Medication Reconciliation Challenges at Discharge from Hospital using an Electronic Medication Management System and Electronic Discharge Summaries

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ABSTRACT
Background: Continuity of care can be facilitated by reconciling changes made to electronic discharge medicines profiles (eDPs) in the electronic medication management system (eMMS) and electronic discharge summaries (eDSs). Aim: To review eDPs containing discrepancies and to discern the proportion of discrepancies reconciled in the eMMS and eDSs.

Method: All eDPs presented to the pharmacy during 4 one-week periods: September/October 2009, March 2011, January 2012, February/March 2012 were reviewed retrospectively. eDPs with changes were identified and the number, type of changes and potential severity assessment were recorded. An eDS was introduced in January 2012, with discharge medicines listed in the eMMS populating the eDSs. eDPs identified by the pharmacist as requiring edits by the prescriber were cross checked with the final version in the eMMS and eDSs.

Results: Number of eDPs reviewed were: 67 (2009), 150 (2011) and 382 (2012). Percentage of eDPs with changes made were: 40% (2009), 33% (2011) and 22% (2012). Percentage of items on eDPs with changes not reconciled in the eMMS were: 100% (2009), 81% (2011) and 31% (2012) (p < 0.0001). Of the eDPs that had changes made, 59% (34) had accurate eDSs in 2012 compared with 11% of handwritten discharge summaries in 2009.

Conclusion: While there has been a substantial improvement in the reconciliation of discharge medicines in the eMMS, further work is required to ensure these are imported into the eDSs so that an accurate list is maintained in both systems.


INTRODUCTION
Medication reconciliation is the process of obtaining, verifying and documenting an accurate list of a patient’s current medicines on admission and comparing it to the admission, transfer and discharge orders to identify and resolve discrepancies. A recent editorial highlighted some startling statistics about the challenges surrounding a patient’s discharge from hospital and the importance of medication reconciliation at the point of discharge. The chance of a patient continuing the same medications at discharge as those on admission is less than 10%. On average, 28% to 40% of a patient’s medications are discontinued during hospitalisation, and 45% of medications prescribed at discharge are initiated during the hospital stay. In another study, more than 60% of patients had three or more changes to their medications during their hospital stay.

This, together with the fact that errors occur at discharge and that the number of errors increases with the number of medications at discharge, makes medication reconciliation at discharge an important focal area for improving continuity of care. Previous studies have shown that 48% of electronic discharge forms faxed to general practitioners (GPs) contained medication errors when compared to the pharmacy copy of the electronic discharge forms. While a subsequent study reported 17% of items on electronic discharge forms had a manual change made to them by a pharmacist and/or a prescriber, 77% were not reconciled in the electronic medication management system (eMMS).

Medication reconciliation at discharge from hospital, involves preparing a complete and accurate list of medicines the patient is to continue taking and details of any changes made during the episode of care. A coordinated and shared responsibility by doctors and pharmacists for medication reconciliation at discharge ensures independent validation and checks.

St Vincent’s Hospital, Sydney, a tertiary referral hospital, implemented the eMMS, MedChart, in 2005. MedChart is used across all inpatient wards, theatres and intensive care units with the exception of the emergency department. On discharge, an electronic discharge medicines profile (eDP) is generated within the eMMS, which serves as a take-home list and as a prescription for supply through the hospital pharmacy to ensure continuity of treatment until the patient is able to obtain further supplies outside the hospital.

An electronic discharge summary (eDS) was introduced in January 2012. Since the discharge medicines section of the eDS is populated by the eDP, a complete and accurate eDP is paramount to ensure medications are accurate on discharge from hospital. This prompted a review of the medical and pharmacy business processes required to prepare an accurate eDP which could be imported into the discharge medicines section of the eDS. Using an eDP to populate the discharge medicines section in the eDS should reduce the errors associated with handwritten and typed discharge summaries, e.g. illegibility, transcription errors, unintentional omissions. Failure to correct discrepancies in the eDP has the potential to cause harm and negatively impact on continuity of care if these are imported into the eDS or remain unreconciled in the eDS and are referred to if the patient is readmitted to hospital.
ELECTRONIC DISCHARGE SUMMARIES

The following key aspects of the medication reconciliation process were highlighted and addressed during the 7-month lead-up period of introducing the hospital’s Medical (Electronic) Discharge Summary and Discharge Medications Procedure:

1. The Medication on Admission (eMOA) module of the eMMS was adopted as the source-of-truth for documenting admission medication histories. Pharmacists were the sole health professionals trained to use the eMOA module for recording medication histories as the eMOA had restricted functionality and usability for doctors. The eMOA provides a list available to any clinician during the patient’s episode of care and at discharge. Other clinicians continue to use medical notes to record medication histories.

2. Identification of eMOA ‘showstoppers’ that restricted doctor buy-in, such as the lack of a comprehensive prescribing function on the eMOA. Functionality enhancements were requested, such as easy one-click prescribing on the inpatient chart and prescribing plan options, to enable automated medication reconciliation across the episode of care.

3. Increased management of discharge prescriptions in the eMMS and reduced paper-based prescriptions. A bulletin was issued by the Director of Clinical Governance advising doctors that every patient must have an eDP completed in the eMMS regardless of whether these medications were being supplied by the hospital pharmacy.

4. Creation of an online tool by the Information Technology Services Centre to facilitate reconciliation of the admission with the discharge medicines. This tool displays the admission and discharge medicine lists side by side, enabling visual medication reconciliation and identification of medications on admission that were withheld and needed recommencing at discharge, and to communicate any changes.

5. Medication reconciliation by pharmacists of eDP revealed discrepancies that required amendments by doctors. If the pharmacist notes a discrepancy on the eDP, this is discussed with the prescriber who must edit and finalise the eDP in the eMMS. The Director of Clinical Governance supported pharmacy business requirements that discharge medicines would not be dispensed from the eDP until the final reconciliation had taken place in the eMMS.

6. Outlining the process of manually importing the eDP into the eDS by doctors. For eDPs which required corrections in the eMMS by the prescriber, the process of reimporting the corrected eDP into the eDS was also stipulated in the Medical (Electronic) Discharge Summary and Discharge Medications Procedure.

7. A free text ‘Details of Medication Change’ in the eDS was created for doctors to communicate reasons for ceased or changed medicines on discharge.

A limited roll out of the eDS and the Medical (Electronic) Discharge Summary and Discharge Medications Procedure began in late December 2011 to a few prescribers. New junior medical officers were trained to use the eDS in the third week of January 2012 and the Medical (Electronic) Discharge Summary and Discharge Medications Procedure was formally implemented in February 2012.

This study aimed to review eDPs containing discrepancies and to discern the proportion of discrepancies reconciled in the eMMS and eDS.

METHOD

Ethics approval for this study was obtained from St Vincent’s Hospital Human Research Ethics Committee. All eDPs presented to the hospital pharmacy during four 1-week periods: September/October 2009, March 2011, January 2012 (the limited roll out period) and February/March 2012 (1 month after the formal launch of the eDS) were reviewed retrospectively.

eDPs with changes were identified and the number and type of changes were recorded. Changes recorded included: frequency, drug, dose, form, duration and any additional or deleted orders made to the prescription. A cross check of the original eDP with the final version in the eMMS and the corresponding eDS (in 2012) was performed to determine whether these changes were reconciled in the eMMS. Chi-square tests were conducted to assess whether the proportion of eDPs with changes not reconciled in the eMMS differed across time periods as the data were categorical.

The NSW Health Severity Assessment Code (SAC) Matrix 2005 was also applied to the errors identified in 2012 to determine the potential consequences of these medication errors had they not been identified. A SAC score of 1 is classified as a high-risk event requiring immediate action, whereas a SAC score of 4 is a low-risk event which can be managed with routine procedures. Each item was reviewed independently by two pharmacists, the resulting scores were averaged and rounded to the nearest whole number.

RESULTS

The eDPs reviewed over the four 1-week periods (2009 to 2012) that had changes made are presented in Figure 1. The complete data set is presented in Table 1. The most common changes to medications are outlined in Table 2. The percentage of items on eDPs with changes that were not reconciled in the eMMS over the four 1-week periods (2009 to 2012) is presented in Figure 2.

In January 2012, 68% (27/40) of eDPs had an eDS available for review, with 67% (18/27) containing the reconciled eDP. In February/March 2012, 86% (31/36) of eDPs had an eDS available for review, with 52% (16/31) containing the reconciled eDP. Of the eDPs that had...
Table 1. Changes made to the eDP in the eMMS

<table>
<thead>
<tr>
<th>Items for review</th>
<th>2012 (Feb/Mar)</th>
<th>2012 (Jan)</th>
<th>2011</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of eDP</td>
<td>195</td>
<td>187</td>
<td>150</td>
<td>67</td>
</tr>
<tr>
<td>eDP with changes</td>
<td>36</td>
<td>40</td>
<td>49</td>
<td>27</td>
</tr>
<tr>
<td>Items for review</td>
<td>1584</td>
<td>1471</td>
<td>1279</td>
<td>510</td>
</tr>
<tr>
<td>Items with changes</td>
<td>58 (4%)</td>
<td>71 (5%)</td>
<td>73 (6%)</td>
<td>54 (11%)</td>
</tr>
<tr>
<td>Items with changes not reconciled in eMMS</td>
<td>20 (35%)</td>
<td>20 (28%)</td>
<td>59 (81%)</td>
<td>54 (100%)</td>
</tr>
</tbody>
</table>

eDP = electronic discharge medicines profile. eMMS = electronic medication management system.

Table 2. Types of changes made to medications not reconciled on the eDP in the eMMS

<table>
<thead>
<tr>
<th>Types of change</th>
<th>2012 (Feb/Mar)</th>
<th>2012 (Jan)</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug changed</td>
<td>1 (2%)</td>
<td>4 (5%)</td>
<td>7 (7%)</td>
</tr>
<tr>
<td>Omission</td>
<td>13 (22%)</td>
<td>25 (33%)</td>
<td>17 (17%)</td>
</tr>
<tr>
<td>Needed to be deleted</td>
<td>11 (18%)</td>
<td>8 (10%)</td>
<td>21 (21%)</td>
</tr>
<tr>
<td>Duplication</td>
<td>0</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>Frequency total</td>
<td>11 (18%)</td>
<td>6 (8%)</td>
<td>26 (26%)</td>
</tr>
<tr>
<td>Dose total</td>
<td>5 (8%)</td>
<td>13 (17%)</td>
<td>12 (12%)</td>
</tr>
<tr>
<td>Duration total</td>
<td>7 (12%)</td>
<td>9 (12%)</td>
<td>13 (13%)</td>
</tr>
<tr>
<td>Presentation/formulation</td>
<td>12 (20%)</td>
<td>10 (13%)</td>
<td>4 (4%)</td>
</tr>
</tbody>
</table>

Table 3. Changes made to the eDPs in the eDS

<table>
<thead>
<tr>
<th>Items for review</th>
<th>2012 (Feb/Mar)</th>
<th>2012 (Jan)</th>
<th>2011</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of eDS</td>
<td>31</td>
<td>27</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Items with changes in eDS</td>
<td>53</td>
<td>46</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Items not reconciled in eDS</td>
<td>20</td>
<td>13</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Items not reconciled in eMMS</td>
<td>12</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Changes not reconciled in eDS</td>
<td>38%</td>
<td>28%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Changes not reconciled in eMMS</td>
<td>23%</td>
<td>22%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>eDS with all items reconciled</td>
<td>16</td>
<td>18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Handwritten discharge summaries with reconciled medication list</td>
<td>-</td>
<td>-</td>
<td>19%</td>
<td>11%</td>
</tr>
</tbody>
</table>

DISCUSSION

The major findings of this study compared to 2009 were a 70-fold increase in the reconciliation of discharge medicines in the eMMS and a 4-fold increase in accurate medicines listed within the discharge summary.

Despite support and mandate from the Director of Clinical Governance that pharmacy would not dispense discharge medicines from the eDP until the reconciliation was complete, in practice pharmacy encountered barriers which affected the dispensary work flow and patient flow. When discrepancies were noted by the pharmacist, the medical team was contacted via telephone to determine the corrections needed on the eDP, i.e. the pharmacist obtained a telephone order from the medical team. Since pharmacists are unable to make changes to the eDP, dispensing discharge medicines from the hand-annotated eDP commenced in the dispensary but was not released until the amended eDP was provided. In some instances, when the reconciled version did not eventuate in time, the pharmacy dispensed from the phone order approved eDP due to pressure from patients wanting to be discharged and the wards needing the beds for new patients.
Our review provides a snapshot of the number of eDPs which are reviewed by a pharmacist over four 1-week periods. One limitation of using a snapshot view is that the sample size is dependent on the number of patients being discharged within pharmacy operating hours. In practice, not all eDPs are reviewed by a pharmacist, i.e. when no supply is required and after hours. Therefore, our numbers do not account for all eDPs available within our institution. Our results highlighted that there has been a positive improvement since 2009 in the level of reconciliation made to eDPs.

Our results were limited by the number of eDS available for review given that the eDS was introduced in 2012. Our results provide a baseline for future audits to assess our progress in improving the level of reconciliation in the eMMS.

There were some difficulties in applying the SAC matrix to these errors. Primarily, because the SAC score is reliant on the consequences which may arise from the error as well as the frequency that the error is likely to reoccur. While there may have been an extreme potential error as well as the frequency that the error is likely to occur. There have been an extreme potential outcome for the discrepancy identified in our study, the pharmacists took a pragmatic approach in determining the SAC score based on the available information and their clinical experience.

To improve medication reconciliation processes at discharge we propose the following recommendations:

1. Maintain independent clinical pharmacy review of eDPs and liaison with doctors to correct discrepancies in a timely manner. This shared responsibility enhances patient care and safety by ensuring eDPs are complete and accurate to minimise medication-related incidents and errors. Future automation possibilities using web services which may improve communication between doctors and pharmacy should be explored, such as notifications when a discharge prescription has been finalised in the eMMS and is ready for clinical pharmacy review.

2. Provide ongoing education and training to doctors to improve the medication reconciliation process so that all changes made to eDPs are re-imported into the eDS to provide accurate information to support continuity of care.

3. Develop fully automated medication reconciliation functionality in the eMMS. Future areas of development include enhancement of the eMOA so that doctors may select a prescribing plan to continue, change, cease, withhold or suspend medications. The use of notification flags via web services and appropriate timed import of the finalised reconciled eDP into the eDS should be developed. This would remove discrepancies and remove the time impost and reliance on doctors to manually import the final reconciled eDP into the eDS.

4. Perform regular audits/compliance reviews to monitor and report on accurate medication reconciliation for discharge medicines and discharge summaries and to identify opportunities for improvement.

In conclusion, while there has been a substantial improvement in the reconciliation of discharge medicines in the eMMS, further work is required to ensure these are imported into the eDS so that an accurate list is maintained in both systems.

Competing interests: None declared.

References

2. St Vincent’s Hospital Management Committee. St Vincent’s Hospital operational procedure: medical (electronic) discharge summary and discharge medications procedure. Darlinghurst: St Vincent’s Hospital Management Committee; 2012.

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