A medication reconciliation form and its impact on the medical record in a paediatric hospital

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Keywords
drugs information, hospital, medication reconciliation, paediatric

Abstract

Objectives The objective of this study was to evaluate the quality of medication information available in medical charts before and after the implementation of a medication reconciliation form.

Patients and methods This study is a retrospective chart review of patients under 18 years who were taking two medications or more at home and were admitted to a paediatric hospital for more than 24 hours and discharged from a general paediatrics, infectious disease, gastroenterology or pneumology ward over two 20-week periods (pre- and post-implementation). Each week, 10 medical records were randomly chosen and reviewed. The quality of the medication information was measured on admission (dose, route of administration and frequency) and on discharge (dose, route of administration, frequency and duration of treatment). The proportion of medications that fully met these criteria was compared between the groups using the chi-squared test.

Results Information was analysed for a total of 3275 medications in the pre-implementation group, vs. 3240 medications in the post-implementation group. Baseline characteristics were similar in both groups. On admission, the quality of medication information was comparable between the pre- and post-implementation groups (29.1 vs. 29.3%, respectively; P=0.86). However, on discharge, an improvement in the quality of information was observed in the post-implementation group (51.7 vs. 65.2%; P<0.001).

Conclusion Our study demonstrated that the forms used in the reconciliation process, in particular the discharge prescription, could increase the quality of the information related to drug use in medical charts. We believe that medication reconciliation forms should be widely used by all the health care professional teams involved in the drug history or prescription process.

Introduction

In 1999, a report by the Institute of Medicine estimated that, annually, up to 98 000 fatalities in the USA were due to medical errors [1]. Medication errors, one of the most frequent medical errors, were among the major issues examined in this report [2]. While the frequency of medication errors in the paediatric population is similar to that observed in the adult population, it is estimated that the risk of serious consequences in children is three times higher [3]. One study conducted in a paediatric academic setting demonstrated that 5.7% of the prescriptions had an error and 31% of the patients were victims of at least one medication error during their hospitalization [3]. Most medication errors (78%) occurred during the prescription phase.

During hospitalization, more than 40% of the prescription errors occur on admission or on discharge [4]. One study identified that in more than 50% of the patients, there was at least one unintended discrepancy between the medications prescribed on admission and the medications regularly taken by the patients [5]. The most frequent error was failing to prescribe a medication on admission, an error that also risked being repeated on discharge.
Many regulatory and accreditation bodies have promoted various strategies aimed at providing safer medical care. One such strategy proposed by the US Institute for Healthcare Improvement and the Canadian Patient Safety Institute was the implementation of medication reconciliation [6,7]. Institute for Healthcare Improvement defines medication reconciliation as ‘creating the most accurate list possible of all medications a patient is taking – including drug name, dosage, frequency and route – and comparing that list against the doctor’s admission, transfer and/or discharge orders with the goal of providing correct medications to the patient at all transition points within the hospital.’ The Medication Reconciliation Handbook provides an operational definition of medication reconciliation: ‘the process of identifying the name, dosage, route and frequency for every medication currently being taken and ordering medication based on reference to this list’ [8]. While medication reconciliation is one of the organizational practices required by the Canadian Council on Health Services Accreditation [9], the extent to which this process is integrated in Canadian health care institutions is still limited according to a pan-Canadian survey in which only 45% of 142 hospitals reported its use [10].

Many studies have demonstrated that medication reconciliation is effective in reducing the number and the severity of unintended discrepancies and adverse drug reactions [11–15]. To implement a successful medication reconciliation process, all the stakeholders need to determine their role in the process and the group as a whole must come to a consensus. To support the process, specific and uniform tools need to be developed to collect relevant information collected by all the health care professionals on a single history form on admission and by doctors on a prescription form on discharge. Both forms should have explicit sections where the professionals can document their intention by drug to stop, modify or continue drug treatment. Patients (or parents) should closely be involved in the process and copies of the form should be provided to the patient for seamless care.

Very few studies distinguish between the advantages linked to the medication reconciliation process itself and the advantages offered by the use of the medication reconciliation form. We hypothesized that the use of the forms for the reconciliation process on patient admission and discharge can increase patient safety by improving the documentation on the decision process for all medications. Thus, the objective of the study was to evaluate the quality of the medication information present in patient medical records, both before and after medication reconciliation forms had been introduced in a paediatric hospital.

Methods

In order to evaluate the quality of the medication information present in patient medical records before and after medication reconciliation implementation, a retrospective chart review was conducted in a 500-bed tertiary paediatric university hospital centre with more than 18,000 annual admissions. The study protocol was approved by the institution’s review board.

The inclusion criteria were: patients under 18 years of age who were taking two medications or more at home and were admitted between October 22, 2006 and March 31, 2007 (pre-implementation group) or between October 21, 2007 and March 29, 2008 (post-implementation group). The patients had to have been admitted to hospital for more than 24 hours and discharged from a general paediatrics, infectious disease, gastroenterology or pneumology ward. The exclusion criteria included patients who were transferred to another hospital and those who died during hospitalization. In order to collect a diversified sample (patient admitted at night or during the day, during weekdays or on weekends, etc.), the first 24 hours of hospitalization during the study period was given a random number. The medical records of the first 10 randomized patients meeting the inclusion criteria were reviewed retrospectively for each week of the 20-week pre- and post-implementation period.

Before the implementation of medication reconciliation, drug histories were mostly accomplished by an emergency department nurse. When hospitalized, a patient’s drug history could be carried out by one or more of the following professionals: nurse, pharmacist, medical intern or resident. Complex drug histories were ascertained by pharmacists during weekdays. No specific form was used.

Medication reconciliation was implemented using two distinct forms: one for drug history and another for the discharge prescription. A copy of these forms remained in the medical record at all times. The drug history form and discharge prescription form were implemented as of October 1, 2007 in the health care units and outpatient clinics. E-mails and internal memos were sent to each unit’s staff in order to advertise their implementation. Informal individual training sessions on its use were given by the investigators to health care professionals in the units included in the study. It was decided that no particular professional would be responsible for the completion of the drug histories. It would be completed in an evolving way in order to collect the most accurate drug with the first 24 hours of hospitalization. Discharge prescriptions were under staff doctor’s responsibility.

With respect to the quality of the medication information on admission, it was measured in terms of the presence of the following compliance criteria for each medication: dose, frequency and route of administration (3 criteria). Other information was collected, such as diagnosis, date, allergies, intolerances, weight, height, body surface and source of the drug history. All the medication information on admission available in the medical record on various forms of the medical charts (e.g. emergency triage form, nursing data collection form, admission note...).was included in the collection. Only the information present in the record in the 24 hours that followed admission was considered, as the literature indicated that medication reconciliation had to be completed within this period [8,16].

With respect to the medications prescribed on discharge, the quality of the information was measured using the presence of the following compliance criteria for each medication: dose, frequency, route of administration and duration of treatment (4 criteria). This measure was applied only to new prescriptions and medications to be continued after discharge. With respect to the medications that were to be discontinued after discharge, the only required compliance criterion was the name of the medication. Other information was collected such as diagnosis, date, allergies, intolerances, weight, height and body surface. All medications prescribed on discharge that were present in the medical record on various forms (e.g. discharge note, hospital summary sheet, medication reconciliation discharge order...) were included in the collection. We used these data to calculate a quality score out of 100 by using a proportion of the criteria found vs. those expected to be present and multiplying by 100.
In order to detect a 10% improvement in the quality of information between the pre-implementation and post-implementation group, the study design required that we recruit 400 patients using an \( \alpha \) bilateral error of 2.5% and a power of 80%. A chi-squared test was used for the category variables and the Student’s \( t \)-test for continuous variables. The data were analysed using the SPSS 15.0 software program (SPSS Inc., Chicago, IL, 2006).

Data on additional information are presented in Table 4. On discharge, the number of forms that mentioned weight, allergies and medications ‘to be discontinued’ or ‘to be continued’ almost doubled in the post-implementation group.

### Discussion

Medication information quality is a key to ensuring patient safety. Our goal was to unify medication information on the medication reconciliation forms, because the use of a large number of forms could cause errors of prescription or administration as a result of conflicting information. Medication reconciliation using an intake form to gather the list of current home medications of admitted patients and a discharge prescription has been suggested in order to increase patient safety. Many hospital centres that use medication reconciliation combine the information on the same form with the discharge prescription [8]. In our centre, medication reconciliation was intentionally divided by using two separate forms. The drug history form could therefore be filled out on admission and modified during hospitalization by all the health care professionals on the multidisciplinary team. The discharge prescription then had to be written out by the doctor, taking into account the treatments received during hospitalization and the medication information collected on patient admission.

Our study demonstrated that the quality of information entered on the single drug history form implemented on patient admission was superior to that on all the other admission forms used previously. Our findings can be compared with those obtained in a study that evaluated medication reconciliation implementation in an ambulatory setting [17]. This study observed an absolute increase of more than 60% in the quantity of medications with all the compliance criteria (name, dose, route of administration and frequency) after implementing medication reconciliation. Nevertheless, the medication lists were considered entirely compliant in only 17% of the cases in the study by Nassaralla et al. [17]. Our study was not able to demonstrate that medication reconciliation implementation improved the quality of medication information present in the medical record over all on patient admission. This finding is likely due to the underutilization of the new drug history form and the lack of consensus about the designated key health care professional (nurse, pharmacist or intern) per ward that should systematically collect that information. The time needed to gather medication information on patient admission is reported to be approximately 10 minutes and may vary from 2 to 35 minutes.

### Results

A total of four hundred patient medical charts from the targeted health care units were included in the analysis. The pre- and post-implementation groups were comparable in terms of baseline characteristics (Table 1). The mean number of admission forms on which medication information was collected was 4.53 ± 1.25 in the pre-implementation group and 4.50 ± 1.34 in the post-implementation group (\( P = 0.79 \)).

On admission, data concerning 2067 medications for the pre-implementation period was compared with that of 2002 medications for the post-implementation period. The quality of the medication information, defined by the presence of 3 criteria, was comparable between the two groups (29.1% vs. 29.3%, respectively; \( P = 0.86 \)) (Table 2). On discharge, 1208 medications were analyzed in the pre-implementation period whereas 1238 medications were studied in the post-implementation period. On discharge, an improvement in the quality of information was observed in the post-implementation group with regard to the quality of medication information, in this case defined by the presence of 4 criteria (51.7% vs. 65.2%, respectively; \( P < 0.001 \)).

Medication information quality was also calculated for each of the forms. On admission, the quality of the information on the medication reconciliation drug history form (64.4%) was higher than that on all the other pre-implementation group forms (\( P < 0.001 \)) (Table 2). On discharge, the quality of the information on the medication reconciliation discharge prescription form (89.3%) was also higher than that on all the other pre-implementation forms (\( P < 0.001 \)) (Table 2). The discharge prescription form was completed in 140 out of 200 post-implementation medical records (70%); however, only 26% of these medical records contained completed drug history forms.

In terms of the criterion analysis of compliance on admission, some minimal differences were observed between the two groups. On discharge, a statistically significant improvement was noted for all the compliance criteria (Table 3).

### Table 1 Patient characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Pre-implementation group (n = 200)</th>
<th>Post-implementation group (n = 200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean length of hospitalization in days (±SD)</td>
<td>6.3 ± 6.5</td>
<td>7.0 ± 13.4</td>
</tr>
<tr>
<td>Units – n (%)</td>
<td>General paediatrics</td>
<td>80 (40.0)</td>
</tr>
<tr>
<td></td>
<td>Infectious diseases</td>
<td>56 (28.0)</td>
</tr>
<tr>
<td></td>
<td>Gastro-enterology and pneumology</td>
<td>64 (32.0)</td>
</tr>
<tr>
<td>Mean number of medications in the medical record (±SD)</td>
<td>10.4 ± 6.6</td>
<td>10.0 ± 6.0</td>
</tr>
<tr>
<td>On admission</td>
<td>6.5 ± 4.4</td>
<td>6.8 ± 4.5</td>
</tr>
</tbody>
</table>

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Table 2. Quality of medication information

<table>
<thead>
<tr>
<th>Forms</th>
<th>Pre-implementation group</th>
<th>Post-implementation group</th>
<th>Mean quality score per source (%)</th>
<th>Quality score</th>
<th>Mean quality score per source (%)</th>
<th>Quality score</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>N/A</td>
<td>N/A</td>
<td>29.1</td>
<td>Medication reconciliation – history (n = 218)</td>
</tr>
<tr>
<td>ED charts (n = 314)</td>
<td>17.8</td>
<td>19.5</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient charts (n = 420)</td>
<td>39.9</td>
<td>39.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge note (n = 427)</td>
<td>37.7</td>
<td>36.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary hospitalization sheet (n = 228)</td>
<td>43.2</td>
<td>42.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary reconciliation note (n = 178)</td>
<td>39.4</td>
<td>36.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge note (n = 458)</td>
<td>51.7</td>
<td>49.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge consultation (n = 367)</td>
<td>31.7</td>
<td>29.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary reconciliation sheet (n = 312)</td>
<td>39.4</td>
<td>36.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge note (n = 458)</td>
<td>51.7</td>
<td>49.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* n: number of medications included in the analysis value was according to the type of form.

† Quality of the information defined by the presence of 3 criteria (dose, frequency, route of administration) on admission and 4 criteria (dose, frequency, route of administration, duration of treatment) on discharge.

‡ Student’s t-test on the difference in means between the information quality of the pre-implementation group and the post-implementation group using the mean quality score.

The difference in the quality of the information on discharge was found to be statistically significant (P < 0.001). The improvement in the quality of information on discharge was due to medication reconciliation discharge prescription form implementation. Analysis using compliance criteria supported the preceding observations.

The quality of information on the discharge prescription form was significantly higher in the post-implementation group than in the pre-implementation group. The higher quality of information contained on the medication reconciliation discharge prescription form even had a favorable impact on the overall quality of the medication information present on discharge. In the post-implementation group, prescribers could not legally write out prescriptions on any other forms than the medication reconciliation discharge prescription form. In our opinion, this partially explains the difference in findings in terms of the quality of the information between the discharge prescription form and the drug history form, for which the quality of the information was not a legal requirement. It is probable that by comparing the quality of information on the medication reconciliation discharge prescription form with the traditional discharge prescription form used in the pre-implementation group (not entered in the medical record), the observed difference would have been less important. In order to measure the differences between the two groups effectively, a prospective study should have been conducted with the pre-implementation group in order to verify the quality of the information on the discharge prescription before it was given to the patient on discharge. Nevertheless, there was more documentation on the medications prescribed on discharge after medication reconciliation implementation. Analysis using compliance criteria supported the preceding observations. The 89% score for information quality on the medication reconciliation discharge prescription form may have been underestimated. In fact, the quality of information collected on the discharge prescription form included ‘to be continued’ drugs, which had to meet the same criteria as the other medications on the form. Very few information was written for ‘to be continued’ drugs, because they were considered as helpful information rather than official prescriptions. Therefore, their inclusion lowered the quality of information score for the discharge form. The implementation of this discharge form gave us important advantages despite the fact that the reconciliation process was not fully implemented on wards as noted earlier.

Our study had some limitations. The absence of a parallel control group did not allow us to ensure that the differences observed between the pre-implementation group and the post-implementation groups were due to medication reconciliation rather than a natural improvement in practice. Our method did not allow us to detect the omission of a medication or the presence of the dosage form (ex. enteric coated). It is an important limitation as these are common medication errors. Furthermore, because this was a single-site study conducted in a university centre, our findings may not be applicable to other settings. However, it is reasonable to think that an improvement in the quality of medication information could be significant in any setting.
Medication reconciliation is known for reducing medication discrepancies in an interdisciplinary continuum. Moreover, our study demonstrated that the forms used in the reconciliation process, in particular the discharge prescription, could increase the quality of the information related to drug use in medical charts. We believe the medication reconciliation forms should be widely used by all the health care professional team involved in the drug history or prescription process. Strong publicity and frequent reminders could improve the use of the drug history form as well as the whole medication reconciliation process.

### Conclusion

Medication reconciliation is known for reducing medication discrepancies in an interdisciplinary continuum. Moreover, our study demonstrated that the forms used in the reconciliation process, in particular the discharge prescription, could increase the quality of the information related to drug use in medical charts. We believe the medication reconciliation forms should be widely used by all the health care professional team involved in the drug history or prescription process. Strong publicity and frequent reminders could improve the use of the drug history form as well as the whole medication reconciliation process.

### References


### Table 3

Information quality based on criterion compliance

<table>
<thead>
<tr>
<th>Number of medications with presence of criterion</th>
<th>Pre-implementation group n (%)</th>
<th>Post-implementation group n (%)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td>n = 2067</td>
<td>n = 2002</td>
<td></td>
</tr>
<tr>
<td>Dose</td>
<td>773 (37.4)</td>
<td>670 (33.5)</td>
<td>0.01</td>
</tr>
<tr>
<td>Frequency</td>
<td>738 (35.7)</td>
<td>758 (37.9)</td>
<td>0.16</td>
</tr>
<tr>
<td>Route of administration</td>
<td>292 (14.1)</td>
<td>330 (16.5)</td>
<td>0.04</td>
</tr>
<tr>
<td>Discharge</td>
<td>n = 1208</td>
<td>n = 1238</td>
<td></td>
</tr>
<tr>
<td>Dose</td>
<td>924 (69.2)</td>
<td>926 (74.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Frequency</td>
<td>620 (47.9)</td>
<td>941 (76.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Route of administration</td>
<td>560 (46.4)</td>
<td>783 (63.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration of treatment</td>
<td>343 (28.4)</td>
<td>638 (51.5)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Chi-squared test.

### Table 4

Additional information

<table>
<thead>
<tr>
<th>Information</th>
<th>Pre-implementation group</th>
<th>Post-implementation group</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>4.10 ± 1.14</td>
<td>3.75 ± 1.27</td>
<td>0.0039</td>
</tr>
<tr>
<td>Weight</td>
<td>2.00 ± 0.97</td>
<td>1.84 ± 1.02</td>
<td>0.109</td>
</tr>
<tr>
<td>Allergies</td>
<td>2.96 ± 1.26</td>
<td>3.12 ± 1.37</td>
<td>0.242</td>
</tr>
<tr>
<td>Address and phone number of the retail pharmacy</td>
<td>0</td>
<td>0.04 ± 0.20</td>
<td>0.004</td>
</tr>
<tr>
<td>Discharge‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>2.41 ± 0.68</td>
<td>2.48 ± 0.98</td>
<td>0.410</td>
</tr>
<tr>
<td>Weight</td>
<td>0.35 ± 0.56</td>
<td>0.83 ± 0.76</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Allergies</td>
<td>0.15 ± 0.44</td>
<td>0.42 ± 0.57</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Medications with ‘to be discontinued’ or ‘to be continued’ mention</td>
<td>0.19 ± 0.51</td>
<td>0.41 ± 0.72</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Student’s t-test on a difference in means.
†Admission (6 forms could be completed for the pre-implementation group and 7 forms for the post-implementation group).
‡Discharge (3 forms could be completed for the pre-implementation group and 4 forms for the post-implementation group).

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