication reconciliation process. [9]
The WHO Standard Operating Protocol for Medication Reconciliation recognizes that a comprehensive staff education program incorporating training of new staff as well as ongoing instruction is a key success factor of medication reconciliation programs. [2] Presently KGH incorporates a brief medication reconciliation information session during orientation for house staff entering residency programs; however, a formal ongoing medication reconciliation training program has not been implemented for physicians.

A variety of medication reconciliation education programs directed at medical trainees have been developed and assessed. [10] Interventions studied vary widely, and include didactic sessions, hands-on experiential sessions and simulations. [10] The majority of interventions have been geared toward trainees at the undergraduate or clerkship level, rather than toward practicing medical residents. [10] The outcomes of the interventions evaluated have focused largely on knowledge, attitude, comfort and confidence with respect to medication reconciliation practices. [10] Conversely, there is little published data to suggest that a medication reconciliation educational intervention impacts behaviours related to medication reconciliation, such as compliance and quality of history taking and documentation.
**Purpose:**

The purpose of this study was to develop a medication reconciliation educational intervention intended for surgical house staff at KGH, and to evaluate the intervention’s impact on medication reconciliation knowledge, compliance and quality.
Objectives:

Develop and deliver a medication reconciliation educational intervention to surgical house staff.

Primary outcomes:

Evaluate the effect of the educational intervention on…

1. Compliance with medication reconciliation on admission for patients under surgical services

2. Quality of Best Possible Medication Histories (BPMHs) completed by surgical house staff in terms of:
   a. Frequency of discrepancies
   b. Potential clinical significance of discrepancies

3. Surgical house staff’s knowledge of medication reconciliation processes
Methods:

Study Population:

This study was conducted at KGH, a 440 bed tertiary care teaching hospital located in Kingston, Ontario. KGH house staff enrolled in the Queen’s University General Surgery, Orthopaedic Surgery, and Urology residency programs were eligible to receive the educational intervention. Forty-two house staff were enrolled in these programs. Those individuals who attended the educational intervention were eligible for inclusion in the quality and knowledge analyses. Attending physicians, medical students, surgical fellows, and residents from non-surgical programs were excluded from evaluation in the quality and knowledge analyses. The following adult surgical subspecialties were included in the compliance analysis:

- Cardiac Surgery
- General Surgery
- Neurosurgery
- Orthopaedic Surgery
- Otolaryngology
- Plastic Surgery
- Thoracic Surgery
- Urology
- Vascular Surgery

While not all surgical subspecialties have specific residency programs, residents from General Surgery, Orthopaedic Surgery, and Urology may rotate through these services.

Patient charts were eligible for selection for the BPMH quality analysis if there was a documented BPMH completed by both a pharmacist and a physician who attended the educational intervention in the fiscal quarter immediately prior to or immediately following the educational intervention.
**Study Design:**

A medication reconciliation educational intervention was developed and delivered to Orthopaedic Surgery, General Surgery, and Urology residency programs as part of their respective educational half day curricula. The style of the educational intervention was a combination of didactic and interactive components. The content of the intervention was informed by existing BPMH and medication reconciliation educational materials, however was tailored to the unique audience of practicing house staff who are currently performing these tasks as part of their clinical responsibilities. [11-15] The educational intervention slides are available in Appendix A. The sessions took place on September 23, 2015 (combined General Surgery and Orthopaedic Surgery audience) and September 25, 2015 (Urology audience) and were approximately 30 minutes in duration.

The effect of the educational intervention on each of the primary outcome measures was evaluated using a before and after study design.
**Data Collection:**

**Medication Reconciliation Compliance**

Medication reconciliation compliance was defined as the percent of patients admitted to a surgical service at KGH in a given fiscal quarter who had a medication reconciliation documented by a physician. Change in medication reconciliation compliance was measured by comparing compliance in the fiscal quarter prior to the educational intervention to compliance in the two fiscal quarters following the educational intervention. This data is collected quarterly by KGH Medical Records as part of a hospital-wide medication reconciliation compliance audit. KGH Medical Records reviews charts for each patient and codes each based on the presence or absence of a medication reconciliation completed by a physician and/or a member of the pharmacy team. Compliance data for surgical services was extracted from the hospital-wide data.
BPMH Quality

BPMH quality was quantified by comparing BPMHs collected by physicians and pharmacists and determining:

- The average number of discrepancies/number of medications/patient
- The potential clinical significance of discrepancies

The types of discrepancies noted were: wrong drug, drug omission, drug commission, wrong dose, wrong frequency, wrong administration time, wrong route, drug only, and other. [16] Definitions of discrepancy types are provided in Appendix B.

Potential clinical significance of discrepancies were classified as:

- Class 1: unlikely to cause patient discomfort or clinical deterioration
- Class 2: potential to cause moderate discomfort or clinical deterioration
- Class 3: potential to result in severe discomfort or clinical deterioration [17]

A change in quality was measured by comparing the mean number of discrepancies/ number of medications/patient and the relative proportions of clinical significance classes prior to and following the educational intervention.

KGH Medical Records data was used to identify patients admitted under a surgical service who had a BPMH completed by both a pharmacist and a physician who attended the educational intervention. Twenty patient charts were randomly selected from the fiscal quarter prior to the educational intervention and 20 from the fiscal quarter following the educational intervention. The physician and pharmacist-completed BPMH documentation were compared for each patient. Each discrepancy was documented and classified by type. Two pharmacists independently evaluated each discrepancy to assign a clinical significance class. Disagreements were resolved by discussion and consensus was reached for all discrepancies. The BPMH Quality Audit data collection form is shown in Appendix C.
Medication Reconciliation Process Knowledge

Medication reconciliation process knowledge was quantified using a knowledge assessment test derived from the educational intervention learning objectives. Participants were assigned an anonymous unique code and asked to voluntarily complete a 5-question test hosted via SurveyMonkey® immediately prior to and following the educational intervention. The pre- and post-test questions were identical. The knowledge assessment test questions and answer key may be found in Appendix D. Change in medication reconciliation process knowledge was measured by comparing the pre-test results to the post-test results for each participant who completed both tests.
**Statistical Methods:**

**Medication Reconciliation Compliance Assessment**

Data was entered into Excel files and was imported into IBM SPSS for statistical analysis. The chi-square test was used to evaluate differences in compliance across the fiscal quarters. A multivariable regression analysis was used to evaluate the effect of fiscal quarter and surgical subspecialty on compliance.

**BPMH Quality Assessment**

Mean number of discrepancies/number of medications/patient was evaluated using an independent samples t-test with a two-sided significance of 0.05. The power calculation was informed by a previous study comparing physician and pharmacist medication reconciliation at KGH. [16] This study found patients were on an average of 10 medications and physicians had an average of 6.9 discrepancies/patient. Selection of 20 patient charts in each group with an expected average of 10 medications each (200 medications/group), would provide a power of 99% to detect a reduction from 7 discrepancies (0.7 discrepancies/number of medications/patient) to 5 discrepancies (0.5 discrepancies/number of medications/patient).

The change in relative distribution of discrepancy clinical significance classes was evaluated using the chi-square test.

**Medication Reconciliation Practice Knowledge Assessment**

Change in medication reconciliation knowledge was evaluated using the Wilcoxon Signed Rank test with a two-sided significance of 0.05.

This study was approved by Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board.

There were no actual or potential conflicts of interest among the investigators.
Results:

A total of 24 surgery residents attended an educational session. Attendance represented 57% of residents enrolled in surgery programs (57% General Surgery, 53% Orthopaedic Surgery, 67% Urology). Demographic information is provided in Table 1.

Medication Reconciliation Compliance Assessment

The distribution of admissions across the surgical subspecialties in each quarter is shown in Figure 1. There was no significant difference in representation of each surgical subspecialty between the fiscal quarters (P = 0.845). The subspecialties with the majority of admissions over the 8-month study period were Orthopaedic Surgery (28.4%), General Surgery (26.1%), Urology (11.4%), and Neurosurgery (10.8%).

Results of the medication reconciliation compliance assessment are summarized in Table 2. Total medication reconciliation compliance across all surgical subspecialties in the fiscal quarter prior to the educational intervention was 53.8%. Compliance in the two fiscal quarters following the educational intervention was 69.8% and 66.5%, respectively. This represents a statistically significant absolute increase in compliance of 16% in the first fiscal quarter that was sustained in the second fiscal quarter following the educational intervention (P < 0.001).

Evaluating each subspecialty showed a significant increase in compliance for General Surgery, Neurosurgery, Orthopaedic Surgery, Thoracic Surgery, and Urology. There was no change in compliance for Cardiac Surgery, Otolaryngology, and Vascular Surgery. Plastic surgery had a significant decrease in compliance.

Results of the multivariable regression model shown in Table 3 indicate an odds ratio for medication reconciliation completion of 2.102 (95% CI 1.815 – 2.434, P <0.001) in the first fiscal quarter and 1.760 (95% CI 1.519 – 2.039, P<0.001) in the second fiscal quarter following the educational intervention relative to the pre-education fiscal quarter.
These results indicate a significantly increased likelihood that medication reconciliation would be completed following the educational intervention.

The multivariable regression model also indicated that odds ratios for medication reconciliation completion were not statistically different among General Surgery, Thoracic Surgery, and Vascular Surgery. Relative to General Surgery, Cardiac Surgery was significantly more likely to complete medication reconciliation, whereas Neurosurgery, Orthopaedic Surgery, Otolaryngology, Plastic Surgery, and Urology were significantly less likely to complete medication reconciliation.

**BPMH Quality Assessment**

Characteristics of patients randomly selected for the BPMH quality assessment are summarized in Table 4. The average number of home medications was 10.7 (range 1 – 26 medications). Common admission diagnoses included bowel obstruction (22.5%), fracture (22.5%), and gallbladder disease (10%). The majority of patients selected for the pre-assessment were admitted under General Surgery (85%) and Orthopaedic Surgery (15%). The majority of patients selected for the post-assessment were admitted under Orthopaedic Surgery (50%) and General Surgery (25%).

The results of the BPMH quality assessment are summarized in Table 5. Examples of physician-completed and pharmacist-completed BPMH documentation may be found in Appendices E and F, respectively. Prior to the educational intervention a total of 170 discrepancies among 234 medications were identified, representing an average of 0.72 (± 0.36) discrepancies/number of medications/patient. Following the educational intervention, a total of 101 discrepancies among 194 medications were identified, representing an average of 0.52 (± 0.33) discrepancies/number of medications/patient. A statistically significant absolute decrease of 0.20 discrepancies/number of medications/patient (95% CI 0.13 – 0.27, P < 0.001) was found following the educational intervention. With an average number of 10.7 medications per
patient in this study, this equates to approximately 2 fewer discrepancies per individual patient's BPMH.

Prior to the educational intervention the majority of discrepancies were classified as class 1 (62.9%), followed by class 2 (31.8%), and class 3 (5.3%). Overall there were 9 discrepancies classified as class 3, with the potential to result in severe discomfort or clinical deterioration (Table 6). Following the educational intervention, the same relative distribution of discrepancy classes was noted – class 1 (65.3%), followed by class 2 (33.7%), and class 3 (1%). Only 1 discrepancy was classified as class 3 following the educational intervention. There was no statistically significant difference in the relative proportion of discrepancy classes following the educational intervention (P = 0.191).

The distribution of discrepancy types identified is shown in Figure 3. Prior to the educational intervention the most common type of discrepancy was omission (61.8%), followed by commission (14.7%), wrong frequency (11.2%), and wrong dose (7.1%). There was no significant difference in relative proportions of each discrepancy type following the educational intervention (P = 0.108). There was, however, a trend toward less omissions and commissions and a greater proportion of other discrepancy types.

**Medication Reconciliation Knowledge Assessment**

Results of the medication reconciliation knowledge assessment are summarized in Table 7. Nine of 24 attendees completed both the pre-test and post-test. The average score on the 5-question test prior to the education was 2.9 and following the education was 3.2, representing an average score increase of 0.3 (95% CI -0.435 – 1.102).

Change in individual participant test scores was not statistically significant (P = 0.317). Despite an overall trend to increased test scores following the educational intervention, completion rates of the tests were too low to provide adequate power to detect a difference.
Discussion:

Delivering the medication reconciliation educational intervention increased compliance with medication reconciliation on admission. This increased compliance was maintained in the second fiscal quarter following the education, suggesting that the effect was not significantly diluted over the 6-month post-education study period. There was, however, a non-significant trend to reduced compliance in the second fiscal quarter. This reinforces the recommendation laid out in the WHO Standard Operating Protocol for Medication Reconciliation that ongoing medication reconciliation instruction is required to maintain the success of such programs. [2] Given the short duration of follow-up in this study, we were unable to determine the optimal frequency of continuing medication reconciliation education. This is a potential area for future study.

The increased compliance noted in 5 of 9 individual surgical subspecialties suggests house staff recognized the applicability of medication reconciliation across a wide array of patient groups within the institution. Plastic surgery was the only subspecialty seen to have a reduction in compliance, however this subspecialty has a small number of admissions each quarter and is therefore sensitive to small fluctuations in compliance. Differences noted in the likelihood of completing medication reconciliation across the surgical subspecialties is not fully understood, however may be affected by the rotation schedules of residents attending the educational intervention. The high likelihood of compliance within Cardiac Surgery, however, was likely driven by a clinic-based collaborative practice model in place for planned procedures unique to this subspecialty, whereby pharmacists collect and document the BPMH and physicians reconcile the list to generate admission orders post-operatively. Despite this unique process, the Cardiac Surgery compliance rates were not statistically different across the fiscal quarters, suggesting little confounding effect on the overall compliance data.
The increase in compliance is also significant when considering only 57% of surgical residents attended the education, and a number of non-surgical residents also rotate through the surgical services who would not have received the education. It is likely that compliance would be further improved had more residents received the education.

The decrease in number of discrepancies/number of medications/patient was a positive finding reflective of an improvement in BPMH quality. Interestingly the results of the pre-education BPMH quality assessment were similar to those in a prior study completed within the KGH internal medicine service, where physician-completed BPMHs had on average 0.66 discrepancies/number of medications/patient. This suggests that physician-completed BPMH quality is an issue beyond the surgical department, and the positive effects of medication reconciliation education may be applicable broadly across the hospital. Despite the positive results, there remained a relatively high number of discrepancies identified following the educational intervention. This suggests that a more in-depth and formalized education as well as ongoing instruction may be required to further reduce discrepancies.

Among all patient charts reviewed, class 1 discrepancies were the most commonly identified, representing 64% of all identified discrepancies. This indicates that the majority of discrepancies among physicians’ BPMH documentation are unlikely to cause patient discomfort or clinical deterioration and therefore pose a small risk to patient safety. Overall there was no significant change in the proportion of class 1, class 2 and class 3 discrepancies. This result may have been driven by the fact that class 3 discrepancies, although numerically different between groups, were rare events. Despite the lack of statistical significance, a numerical reduction from 9 to 1 class 3 discrepancies among 20 patients may still be interpreted as a clinically significant finding. These discrepancies have the potential to result in severe patient discomfort or
clinical deterioration, therefore avoidance of a single event is clinically significant from a patient safety perspective.

There was no statistical difference noted in the distribution of discrepancy types. However, there was a trend toward a decreased proportion of omissions and commissions, from 75% to 58%. This may indicate that the educational intervention resulted in more rigorous information gathering in order to obtain a full list of medications actually being taken by patients. Ultimately this would likely have resulted in more medications being listed, and overall more opportunities to identify other discrepancies, such as wrong dose and wrong frequency.

The results of the knowledge test indicate there was no significant change in medication reconciliation practice knowledge following the educational intervention. This assessment was likely underpowered, however, due to the small number of residents completing both tests. Nevertheless, the mean score of 2.9 out of a possible 5 shows participant had reasonable baseline knowledge prior to the education. This suggests that medication reconciliation education is best geared toward achievement of application-type learning objectives that address practical aspects related to the process, rather than addressing knowledge-based learning objectives.
There are a number of limitations to consider when interpreting the results of this study. There are external confounding factors that may have influenced the results of the compliance analysis. Of note, not all admission order sets used in the department of Urology contain the admission medication reconciliation page, likely contributing to the low baseline compliance observed. On January 14, 2016 a new Transurethral Resection of the Prostate and Transurethral Resection of a Bladder Tumour Admission Order Set was implemented that contained the admission medication reconciliation page. This would have contributed to the improved compliance in the Urology service in the second fiscal quarter following the educational intervention. This effect is expected to be small overall as Urology admissions in this quarter represented only 11.3% of the total number of surgical admissions.

In the quality assessment there were differences between the two groups evaluated. Differences were noted in the patient charts selected, including average patient age, number of medications, and admitting service. Additionally, the residents completing medication reconciliation were not matched between groups, potentially resulting in inter-individual variability in competency influencing the quality assessment. Furthermore, not all attendees were randomly selected for inclusion in the quality analysis, and the sample size was not sufficiently large in order to reliably evaluate the change in quality among each individual resident. These considerations suggest that the results of the quality assessment should be interpreted to reflect a global or aggregate assessment of quality, not the performance of any one individual, and ultimately should be interpreted with caution due to the presence of un-accounted for confounding factors.
Conclusion:

A brief medication reconciliation educational intervention significantly increased medication reconciliation compliance and BPMH quality, without significantly impacting process knowledge test scores among surgical house staff at a tertiary teaching hospital. This shows that medication reconciliation education influenced behaviours related to medication reconciliation among practicing surgical house staff for at least 6 months. The optimal frequency of ongoing instruction is unclear and is a potential area of future study. This study indicates a formal medication reconciliation educational intervention has the potential to improve patient health outcomes by reducing the risk of medication related adverse events. These findings may likely be extrapolated to other services within the hospital.
References:


8. *Quality Improvement Plan Narrative for Health Care Organizations in Ontario - Kingston General Hospital.*


15. Riordon, M., *PGY1 Orientation - Pharmacy Session [PowerPoint presentation].*


Table 1: Characteristics of Educational Intervention Attendees

<table>
<thead>
<tr>
<th></th>
<th>Residents who attended education (n)</th>
<th>Total residents (n)</th>
<th>Percent attendance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Surgery</strong></td>
<td>12</td>
<td>21</td>
<td>57.14</td>
</tr>
<tr>
<td></td>
<td>Year 1: 33</td>
<td>Year 2: 25</td>
<td>Year 3: 16.6</td>
</tr>
<tr>
<td></td>
<td>Year 4: 16.6</td>
<td>Year 5: 8.3</td>
<td></td>
</tr>
<tr>
<td><strong>Orthopaedic Surgery</strong></td>
<td>8</td>
<td>15</td>
<td>53.33</td>
</tr>
<tr>
<td></td>
<td>Year 1: 25</td>
<td>Year 2: 0</td>
<td>Year 3: 25</td>
</tr>
<tr>
<td></td>
<td>Year 4: 25</td>
<td>Year 5: 25</td>
<td></td>
</tr>
<tr>
<td><strong>Urology</strong></td>
<td>4</td>
<td>6</td>
<td>66.66</td>
</tr>
<tr>
<td></td>
<td>Year 1: 0</td>
<td>Year 2: 25</td>
<td>Year 3: 25</td>
</tr>
<tr>
<td></td>
<td>Year 4: 25</td>
<td>Year 5: 25</td>
<td></td>
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</tbody>
</table>
### Table 2: Medication Reconciliation Compliance Results

<table>
<thead>
<tr>
<th>Compliance</th>
<th>Pre-education (%)</th>
<th>Post-education Q3 (%)</th>
<th>Post-education Q4 (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>53.8</td>
<td>69.8</td>
<td>66.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiac Surgery</td>
<td>85.0</td>
<td>88.3</td>
<td>90.0</td>
<td>0.432</td>
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<tr>
<td>General Surgery</td>
<td>55.8</td>
<td>82.9</td>
<td>73.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>47.5</td>
<td>64.1</td>
<td>70.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Otolaryngology</td>
<td>31.1</td>
<td>44.7</td>
<td>40.9</td>
<td>0.390</td>
</tr>
<tr>
<td>Orthopaedic Surgery</td>
<td>58.3</td>
<td>66.2</td>
<td>66.2</td>
<td>0.011</td>
</tr>
<tr>
<td>Plastic Surgery</td>
<td>55.1</td>
<td>27.0</td>
<td>29.7</td>
<td>0.012</td>
</tr>
<tr>
<td>Thoracic Surgery</td>
<td>63.0</td>
<td>88.1</td>
<td>71.6</td>
<td>0.005</td>
</tr>
<tr>
<td>Urology</td>
<td>16.8</td>
<td>41.6</td>
<td>36.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Vascular Surgery</td>
<td>69.1</td>
<td>81.0</td>
<td>77.1</td>
<td>0.101</td>
</tr>
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</table>

* fiscal quarter
Table 3: Medication Reconciliation Compliance Multivariable Logistic Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>P-value</th>
<th>95% C.I. Lower</th>
<th>95% C.I. Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal Quarter (Reference - Pre-education)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Post-education Q1</td>
<td>2.102</td>
<td>&lt;0.001</td>
<td>1.815</td>
<td>2.434</td>
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<tr>
<td>Post-education Q2</td>
<td>1.760</td>
<td>&lt;0.001</td>
<td>1.519</td>
<td>2.039</td>
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<tr>
<td>Surgical Subspecialty (Reference - General Surgery)</td>
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<td>Cardiac Surgery</td>
<td>3.054</td>
<td>&lt;0.001</td>
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<td>4.209</td>
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<td>Neurosurgery</td>
<td>0.624</td>
<td>&lt;0.001</td>
<td>0.506</td>
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<td>Orthopedic Surgery</td>
<td>0.723</td>
<td>&lt;0.001</td>
<td>0.616</td>
<td>0.850</td>
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<td>Otolaryngology</td>
<td>0.256</td>
<td>&lt;0.001</td>
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<td>Plastic Surgery</td>
<td>0.268</td>
<td>&lt;0.001</td>
<td>0.182</td>
<td>0.394</td>
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<tr>
<td>Thoracic Surgery</td>
<td>1.211</td>
<td>0.289</td>
<td>0.850</td>
<td>1.726</td>
</tr>
<tr>
<td>Urology</td>
<td>0.183</td>
<td>&lt;0.001</td>
<td>0.147</td>
<td>0.226</td>
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<tr>
<td>Vascular Surgery</td>
<td>1.300</td>
<td>0.064</td>
<td>.985</td>
<td>1.717</td>
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</table>
Table 4: Characteristics of Patients Evaluated in the BPMH Quality Assessment

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>PRE-education (n= 20)</th>
<th>POST-education (n= 20)</th>
<th>Total (n= 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%)</td>
<td>Number (%)</td>
<td>Number (%)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6 (30.0)</td>
<td>9 (45.0)</td>
<td>15 (37.5)</td>
</tr>
<tr>
<td>Age, mean ±SD</td>
<td>58.7 ± 21.0</td>
<td>74.0 ± 14.8</td>
<td>66 ± 16.5</td>
</tr>
<tr>
<td>Average # of home medications on Phar-</td>
<td>11.7 ± 7.0</td>
<td>9.7 ± 5.4</td>
<td>10.7 ± 6.3</td>
</tr>
<tr>
<td>maceutical-completed BPMH ±SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assigned Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac Surgery</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>General Surgery</td>
<td>17 (85.0)</td>
<td>5 (25.0)</td>
<td>22 (55.0)</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>0 (0.0)</td>
<td>1 (5.0)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Otolaryngology</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Orthopaedic Surgery</td>
<td>3 (15.0)</td>
<td>10 (50.0)</td>
<td>13 (32.5)</td>
</tr>
<tr>
<td>Thoracic Surgery</td>
<td>0 (0.0)</td>
<td>1 (5.0)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Urology</td>
<td>0 (0.0)</td>
<td>1 (5.0)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Vascular Surgery</td>
<td>0 (0.0)</td>
<td>2 (10.0)</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Admission Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bowel obstruction</td>
<td>7 (35.0)</td>
<td>2 (10.0)</td>
<td>9 (22.5)</td>
</tr>
<tr>
<td>Gallbladder disease</td>
<td>2 (10.0)</td>
<td>2 (10.0)</td>
<td>4 (10.0)</td>
</tr>
<tr>
<td>Hernia</td>
<td>3 (15.0)</td>
<td>0 (0.0)</td>
<td>3 (7.5)</td>
</tr>
<tr>
<td>Fracture</td>
<td>1 (5.0)</td>
<td>8 (40.0)</td>
<td>9 (22.5)</td>
</tr>
<tr>
<td>Trauma</td>
<td>2 (10.0)</td>
<td>0 (0.0)</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (25.0)</td>
<td>8 (40.0)</td>
<td>13 (32.5)</td>
</tr>
</tbody>
</table>
Table 5: BPMH Quality Assessment Results

<table>
<thead>
<tr>
<th></th>
<th>Pre-education</th>
<th>Post-education</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Medications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>234</td>
<td>194</td>
<td></td>
</tr>
<tr>
<td>Per Patient, mean ± SD</td>
<td>11.7 ± 7.0</td>
<td>9.7 ± 5.4</td>
<td>0.0012</td>
</tr>
<tr>
<td>Number of Discrepancies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Per Patient, mean ± SD</td>
<td>8.5 ± 6.2</td>
<td>5.1 ± 3.3</td>
<td>0.0001</td>
</tr>
<tr>
<td>Per # medications per Patient, mean ± SD</td>
<td>0.72 ± 0.36</td>
<td>0.52 ± 0.33</td>
<td>0.0001</td>
</tr>
<tr>
<td>Discrepancy Significance Class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>107 (62.9)</td>
<td>66 (65.3)</td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>54 (31.8)</td>
<td>34 (33.7)</td>
<td>0.191</td>
</tr>
<tr>
<td>Class 3</td>
<td>9 (5.3)</td>
<td>1 (1.0)</td>
<td></td>
</tr>
<tr>
<td>Discrepancy Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong Drug</td>
<td>1 (0.6)</td>
<td>4 (4.0)</td>
<td></td>
</tr>
<tr>
<td>Omission</td>
<td>105 (61.8)</td>
<td>49 (48.5)</td>
<td></td>
</tr>
<tr>
<td>Commission</td>
<td>25 (14.7)</td>
<td>10 (9.9)</td>
<td></td>
</tr>
<tr>
<td>Wrong Dose</td>
<td>12 (7.1)</td>
<td>14 (13.9)</td>
<td></td>
</tr>
<tr>
<td>Wrong Frequency</td>
<td>19 (11.2)</td>
<td>15 (14.9)</td>
<td>0.108</td>
</tr>
<tr>
<td>Wrong Administration Time</td>
<td>6 (3.5)</td>
<td>3 (3.0)</td>
<td></td>
</tr>
<tr>
<td>Wrong Route</td>
<td>0 (0.0)</td>
<td>3 (3.0)</td>
<td></td>
</tr>
<tr>
<td>Drug Only</td>
<td>1 (0.6)</td>
<td>1 (1.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.6)</td>
<td>2 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Discrepancy Type</td>
<td>Physician Order</td>
<td>Actual Patient Usage*</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------</td>
<td>-----------------------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Pre-education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong Dose</td>
<td>Prednisone 2 mg PO daily</td>
<td>Prednisone 10 mg PO daily</td>
<td>Risk of disease flare (depending on indication) and risk of adrenal suppression with abrupt reduction in dose by 80%</td>
</tr>
<tr>
<td>Omission</td>
<td>N/A†</td>
<td>Hydromorphone LA 24 mg PO BID</td>
<td>Risk of withdrawal with abrupt discontinuation</td>
</tr>
<tr>
<td>Omission</td>
<td>N/A</td>
<td>Venlafaxine XR 37.5 mg PO TID</td>
<td>Risk of withdrawal with abrupt discontinuation</td>
</tr>
<tr>
<td>Omission</td>
<td>N/A</td>
<td>Gabapentin 600 mg PO in the morning and evening and 900 mg QHS</td>
<td>Risk of withdrawal with abrupt discontinuation</td>
</tr>
<tr>
<td>Wrong Frequency</td>
<td>Furosemide 80 mg PO daily</td>
<td>Furosemide 80 mg PO BID</td>
<td>Risks associated with an acute exacerbation of heart failure in the setting of acute illness</td>
</tr>
<tr>
<td>Commission</td>
<td>Citalopram 20 mg PO BID</td>
<td>Patient does not take</td>
<td>Risk of sedation, QT prolongation and other adverse effects with initiation of medication at a high dose</td>
</tr>
<tr>
<td>Commission</td>
<td>Quetiapine 50 mg PO BID and 75 mg PO QHS</td>
<td>Patient does not take</td>
<td>Risk of sedation, QT prolongation and other adverse effects with initiation of medication at a moderate-high dose</td>
</tr>
<tr>
<td>Commission</td>
<td>Trazodone 100 mg PO daily at 21:00 hours</td>
<td>Patient does not take</td>
<td>Risk of sedation with initiation of medication</td>
</tr>
<tr>
<td>Commission</td>
<td>Dabigatran 220 mg PO daily</td>
<td>Patient does not take</td>
<td>Risk of bleeding associated with medication</td>
</tr>
<tr>
<td><strong>Post-education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong Drug</td>
<td>Sulfinpyrazine 1000 mg PO BID</td>
<td>Sulfasalazine EC 1000 mg PO BID</td>
<td>Risk of nephrotoxic, hematologic and other effects of receiving sulfinpyrazine at dose exceeding daily recommended dose of 800 mg as well as risk of exacerbation of disease due to not receiving sulfasalazine EC</td>
</tr>
</tbody>
</table>

*Actual patient usage determined and documented by pharmacist
†Not applicable
Table 7: Medication Reconciliation Knowledge Assessment Results

<table>
<thead>
<tr>
<th>Attendees Completing Tests</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>9</td>
</tr>
<tr>
<td>Percent of Total (n= 24) (%)</td>
<td>37.5</td>
</tr>
<tr>
<td>Pre-education Test Score</td>
<td></td>
</tr>
<tr>
<td>Mean (of a possible 5) ± SD</td>
<td>2.889 ± 0.928</td>
</tr>
<tr>
<td>Mean Percent (%)</td>
<td>57.8</td>
</tr>
<tr>
<td>Post-education Test Score</td>
<td></td>
</tr>
<tr>
<td>Mean (of a possible 5) ± SD</td>
<td>3.222 ± 0.667</td>
</tr>
<tr>
<td>Mean Percent (%)</td>
<td>64.4</td>
</tr>
<tr>
<td>Difference in Mean Test Scores ± SD</td>
<td>0.333 ± 1.000</td>
</tr>
<tr>
<td>P-value</td>
<td>0.317</td>
</tr>
</tbody>
</table>
Figure 1: Distribution of Admissions Across Surgical Subspecialties
Figure 2: Medication Reconciliation Compliance by Surgical Subspecialty and Fiscal Quarter

<table>
<thead>
<tr>
<th>Surgical Subspecialty</th>
<th>PRE-education F2016 Q1</th>
<th>PRE-education F2016 Q2</th>
<th>POST-education F2016 Q3</th>
<th>POST-education F2016 Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Surgery</td>
<td>85%</td>
<td>83%</td>
<td>85%</td>
<td>83%</td>
</tr>
<tr>
<td>General Surgery</td>
<td>66%</td>
<td>64%</td>
<td>66%</td>
<td>64%</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>63%</td>
<td>64%</td>
<td>63%</td>
<td>64%</td>
</tr>
<tr>
<td>Otolaryngology</td>
<td>45%</td>
<td>48%</td>
<td>45%</td>
<td>48%</td>
</tr>
<tr>
<td>Orthopaedic Surgery</td>
<td>58%</td>
<td>59%</td>
<td>59%</td>
<td>59%</td>
</tr>
<tr>
<td>Plastic Surgery</td>
<td>55%</td>
<td>55%</td>
<td>55%</td>
<td>55%</td>
</tr>
<tr>
<td>Thoracic Surgery</td>
<td>88%</td>
<td>88%</td>
<td>88%</td>
<td>88%</td>
</tr>
<tr>
<td>Urology</td>
<td>73%</td>
<td>71%</td>
<td>73%</td>
<td>71%</td>
</tr>
<tr>
<td>Vascular Surgery</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
</tr>
<tr>
<td>TOTAL Compliance</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
</tbody>
</table>
Figure 3: Distribution of BPMH Discrepancy Types

Pre-education

Omission 61%
Comission 14%
Wrong Dose 7%
Frequency 11%
Administration Time 4%
Drug only 1%
Route 0%
Other 1%

Post-education

Omission 48%
Comission 10%
Wrong Dose 14%
Frequency 15%
Wrong Drug 4%
Other 2%
Drug only 1%
Route 3%
Administration Time 3%
Appendix A
Medication Reconciliation Educational Intervention

Medication Reconciliation – A Refresher Course

Leslie Young  BSc Hons, BSc Pharm, PharmD, RPh
Pharmacy Resident

Learning Objectives
- Define medication reconciliation
- Summarize the rationale for completing medication reconciliation for patients
- List possible sources of information to complete a best possible medication history
- Identify documentation requirements for a best possible medication history
- Apply the technical process of medication reconciliation to generate accurate and complete medication orders for patients under your care

What is Medication Reconciliation? KGH

MeSH heading definition:
- The formal process of obtaining a complete and accurate list of each patient’s current home medications,

including name, dosage, frequency, and route of administration,

and comparing admission, transfer, and/or discharge medication orders to that list.

The reconciliation is done to avoid medication errors.

What Are Our Goals?

- Medication Reconciliation on admission
  - KGH Quality Improvement Plan Strategic Performance Indicator
- Goal – 100% of patients
  - Target Outcome
    • All preventable harm to patients is eliminated
- Fiscal 2014-2015 compliance:
Why Medication Reconciliation?

Murphy's Laws of Medication Histories

- Medication lists are out-dated unless proven otherwise
- No two information sources will ever give you the same list of medications for a patient
- Patients will always forget one or more medications if they are not prompted

Best Possible Medication History

- Who?
  - Every patient
- What?
  - A complete list of ALL medications taken
- When?
  - As early as possible following hospital admission
- Where?
  - Form embedded in admission order sets
- Why?
  - The BPMH is the cornerstone of medication reconciliation
- How?
  - By taking a systematic and comprehensive approach

Statistics are based on a recent 5-year study of CMPA medicolegal cases.

Outstanding care, always™

Images adapted from WHO's 5 High 5a MedRec Standard Operating Procedures

Outstanding care, always™

STEP 1

THE BEST POSSIBLE MEDICATION HISTORY

"BPMH"
Best Possible Medication History

- Take a systematic approach
- Access at least TWO information sources
  - Always include patient and/or caregiver interview when possible
  - Other information sources?

BPMH – What to Document

- Prescription medications, physician samples
- OTC/Non-prescription medications
- Supplements, vitamins, minerals
- Herbal products, traditional medicines
  

BPMH – What to Document

- Drug NAME
- Drug DOSE
- ROUTE of administration
- FREQUENCY of use
  - Include INDICATION for PRN medications

*document how the patient actually uses the medication, not simply what’s listed on the medication vial*

ODB Drug Profile Viewer

<table>
<thead>
<tr>
<th>Medications not covered by ODB?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desvenlafaxine ER (Pristiq®) 50 mg PO daily</td>
</tr>
<tr>
<td>OTC medications, supplements, herbs?</td>
</tr>
<tr>
<td>Aspirin 81 mg PO daily</td>
</tr>
<tr>
<td>Interpreting directions?</td>
</tr>
<tr>
<td>Warfarin 2.5mg PO daily</td>
</tr>
<tr>
<td>Metoprolol 25mg PO BID</td>
</tr>
</tbody>
</table>
Community pharmacy record
- OTC medications, supplements, herbals?
- Other pharmacies used?

Blister pack
- PRN medications?
- Inhalers, sprays, patches, creams, injections, eye/ear drops?
- OTC medications, supplements, herbals?

BPMH - What If Scenarios

- What if...
  - Patient has altered LOC and arrives alone?
  - Patient is 30 years old and does not have an ODB DPV claims list?
  - Patient arrives from a long term care facility?
  - Patient arrives following consultation at pre-surgical screening clinic?
  - Patient arrives at 3 am and his pharmacy is closed?

BPMH – Interview Guide

1. What medications are you taking at this time?
2. Have you had any recent hospitalizations or other injuries?
3. Are you currently on any medications that you are taking in a different manner than prescribed?
4. Are you aware of any drug interactions you may be experiencing?
5. Have you had any recent changes in your health or well-being?
6. Are there any medications that you are not taking as prescribed?
7. Are you aware of any side effects or concerns you may be experiencing?
8. Are there any medications that you are taking in a manner that is not prescribed?
9. Are you aware of any drug interactions you may be experiencing?
10. Are there any medications that you are taking in a manner that is not prescribed?

BPMH – Interview Guide

Introduction
- Introduction to the importance of medication history recording.
- Explanation of the reasons why medication history is important.
- Explanation of the steps involved in recording medication history.

Concurrent Medications
- Identify concurrent medications.
- Record the medications and dosages.
- Verify the accuracy of the information.

Medication Schedule
- Establish a medication schedule.
- Record the times and dosages.
- Verify the accuracy of the information.

Prescribed Medications
- Identify prescribed medications.
- Record the medications and dosages.
- Verify the accuracy of the information.

Non-Prescribed Medications
- Identify non-prescribed medications.
- Record the medications and dosages.
- Verify the accuracy of the information.

Allergies
- Identify medications to which you are allergic.
- Record the medications and dosages.
- Verify the accuracy of the information.

Medical History
- Identify medical conditions that affect medication dosing.
- Record the medical conditions.
- Verify the accuracy of the information.

Previous Admissions
- Identify previous hospital admissions.
- Record the hospital admissions.
- Verify the accuracy of the information.

Medication Reconciliation
- Identify medications you are taking now.
- Record the medications.
- Verify the accuracy of the information.

BPMH – Interview Guide

INTRODUCTION
- Introduction to the importance of medication history recording.
- Explanation of the reasons why medication history is important.
- Explanation of the steps involved in recording medication history.

BPMH – Interview Guide

Medication Schedule
- Establish a medication schedule.
- Record the times and dosages.
- Verify the accuracy of the information.

Prescribed Medications
- Identify prescribed medications.
- Record the medications and dosages.
- Verify the accuracy of the information.

Allergies
- Identify medications to which you are allergic.
- Record the medications and dosages.
- Verify the accuracy of the information.

Medical History
- Identify medical conditions that affect medication dosing.
- Record the medical conditions.
- Verify the accuracy of the information.

Previous Admissions
- Identify previous hospital admissions.
- Record the hospital admissions.
- Verify the accuracy of the information.

Medication Reconciliation
- Identify medications you are taking now.
- Record the medications.
- Verify the accuracy of the information.

BPMH – Interview Guide

Medication Schedule
- Establish a medication schedule.
- Record the times and dosages.
- Verify the accuracy of the information.

Prescribed Medications
- Identify prescribed medications.
- Record the medications and dosages.
- Verify the accuracy of the information.

Allergies
- Identify medications to which you are allergic.
- Record the medications and dosages.
- Verify the accuracy of the information.

Medical History
- Identify medical conditions that affect medication dosing.
- Record the medical conditions.
- Verify the accuracy of the information.

Previous Admissions
- Identify previous hospital admissions.
- Record the hospital admissions.
- Verify the accuracy of the information.

Medication Reconciliation
- Identify medications you are taking now.
- Record the medications.
- Verify the accuracy of the information.

BPMH – Interview Guide

Medication Schedule
- Establish a medication schedule.
- Record the times and dosages.
- Verify the accuracy of the information.

Prescribed Medications
- Identify prescribed medications.
- Record the medications and dosages.
- Verify the accuracy of the information.

Allergies
- Identify medications to which you are allergic.
- Record the medications and dosages.
- Verify the accuracy of the information.

Medical History
- Identify medical conditions that affect medication dosing.
- Record the medical conditions.
- Verify the accuracy of the information.

Previous Admissions
- Identify previous hospital admissions.
- Record the hospital admissions.
- Verify the accuracy of the information.

Medication Reconciliation
- Identify medications you are taking now.
- Record the medications.
- Verify the accuracy of the information.
**Surgery Admission Order Set (Adult)**

**ADMISSION ORDERS FOR HOME MEDICATIONS**

**Prescription:** List all outpatient prescriptions, over the counter medications and herbal remedies the patient is taking at home. (i.e., “home medications” at the time of admission and specify the status at admission (i.e., continue, discontinue, or change).

**Order:** Changes in dose, route or frequency of home medications and (2) all new medications started on admission to hospital on the “New Admission Medication Orders” (see page 2 of order).

At Transcription: Only transcribe medications that are identified as “continue.”

<table>
<thead>
<tr>
<th>Medication Name</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Use generic names if possible)</td>
<td>(e.g., PO, SQ, IM, topical, inhal)</td>
<td>(e.g., daily, qid, tid)</td>
<td></td>
</tr>
</tbody>
</table>

**Patient has no home medications**

**Refer to KGH GUIDELINES FOR THE PREOPERATIVE MANAGEMENT OF MEDICATIONS in the KGH Drug Formulary if a surgical intervention is required.**

---

**HOME MEDICATION HISTORY**

**RECONCILIATION**

- **Name:** [Name]
- **Dose:** [Dose]
- **Route:** [Route]
- **Frequency:** [Frequency]

**Discrepancy:**

- [Discrepancy]

**Prescription:**

- **Medication:** [Medication]
- **Dose:** [Dose]
- **Route:** [Route]
- **Frequency:** [Frequency]

**With Administration Orders**

- **Name:** [Name]
- **Dose:** [Dose]
- **Route:** [Route]
- **Frequency:** [Frequency]

**Reconciliation:**

- **Not ordered (Withdrawn)**

---

**Additional Comments:**

[Additional comments]
Spot The Issue

Home Medication History

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramipril</td>
<td>1 mg x 2</td>
<td>NSQ</td>
<td>q.d.</td>
</tr>
<tr>
<td>ASA</td>
<td>100 mg x 2</td>
<td>NSQ</td>
<td>b.i.d.</td>
</tr>
<tr>
<td>Metformin</td>
<td>500 mg x 2</td>
<td>NSQ</td>
<td>q.d.</td>
</tr>
</tbody>
</table>

Reconciliation

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramipril</td>
<td>1 mg x 2</td>
<td>NSQ</td>
<td>q.d.</td>
</tr>
<tr>
<td>ASA</td>
<td>100 mg x 2</td>
<td>NSQ</td>
<td>b.i.d.</td>
</tr>
<tr>
<td>Metformin</td>
<td>500 mg x 2</td>
<td>NSQ</td>
<td>q.d.</td>
</tr>
</tbody>
</table>

Take Home Points

Don't just do it... Do it right!

Be systematic and comprehensive to avoid errors that may harm your patients.

Remember –
Garbage in = Garbage out

What Are Our Goals?

- Goal – 100% of patients receive Medication Reconciliation on admission
  - Target Outcome
    - All preventable harm to patients is eliminated

Medication Reconciliation Compliance

Urology
Orthopedic surgery
General surgery

Cardiology
Neurology

General medicine

How Can We Achieve our Goals?

- Use admission order sets embedding the medication reconciliation process
  - Generic Surgery Admission Order Set
  - Disease-specific Admission Order Sets
    - Admission orders not written on a pre-printed order are NOT counted as a completed Medication Reconciliation

Looking for Resources?

- Queen's University Medication Reconciliation Learning Guide
  - https://meds.queensu.ca/central/assets/modules/mm/
- Sunnybrook e-BPMH training package
  - http://sunnybrook.ca/education/content/?page=education-bpmh-training
- Alberta Health Sciences Med Rec e-Learning Module
- Safer Healthcare Now! Medication Reconciliation in Acute Care Getting Started Kit
Appendix B

Definitions of Discrepancy Types [16]

Wrong Drug: Medication taken by the patient not the same as the one listed on the BPMH.

Omission: Medication taken by the patient but not listed on the BPMH.

Commission: Medication no longer taken by the patient but listed on the BPMH.

Wrong dose: Medication taken at a different dosage than that listed on the BPMH.

Wrong frequency: Medication taken at a different frequency than the one listed on the BPMH.

Administration time: Medication taken at a different time of the day than the one listed on the BPMH.

Wrong route: Medication taken with a different route of administration that the one listed on the BPMH.

Drug only: Medication name was the only information recorded (i.e. without a dosing regimen).
Appendix C

BPMH Quality Audit Data Collection Form

<table>
<thead>
<tr>
<th>Date of Audit (DD/MM/YYYY)</th>
<th>Reviewing Pharmacist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Admission (DD/MM/YYYY)</td>
<td>Assigned ID number</td>
</tr>
<tr>
<td>Assigned Service</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>Sex</td>
</tr>
<tr>
<td>Admission Diagnosis</td>
<td>Total number of discrepancies identified</td>
</tr>
<tr>
<td></td>
<td>Total number of medications on RPh BPMH</td>
</tr>
</tbody>
</table>

Discrepancies Identified in Medication Reconciliation

<table>
<thead>
<tr>
<th>Physician’s Order with Discrepancy*</th>
<th>Type of Discrepancy</th>
<th>Significance (Rater 1)</th>
<th>Significance (Rater 2)</th>
<th>Significance (Consensus)</th>
<th>Discrepancy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Wrong drug</td>
<td>1. Unlikely</td>
<td>1. Unlikely</td>
<td>1. Unlikely</td>
<td>Information regarding how the patient actually takes the medication as per pharmacist-completed BPMH AND discrepancies classified as 'other'</td>
</tr>
<tr>
<td></td>
<td>4. Dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Admin time</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>7. Route</td>
<td></td>
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<tr>
<td></td>
<td>8. Drug only</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>9. Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** if there are multiple discrepancies within a single order each is entered on a separate line

*Omissions are written as documented on the Medication Reconciliation completed by the pharmacist

**Note:** please describe discrepancies with class 3 severity

<table>
<thead>
<tr>
<th>Drug name</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Indicate 1-9</th>
<th>Indicate 1-3</th>
<th>Indicate 1-3</th>
<th>Indicate 1-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>5</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix D
Pre and Post Knowledge Assessment Test Questions

<table>
<thead>
<tr>
<th>Learning Objective Addressed</th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define medication reconciliation</td>
<td>Medication reconciliation is defined as collecting and documenting a comprehensive history of medications a patient is taking prior to hospital admission, including both prescription and non-prescription medications. True False</td>
<td>F</td>
</tr>
<tr>
<td>Summarize the rationale for completing medication reconciliation for patients</td>
<td>Medication reconciliation is an important quality improvement plan performance indicator, with a hospital wide goal of achieving medication reconciliation on admission for 90% of patients. True False</td>
<td>F</td>
</tr>
<tr>
<td>List possible sources of information to complete a best possible medication history</td>
<td>A physician documented a medication history for a newly admitted patient by conducting an interview with the patient and confirming the list with the patient’s ODB drug profile viewer claims list. Accessing these sources of information is adequate to generate a best possible medication history. True False</td>
<td>T</td>
</tr>
<tr>
<td>Identify documentation requirements for a best possible medication history</td>
<td>All of the following must be documented when completing a best possible medication history: Prescription medications, over-the-counter or non-prescription medications, supplements, vitamins, minerals, herbal remedies, and traditional medicines. True False</td>
<td>T</td>
</tr>
<tr>
<td>Apply the technical process of medication reconciliation to generate accurate and complete medication orders for patients under your care</td>
<td>A patient is taking drug Y as an outpatient. On admission you wish to discontinue drug Y as it is causing side effects. When completing the ‘Admission Orders for Home Medications’ in the admission pre-printed order set it is appropriate to omit drug Y from the list of outpatient medications. True False</td>
<td>F</td>
</tr>
</tbody>
</table>
Appendix E

Example of a Physician-Completed Medication Reconciliation

<table>
<thead>
<tr>
<th>Medication Name (Use generic names if possible)</th>
<th>Dose (e.g. mg, mg, units)</th>
<th>Route (e.g. PO, SL, IM, topical, inhaled)</th>
<th>Frequency (e.g. daily, bid, tid) (Include indication for prn medications)</th>
<th>Continue</th>
<th>Discontinue</th>
<th>Change from new revamped Drug Formulary</th>
<th>Approved by</th>
<th>Notified by</th>
<th>Keep at Bedside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metoprolol Tartrate</td>
<td>50 mg</td>
<td>PO</td>
<td>BID</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diltiazem HCl</td>
<td>80 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furosemide</td>
<td>40 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levotyroxine Sodium</td>
<td>112 mcg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olmesartan Medicinal</td>
<td>20 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrochlorothiazide</td>
<td>12.5 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>30 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baclofen</td>
<td>10 mg, 20 mg</td>
<td>PO</td>
<td>AM and Noon, @ HS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nobilon</td>
<td>0.5 mg</td>
<td>PO</td>
<td>evening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celecoxib</td>
<td>200 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supromorphine Patch</td>
<td>20 mg</td>
<td>Transdermal</td>
<td>Applied Sat/Sun, removed on one week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dextroamphetamine Hydrochloride</td>
<td>200 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium Orale</td>
<td>840 mg</td>
<td>PO</td>
<td>daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- Personal medications should be used when the patient has provided verbal consent and the medication is not listed in the hospital Formulary or the medication is a multi-dose preparation. Patients should use their personal eye drops and inhalers whenever possible. Personal topical multi-dose preparations should be kept at the bedside.
- Pharmacy Use Only: Reviewed by: ___ Entered by: ___ Checked by: ___

Prescriber Printed Name | Designation | Signature | Date (YYYYMMDD) | Time (HMM): | Page 3 of 6
Appendix F

Example of a Pharmacist-Completed Medication Reconciliation

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Formulation</th>
<th>Dosage</th>
<th>Frequency</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen</td>
<td>500 mg Cap</td>
<td>3 x day</td>
<td>PM, AM, PM</td>
<td>Pain, Fever</td>
</tr>
<tr>
<td>Metamucil</td>
<td>P Pall</td>
<td>1 x day</td>
<td>PM</td>
<td>Irritable Bowel Syndrome</td>
</tr>
<tr>
<td>Omeprazone</td>
<td>20 mg Tab</td>
<td>1 x day</td>
<td>PM</td>
<td>Dyspepsia</td>
</tr>
<tr>
<td>Losartan</td>
<td>50 mg Cap</td>
<td>1 x day</td>
<td>AM</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Metformin</td>
<td>500 mg Tab</td>
<td>1 x day</td>
<td>AM</td>
<td>Type 2 Diabetes</td>
</tr>
<tr>
<td>Atenolol</td>
<td>100 mg Cap</td>
<td>1 x day</td>
<td>AM</td>
<td>Hypertension</td>
</tr>
</tbody>
</table>

Additional Comments:

- Patient is also taking non-prescription medications:
  - Multivitamin (Multivitamin 10x daily)
  - Fish Oil (3x daily)