Medication reconciliation in a Swiss hospital: methods, benefits and pitfalls

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ABSTRACT

Objectives To assess the feasibility and main obstacles to the implementation of a medication reconciliation (MR) process in a Swiss hospital and to develop a standardised method which can be used in similar healthcare systems.

Methods For this prospective, observational single-centre and single-ward study, a best possible medication history (BPMH) was established by a clinical pharmacist for 147 patients with heart failure based on two sources and a patient interview for each case. Identified discrepancies with medication histories established during emergency service were conveyed to the ward physician. At the end of each hospital stay, the planned discharge treatments were compared with the BPMHs to identify discrepancies and to propose modifications. After a final validation, the comparative treatment plans were distributed.

Results MR was conducted for 120 (82%) patients and the mean time needed was 74 min/patient. At least one discrepancy was identified among 94% of the patients on admission, with 4.1 discrepancies found per patient (mainly omissions). At discharge, 83% of the patients had at least one discrepancy, with 2.3 discrepancies found per patient (mainly unintentional substitutions). The majority (86%) of pharmaceutical interventions to adjust the discharge prescriptions were accepted by the physician.

Conclusions A standardised method of MR which offers precise definitions of discrepancies and key tools for the process was developed. This method was applicable to most of our cohort and it effectively identified medication discrepancies. Two potential obstacles for its implementation are the time needed for MR and the questionable impact of pharmaceutical interventions on discrepancies.

INTRODUCTION

Adverse drug events (ADE) occur in 5%–40% of hospitalised patients, and in 12%–17% of patients after hospital discharge.¹ A significant portion of them are avoidable.^{2,3} Transitions between hospital and home, on admission or at discharge, can lead to ADE resulting from medication errors such as medication discrepancies, inappropriate prescriptions, poor adherence and inadequate monitoring.

In hospitals, medication discrepancies largely arise due to communication issues at transition steps, with up to 70% of patients having at least one discrepancy between regularly taken drugs at home and hospital-prescribed drugs on admission or discharge.^{4–7} According to the US Institute for Healthcare Improvement, a lack of accuracy in

medication history is responsible for 50% of medication errors and for 20% of ADE in hospitals.⁸ In a recent Spanish study, 50% of medication histories on admission and 83% of discharge prescriptions were incomplete or imprecise.⁹ In another study, 24% of discrepancies on admission were maintained during hospitalisation, while 41% remained at discharge.¹⁰ It has been reported that the majority of discrepancies at discharge result from incomplete, discordant or erroneous data collection on hospital admission.^{4,11} These discrepancies can have both clinical and economic impacts, with an increase in morbidity, mortality, length of hospital stay, medical consultations and early readmission.^{5–8,12}

A medication reconciliation (MR) process can identify many discrepancies and reduce potential harm, yet the impact of this process on clinical outcome is less clear.^{1,13} One way to improve clinical care is to target MR for patients considered at greatest risk of ADE or to include MR in the transition plan from hospital to home.^{1,14,15}

It is well established that MR is important, and many countries already have standardised processes for MR. However, in Switzerland, MR is not widespread. Therefore, the aim of this study was to assess the feasibility and main obstacles to the implementation of an MR process in a Swiss hospital and to develop a standardised method with tools which can be used in similar healthcare systems.

METHODS

This prospective, observational single-centre and single-ward study was conducted between November 2013 and December 2014 at the Service of Internal Medicine of the Lausanne University Hospital, Lausanne, Switzerland. It represents an arm of the study, 'Lowering EARly Readmission of patients hospitalized with Heart Failure' (LEAR-HF), which was designed to assess the efficacy of a multidisciplinary transition plan for a cohort of patients with heart failure¹⁶ (Garnier A *et al*, under review, 2017). A nurse collected information sources regarding drugs taken and was responsible for therapeutic education and follow-up after discharge, while a clinical pharmacist performed the whole MR and the physician was responsible for prescriptions administered throughout the hospital stay and at discharge.

All of the participating patients signed a written consent.

Patients

Enrolled patients were hospitalised with symptomatic heart failure (New York Heart Association

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scoring >1) and discharged home. Patients undergoing haemodialysis and those listed for heart transplantation were excluded.

Methods of reconciliation

Admission

More than 90% of patients of our service are admitted through the emergency service (emergency room, ER) where a first medication history is completed as a free text. The sources are neither referenced nor transmitted to the ward. A list of prescriptions is generated based on this history which is rarely reviewed by the physician in charge.

After consent and information sources for drugs were obtained by a transition nurse, a clinical pharmacist performed an MR based on: (1) one medical source (a general practitioner (GP) or a discharge report generated within the past 6 months); and (2) one practical source (treatment plan, label of a pillbox, drug boxes or information provided by the outpatient pharmacy). The pharmacist then extracted diagnostics and comorbidities from each patient's electronic medical record to determine if the patient received treatment for all relevant diagnoses and complete the medication history with target questions if necessary. Both sources were compared and a structured interview with the patient was conducted to obtain a best possible medication history (BPMH). Each drug name, dosage and schedule were validated by the patient. Adherence to prescribed doses was assessed based on questions regarding the usefulness, side effects and drug issues that the patient could report. Afterwards, each BPMH was compared with the corresponding ER medication history to record discrepancies. The BPMH was transmitted to the physician in charge and the pharmacist informed him, both orally and in writing, of all discrepancies and adherence problems identified.

Discharge

At the end of each hospital stay, the physician prepares a discharge prescription in the computerised prescription system (computerised physician order entry, CPOE). The discharge prescription is based on the hospital prescription with no tool to compare it with the medication history.

For MR, the clinical pharmacist compared the discharge prescription with the BPMH. Differences observed were analysed to define if they were intentional (adaptation of medication during hospitalisation) or unintentional (discrepancies). If no documentation was found in the medical record, they were discussed with the physician. The pharmacist then proposed modifications for all of the identified discrepancies, and integrated clinical interventions to enhance therapeutic adherence (eg, simplification of schedule or change of pharmaceutical form if barriers were detected on admission) or safety (eg, significant interactions) if needed. After a final validation of the discharge prescription, the clinical pharmacist wrote a comparative treatment plan (three-copy paper form), which was provided to the patient by the physician for discharge, to the outpatient pharmacy with the discharge prescription and to the GP by fax.

The pharmacist recorded the time needed for the various steps of the MR process, the number and types of discrepancies, and the number and acceptability of pharmaceutical interventions at discharge. The feasibility was assessed by the proportion of patients to whom MR was applied.

Definitions

To standardise a method for MR, discrepancies were precisely defined and were adapted from various sources and clinical experience.^{8–11 17} Initially, unintentional differences were classified as discrepancies if appropriate. Next, these discrepancies were determined to be relevant or not. This was especially useful for omissions on admission and for determinations of which

Table 1 Definitions and examples of discrepancies

Category of discrepancy	Definition	Considered a discrepancy	Not considered a discrepancy
Discrepancies	Unintentional differences between documented medication histories		
Omission	A drug not present in the medication history or the discharge treatment which is used or still needed	Calcium-vitamin D ₃ hold during hospital stay and not prescribed at discharge	Drugs identified with the checklist on admission without regular or medical use: <ul style="list-style-type: none"> ► PRN or OTC drugs taken less than once per week ► Temporary or seasonal treatment (eg, nasal drops, hay fever drugs) ► Creams used as cosmetics (eg, moisturisers) ► Herbal teas ► Dietary supplements
Addition	A drug present in the medication history or the discharge treatment which is not taken or not necessary	PRN analgesics never taken in hospital yet prescribed at discharge; sleeping pills introduced during hospitalisation but not necessary at home	A drug cited on admission but specified as being 'stopped by the patient' or 'used occasionally'
Substitution	A wrong or inaccurate commercial name	Confusion between brand names and generic names where the patient could think they are two different drugs	Confusion between two generics with almost the same name or from a different manufacturer
Dose	A wrong or inaccurate total daily dose or number of pills per dose, or a missing dose	Lisinopril 10 mg by mouth once a day vs 1/2-0-0-0	Alendronate once per week (only one dose possible)
Frequency	A wrong, inaccurate or missing frequency	Acetaminophen taken daily when documented as PRN or vice versa	If the frequency was not mentioned for the PRN drugs on admission
Schedule	A wrong or missing schedule, but only if it was not implicit or clinically relevant	Acenocoumarol 1 mg by mouth once a day	Ramipril 5 mg by mouth once a day (supposed to be taken in the morning and not clinically relevant)
Formulation	A wrong or missing pharmaceutical form, but only if it was not implicit or clinically relevant	Salmeterol Diskus versus aerosol	Tablets versus capsules

OTC, over the counter; PRN, as needed.

Table 2 Relevance of discrepancies: examples of omissions on admission

Relevant discrepancy	Non-relevant discrepancy
PRN drug taken more than once per week (eg, laxatives, analgesics, sleeping pills)	Analgesics for headache Antacids after specific meals
OTC drug taken every day (eg, topical NSAIDs, vitamins, mineral salts)	Homeopathy Phytotherapy if not clinically relevant Dietary supplements
Drops for glaucoma	Nasal drops
Artificial tears used every day	Artificial tears used occasionally
Topical oestrogens	Topical antivaricose therapy
Emergency drugs, even if taken less than once per week (eg, nitroglycerin, antiasthmatic sprays)	
Scheduled interval drugs (eg, injections of vitamin B ₁₂ once per month)	
NSAID, non-steroidal anti-inflammatory drug; OTC, over the counter; PRN, as needed.	

drug should be included in the BPMH. Definitions and examples are provided in [tables 1 and 2](#).

Tools

Checklist for patient interview

A structured document was developed with a checklist to identify drugs frequently not documented or forgotten during a medication history: 'Not swallowed' medications (eg, topical drops, sprays, creams, patches, suppositories), 'as needed' drugs (eg, analgesics, laxatives, sleeping pills) and 'over the counter' drugs (eg, vitamins, mineral salts, dietary supplements, phytotherapy, homeopathy).

Comparative treatment plan

A comparative treatment plan explaining every modification from the BPMH was transmitted to the patient, the outpatient pharmacy and the GP to highlight the results of the MR and to optimise the transition plan. The plan included three sections: drugs introduced, drugs modified (with before-after comparison) and drugs discontinued (accompanied by the reasons). Additional information was integrated to improve adherence or comprehension (eg, indication of each medication).

RESULTS

There were 147 patients in the LEAR-HF study. MR was applied to 120 (82%) of our patient cohort: 111 patients on admission and 101 patients at discharge. Twenty-seven patients did not receive any intervention because the time was too short between their inclusion in the study and their discharge, 9 patients were dropped on admission because they had already been included and were readmitted a few days after discharge, and 19 patients were missed because they were hastily or unexpectedly discharged. The mean time needed by the pharmacist was 74 min/patient. In addition, the transition nurse needed ~13 min to collect drug sources and the physician needed ~15 min to discuss discrepancies ([table 3](#)).

Patients and sources

The mean number of drugs reported on admission was 9.1, and at discharge 10.2. Approximately 70% of the patients managed their own drug treatment. For 63% of the subjects, the medical source used was a previous discharge report from our hospital.

Table 3 Time needed for MR (mean±SD/patient)

	Clinical pharmacist*	Transition nurse†	Physician in charge‡	Total time
On admission	31±8 min	13 min	5 min	64 min
Patient interview	15±5 min			
At discharge	28±9 min	—	10 min	38 min
Total time	74±15 min	13 min	15 min	102 min

*Measured times.

†Mean estimated time for the collection of drug sources from eight consecutively enrolled patients.

‡Mean estimated times to discuss discrepancies.

MR, medication reconciliation.

Information from a GP was used in 33% of the cases. The practical source for 58% of the patients was a treatment plan or the label of a pillbox, while information for 14% and 12% of the patients was obtained from the outpatient pharmacy or drug boxes, respectively. No medical source and no practical source could be found for 4% and 16% of the participating patients, respectively. For these patients, their MR was completed with only one source.

Characteristics of the patients examined and their attitudes towards their treatments are reported in [table 4](#).

Discrepancies

On admission, 1028 drugs were recorded by the clinical pharmacist for BPMHs. Among the 111 patients who underwent MR, 94% had at least one discrepancy in their admission medication history established in the ER. The mean number of discrepancies was 4.1/patient (456/111). The types of discrepancies are reported in [figure 1](#).

Table 4 Characteristics of the heart failure cohort assessed in this study (n=120)

Patient characteristics	n
Male	70 (58.3%)
Female	50 (41.7%)
Age (years), mean±SD	78.1±10.5
Number of drugs on admission*, mean±SD (interval)	9.1±4.4 (0–22)
Number of drugs at discharge†, mean±SD (interval)	10.2±3.6 (2–22)
Drug treatment management performed by:	
Patient	85 (70.8%)
Home healthcare facility	23 (19.2%)
Family member(s)	9 (7.5%)
Outpatient pharmacy	3 (2.5%)
Attitude towards treatment‡	n (%)
Knowledge	
All of the drugs named (or approximately named)	73 (67)
Indication of every drug known	56 (50)
Use of undocumented drugs	66 (60)
Use of phytotherapy and homeopathy	28 (25)
Adherence barrier	
Reticence regarding the usefulness of one or more drugs	22 (20)
Side effects experienced	17 (15)
Technical difficulty with administration	11 (10)
Time difficulty with administration	11 (10)
Reported oversights or treatment interruptions	12 (11)

*After best possible medication history (BPMH).

†n=101.

‡n=111 (patients interviewed).

^a recorded in the admission medication history established in the ER

^b recorded in the discharge prescription prepared in the CPOE

Figure 1 Numbers and types of drug discrepancies that were identified compared with the best possible medication histories (BPMH). CPOE, computerised physician order entry; ER, emergency room.

Patient interviews identified 148 drugs that were not previously documented. Most of these drugs were comfort products or drugs that were only used occasionally (eg, artificial tears, topical anti-inflammatories, laxatives) and were not included in the BPMH unless the patient specifically asked for them. Twenty-eight drugs were considered relevant and were included in the BPMHs.

At discharge, 902 drugs retained in the BPMHs were compared with the discharge prescriptions prepared in the CPOE. Among 101 patients, 83% had at least one discrepancy in the treatment planned by the physician, with a total of 231 discrepancies identified (mean, 2.3/patient). Furthermore, 49% of the discrepancies represented unintentional substitutions and 26% represented omissions (figure 1).

Pharmaceutical interventions

Among the discharge MRs, the clinical pharmacist proposed 273 changes (six interventions on discrepancies were missed because the physician could not be reached). As a result, 89% of the 101 patients needed pharmaceutical interventions, with the mean number of proposed changes per patient being 2.7 (range, 0–11). Most interventions concerned discrepancies, although 18% of them were clinical interventions to enhance therapeutic adherence or patient safety. Details regarding these recommendations and their acceptance are reported in table 5.

Table 5 Pharmaceutical interventions proposed to optimise discharge treatments

Type of proposition	Total number	Number accepted	% Accepted
Omission	55	39	71
Substitution	113	109	97
Dose	15	11	73
Addition	16	13	81
Frequency of dose	3	3	100
Schedule of dose	19	15	79
Formulation	4	3	75
Adherence/security*	48	42	88
Total	273	235	86

*For example, error in dose regimen, significant interactions, duration of treatment, simplification of schedule or dosage.

DISCUSSION

Method and feasibility

To date, a large volume of literature exists regarding the processes and outcomes of MR, although wide variations exist in the methodology and terminology used. Our proposed method is reproducible due to the detailed process, precise definitions of discrepancies and key tools provided for patient interviews and transition plans. Precise definitions help provide focus regarding relevant discrepancies, while the key tools can be used by other healthcare professionals and could be integrated in the CPOE.

In the present study, MR was applied to 82% of our patient cohort. We observed that MR was suitable in our conditions, but two points could be optimised to enhance its feasibility: first the process must begin as soon as possible after admission and the organisation needed for patient discharge should not be underestimated. The latter is particularly important to ensure patient safety and continuity of care. To achieve this, the real place of this activity has to be more recognised in Swiss hospitals.

Benefits

Many studies have demonstrated that medication discrepancies are frequent on admission and discharge and that MR can identify them effectively.^{4–7} Compared with two studies with similar profiles regarding approach, definitions and healthcare systems,^{8,10} discrepancies on admission were more frequent in the present study (4.1/patient vs 3.2/patient⁸ and 3.4/patient¹⁰). We attribute this difference to external factors. For example, our cohort had a high number of drugs (9.1 drugs after reconciliation vs 6.0⁸ and 7.2)¹⁰ and frequent changes in medication. Both studies reported a positive correlation between the number of drugs on admission and the number of discrepancies observed. Second, medical histories were obtained in a time-constrained ER environment compared with a geriatric ward.¹⁰ Medication histories were also recorded as free text in a computerised system, thus many inaccurate or imprecise data were recorded. The latter result is consistent with that of a Spanish study where 44% of discrepancies on admission were found to be caused by incomplete data collection in the ER.⁹ Thus, MR on admission was particularly beneficial in our environment and with patients with heart failure.

Two key tools for our proposed MR process are a checklist for use during patient interviews and the development of a treatment plan in comparison to the BPMH. In accordance with a Finnish study showing that 63% of individuals in long-term home care were taking more drugs than indicated in their file,¹⁸ we found by using the checklist that 60% of our patients were using undocumented drugs, which included a total of 148 drugs. Regarding the treatment plan, all of the discrepancies with the BPMH had been corrected or were explained (adaptation of medication during hospitalisation). Moreover, this document provided at the right moment the same information to the patient, the outpatient pharmacist and the GP. As such, this document was an essential element for establishing a transition plan and these two tools improved the traditional practice.

In general, pharmaceutical interventions at discharge were intended to warrant continuity of care and not to provide a medication review or therapeutic education. However, in 48 cases (18% of the interventions), the pharmacist needed to intervene outside of the context of the discrepancies to increase therapeutic adherence or patient safety. These interventions were widely accepted by the physicians involved (88%) and they indicate that clinical pharmacists can add value to MR at discharge.

Pitfalls

The two main obstacles for implementation of an MR process are the time needed and an ability to demonstrate the value of the time investment in reducing discrepancies. In the present study, the mean time needed by the pharmacist for MR on admission was 46 min/patient, plus 13 min for the transition nurse to collect drug sources, and at discharge 28 min/patient. In comparison, other studies have reported times of 15–44 min/patient on admission and 34 min/patient at discharge for MR.^{5 10 11 17 19} The time invested by the pharmacist was substantially extended because he/she had to report information on formularies. Consequently, an electronic tool is key for the input, analysis, comparison and distribution of MR information. Furthermore, the sharing of responsibilities among different healthcare professionals in a coordinated manner distributes the burden inherent to this process.

The clinical impact of observed discrepancies on patient safety is questionable. The majority of the discrepancies identified involved omissions on admission and unintentional substitutions at discharge. However, only 28 of the 148 drugs that were not previously documented and were identified by our checklist on admission were considered relevant by the pharmacist and were included in the BPMH. Meanwhile, pharmaceutical interventions for the unintended substitutions at discharge were mostly accepted, but added little value, and it is possible that an adapted computerised tool could correct the latter automatically. Contrariwise, more notable pharmaceutical interventions at discharge that involved omissions or dose discrepancies were not accepted while they could impact treatments and their effectiveness. The reason was that since pharmaceutical intervention on admission was not performed, medication histories were rarely corrected. Therefore, some omitted drugs were not restarted during hospitalisation and the physician considered them useless to prescribe them again (eg, antidepressants), while some doses were not corrected and it was deemed too dangerous to change them at discharge (eg, antihypertensive drugs). Thus, the goal of an effective MR process is to focus interventions on significant discrepancies, to correct medication histories and to prevent discrepancies at discharge. Previously, when MR was performed prior to an admission medication order, the percentage of patients with at least one discrepancy was reduced from 46% to 2%.¹⁹

Limitations

The present study had several limitations. First, it was conducted in a single ward with high-risk patients and there was no comparison group or historic comparison. Second, the potential harm of the observed discrepancies both in hospital and after discharge was not evaluated, unlike in other studies.^{5 8 19}

The proposed method also has limitations. First, the feasibility on admission is potentially biased. Our cohort of patients was particularly collaborative, alert, had undergone frequent hospitalisations and had good ambulatory follow-up. Consequently, the interview and time spent to collect the drug sources were probably facilitated. The method has to be validated in a population of standard patients. Then, despite the systematic use of two drug sources and an interview of each patient, the BPMH obtained may not have been entirely accurate. We made several subjective choices, including designating preferred sources when the

patient could not clarify an information and making decisions regarding which undocumented drugs were included in the BPMH. These elements should be organised and validated before implementing the MR process. Finally, the MR was applied only by two persons (a clinical pharmacist and his/her substitute). The process has to be conducted by other healthcare professionals to assess its feasibility and detect other potential obstacles for implementation.

CONCLUSIONS

A standardised and reproducible method of MR was developed. Precise definitions of discrepancies combined with a checklist for patient interview and a comparative treatment plan are its key features. This method was applied to most of our cohort patients and effectively identified medication discrepancies. Two potential obstacles for implementation of this method are the time needed for this process and the questionable clinical impact of observed discrepancies. To address these, clinical pharmacists must be supported by an effective electronic tool and by other healthcare professionals and the clinical impact must be optimised by focusing and communicating effectively on significant discrepancies.

What this paper adds

What is already known on this subject

- Medication discrepancies frequently occur on admission and at discharge in hospitals and medication reconciliation can effectively identify them.
- There are wide variations in the methodology and terminology currently used in this field.
- Medication reconciliation is a time-consuming process and its clinical impact must be demonstrated to support its implementation.

What this study adds

- Our method includes precise definitions of discrepancies to ensure its reproducibility and to focus efforts on addressing relevant discrepancies.
- We developed two key tools for medication reconciliation: a checklist for interviews to detect discrepancies on admission and a comparative treatment plan that can be distributed at discharge.
- The key tools can be used by other healthcare professionals and be integrated in the computerised prescription system.

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