Experiences from the implementation of structured patient discharge information for safe medication reconciliation at a Swedish university hospital

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Experiences from the implementation of structured patient discharge information for safe medication reconciliation at a Swedish university hospital

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Abstract

Study objectives: A method for medication reconciliation that reduces medication errors and healthcare contacts when a patient is discharged from hospital, LIMM-DI (Lund integrated medicines management-discharge information) had been previously developed by the authors. LIMM-DI is structured information written for the patient and sent to the next caregiver. In this study, the use (implementation ratio) and errors when used were measured.

Methods: During two three-week periods in 2008 and 2009 information on the use of LIMM-DI for every discharged patient at Skåne University Hospital in Lund, Sweden was collected. Medication errors and quality by chart reviews based on a previously developed checklist were also measured. The focus was placed on the medication report—which medications have been changed and why—and the medication list, two vital parts of LIMM-DI.

Results: One hundred and thirty eight (27%) and 163 (31%) of the patients received LIMM-DI in periods 1 and 2, respectively. The mean number of errors per patient decreased from period 1 to 2 in the medication list (6.5 [standard deviation, SD, 6.0] versus 3.9 (SD, 4.2), p = 0.00098) but not in the medication report (5.3 [SD, 6.3] versus 5.3 [SD, 5.9], p = 0.99).

Conclusion: Contrary to expectations, the implementation of LIMM-DI was slow and there was no great reduction in the number of medication errors. There is a need to improve the current strategy and to consider alternative strategies for improving patient safety in the discharge medication reconciliation process.

Keywords

Discharge information, hospital, medication errors/report, medication reconciliation, quality

Introduction

Medication error has been defined as 'Any error in the process of prescribing, dispensing, or administering a drug, whether there are adverse consequences or not' [1]. Patients, in particular the elderly, are often moved between different settings in the healthcare system. At all transitions, but especially on admission to, and discharge from a hospital, there are several factors that can lead to medication errors. Among the most common are omission and commission errors of drugs, errors in dose and pharmaceutical formulation. Experience from hundreds of organisations has shown that poor communication of medical information at transition points is responsible for as many as 50% of all medication errors in the hospital and up to 20% of adverse drug events [2]. In the two settings of the study, a university and a county hospital, there were errors among 55–85% of the patients in the transition to and from nursing homes, or help with medication dispensing from community care [3, 4].

Medication reconciliation is defined as 'The process of identifying the most accurate list of a patient's current medicines—including the name, dosage, frequency and route—and comparing them with the current list in use, recognising any discrepancies and documenting any changes, thus resulting in a complete list of medicines, accurately communicated' [2]. Establishing these details can involve discussion with the patient and/or carers and the use of records from primary care or from pharmacy. Different sources for information are available in different countries, regions or counties. Each time a patient moves from one setting to another, clinicians should compare previous medication prescriptions with new ones and plans for care, and reconcile any differences. If this process does

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not occur in a standardised manner designed to ensure complete reconciliation, medication errors can lead to adverse events and harm [2]. Solutions to the problems have included telephone follow-up by a pharmacist after discharge [5], discharge summary to community pharmacies [6-12] and to general practioners [10, 11, 13].

A practical and simple method for documentation at Skåne University Hospital in Lund (SUS-L) was needed; such documentation would be beneficial for communication with patients, their general practitioners and community care nurses. Therefore, a medication report was developed and introduced on one of the acute medicine wards. This led to an award at SUS-L in 2003. In 2004–05, a study on seven wards was performed, showing the benefit of such a report [4, 14]; the medication report became mandatory at patient discharge at the hospital in 2006. Suggestions and procedures on how to implement the activities based on experiences from the study were written in an internal report, and help offered to the health professionals involved. By late 2007, medication reports were mandatory for all hospitals in the south region of Sweden (Skåne); moreover, implementation had to be reported back to the regional authorities. In 2008, the medication report was acknowledged by the European Union Network for Patient Safety to be tested in European hospitals. In spring 2009, the authors of the report received the 'Gold Scalpel' for best innovation in Swedish health care.

The medication report has now been included in a structured discharge information leaflet, LIMM-DI (Lund integrated medicines management-discharge information), see Appendix 1. The discharge information leaflet:

- is written for the patient
- gives a short presentation of causes for admission, what has been done and planned
- includes a medication report of all medication changes at the hospital and the reasons for them (what and why)
- includes a medication list with information on drug, dosing, effects and any special comments
- is given to the patient at discharge and sent to the patient's general practitioner and the community care nurses within 24 hours of discharge.

Since 2008 it has been mandatory at SUS-L for all patients who need discharge information to receive the written LIMM-DI. This leaflet is based on a Microsoft Word document as shown in Appendix 1. This leaflet is also linked to the electronic patient chart system used in the hospital (Melior, Siemens Corporation, Sweden).

Aim of the study

The aim of this study was to investigate the use (implementation ratio) and the quality of LIMM-DI on wards at SUS-L. Whether patients get the written information, the error rate and other problems related to non-optimal quality were studied.

Methods

Study design, setting and study population

This is a prospective, cross-sectional survey at SUS-L, one of eight university hospitals in Sweden, with 1,200 beds and almost 8,000 employees. Elderly patients (≥ 65 years) and with a total of five or more medicines at discharge were included if they had been admitted to a ward during weeks 3 to 5 in 2008 (period 1). Because the implementation rate of ward-based procedures was low in period 1 and there were many medication errors, a second survey (period 2) was performed during weeks 35–37 in 2009; activity in the two periods were then compared. Patients with a treatment period shorter than 24 hours and patients admitted to a psychiatric ward were excluded.

Implementation of ward-based procedures for discharge information (interventions)

Before the first survey (period 1), information about the forthcoming study (shown in the introduction section of this manuscript) was advertised and presented as news in hospital-based journals, on the hospital homepage and at several meetings for physicians and nurses who were responsible for departments, wards and patients. In due course, the chief physician of the hospital, who is responsible for patient safety, sent an e-mail to the heads of all involved departments with information about the survey, its background, responsibilities and expected actions to be taken.

The information was disseminated in the same way before the second survey. In addition, the low implementation rate of ward-based procedures from the first survey was presented, as well as additional information about the hospital and regional demands based on patient safety aspects. There was an agreement at the meetings attended by healthcare professionals that LIMM-DI was important and that the introduction of ward-based procedures should be high priority. Information and presentation materials were provided to the head of departments for further information and discussion in their departments.

Collection of data

For both periods the survey was sent by e-mail from the physician responsible for patient safety at the hospital to the heads of all departments included in the study. The survey asked questions about procedures for discharge

information and communication with the patient, and also with primary and community care. A ward-specific list of patients discharged during the study period was supposed to be returned, as part of the intervention.

Based on the ward-specific patient discharge list, data were collected from the electronic or paper-based patient chart system on whether the individual patients on the list had received written discharge information or not [17]. Relevant patient demographics were collected and also detailed information for evaluation of errors and quality of LIMM-DI.

Evaluation of errors and quality

The number of errors in the medication report, as well as any changes and the reason for them, and in the medication list (correct drug and dose, and also indication or reason for use) were checked according to a checklist that was accepted as a quality standard at the hospital [17]. Errors in the medication report were checked by comparing the medication list in the patient chart system at admission and at discharge, and checking that this change was correctly documented in the medication report or elsewhere in the written discharge information. If not, it was considered an error. Missing information on generic substitution was not considered an error. Errors in the medication list in LIMM-DI were checked by comparing them with the medication list in the patient chart system at discharge and also compared with information in the medication report. This evaluation was performed by two pharmacy students, as an examination project for a Masters degree in pharmacy, in close collaboration and by daily contact with a senior researcher and clinical pharmacist (ÅB).

The quality of the discharge information in general was also checked according to the checklist [17]. The base for the recommended LIMM-DI according to Appendix 1 and questions for grading the quality were patient understanding and readability of the discharge information. This was developed by discussions with experts and by patient interviews (project report in Swedish).

Data analysis

The R language and environment for statistical computing was used for the statistical analysis [15]. Unpaired t-test was used for normal distributed parameters and Mann-Whitney U-test for non-normal distributed parameters. For comparisons of proportions Fisher exact test was used.

Results

Patient inclusion and demographics

There were no major improvements in the use (implementation ratio) of LIMM-DI by the patients between the two periods; 163 (31%) and 138 (27%) of the patients received written information in period 2 and 1 respectively. In period 2, four of the 13 wards wrote discharge information to all patients and 11 to more than 50% of the patients. Corresponding values for period 1 were five and 12 of 14 wards. Only one of the discharge information notes in both periods was written by a surgery ward physician. The rest were from more medical-oriented wards. Among the patients who received LIMM-DI there were no important differences in demographic parameters, as shown in Table 1.

Errors in the medication report and medication list

Results based on all drug errors, for wards producing at least one LIMM-DI, are given in Tables 2 and 3. There were no differences in the mean number of errors per patient in the medication report (period 1, 5.3 (SD 6.3); period 2, 5.3 (5.9); $p = 0.99$). It can be noted that there was also no difference in the number of drugs per patient between periods. The mean number of errors per patient in the medication list improved from period 1 to 2 (period 1, 6.5 (6.0); period 2, 3.9 (4.2); $p = 0.00098$). This improvement was based on the improvement in the parameter 'effect/indication is properly noted and understandable for the patient'.

Types of error found in LIMM-DI

A description of the types of error is shown in Table 4; the results are based on the evaluation form used [17]. There were no differences in the mean number of errors per patient (period 1, 2.3 (1.2); period 2, 2.2 (1.0); $p = 0.39$).

Table 1: Inclusion and demographics of wards and patients in the two study periods

	Period 1	Period 2	P value
Number of patients who should receive LIMM-DI according to inclusion criteria	504	520	0.17
Number of patients who received a LIMM-DI (%)	138 (27)	163 (31)	
Number of wards that should produce LIMM-DI	37	34	1.0
Number of wards with at least one written LIMM-DI (%)	14 (38)	13 (38)	
Patient age, mean (SD)	80.7 (8.5)	80.2 (7.4)	0.61
Females (%)	82 (59)	84 (51)	0.20
Number of days admission on the ward, mean (SD)	12.9 (12.1)	10.6 (8.3)	0.056
Total number of drugs, mean (SD)	10.9 (4.6)	10.6 (4.0)	0.57

Table 2: Description of errors in the LIMM-DI medication report

	Period 1 (138 patients)		Period 2 (163 patients)	
	Number	%	Number	%
Medication added erroneously	88	12	125	15
Medication withdrawn erroneously	152	21	184	21
Dose too high	27	3.7	30	3.5
Dose too low	23	3.1	27	3.1
Wrong dose interval	15	2.0	3	0.3
Wrong formulation (administration route)	1	0.1	1	0.1
Erroneous generic substitution	10	1.4	2	0.2
Reason for change is *not* noted	412	57	487	57
Total drug errors	728	100	859	100

Quality of LIMM-DI: comparison between wards and change between periods

A total of 10 wards wrote LIMM-DI in both periods and are included in Table 5. For individual wards there were some major changes. For example, in the inclusion of patients (ward K decreased) and in the number of errors for the different parts of the evaluation form (wards A, L and S improved, and B and F worsened). However, it should be noted that some of these changes (wards F and L) are based on very few included patients.

Table 3: Description of errors in the LIMM-DI medication list

	Period 1 (138 patients)		Period 2 (163 patients)	
	Number	%	Number	%
Medication added erroneously (commission error)	23	2.6	37	5.8
Medication withdrawn erroneously (omission error)	57	6.3	49	7.7
Dose too high	12	1.3	7	1.1
Dose too low	11	1.2	12	1.9
Wrong dose interval	17	1.9	6	0.9
Wrong formulation	6	0.7	1	0.2
Erroneous generic substitution	6	0.7	11	1.7
Effect/indication is *not* properly noted nor understandable for the patient	765	85	513	81
Total drug errors	897	100	636	100

Table 4: Description of errors in LIMM-DI

	Period 1 (138 patients)		Period 2 (163 patients)	
	Number	%	Number	%
a. Discharge information is written on more than one page	27	8.3	34	9.6
b. The patient's name and identity is *not* clear	28	8.6	0	0
c. The responsible physician at the hospital is *not* named	6	1.8	6	1.7
d. The family physician is *not* named	79	24	73	21
e. The care time from admission to discharge is *not* given with year, month and day	0	0	3	0.8
f. There is *no* description of the reason for admission	1	0.3	0	0
g. There is *no* description of the care process	8	2.5	4	1.1
h. There is *no* description of future plans and follow-up	10	3.1	3	0.8
i. Each sentence in the medication report *does not* start with the drug name	110	34	120	34
j. Formulations are *not* given or written in brief: e.g. 'capsules' or 'caps' can be used but not 'C'	55	17	118	33
	324	100	361	100

Discussion

Despite activities for intervention and demand at the hospital, the number of patients who received LIMM-DI was low and did not improve much from period 1 to 2. Among the more than 1,000 patients that according to hospital policy and according to our inclusion criteria should have received LIMM-DI, only 27% and 31% of the patients in periods 1 (2008) and 2 (2009), respectively, received the information. Although the error rates in the medication list decreased significantly, a more general improvement in error rates

Table 5: Summary of mean number of errors per patient for each ward included (decoded) in both periods, according to a checklist 'summary' [17]

Ward	Number of patients		In LIMM-DI text		Medication report				Medication list				Total number of errors	
					What		Reason		Correct		Indication			
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
A	18	**33**	1.6	**1.7**	2.6	**2.3**	3.9	**3.1**	0.8	**0.9**	5.8	**1.6**	14.7	**9.6**
B	18	**34**	1.5	**2.1**	1.6	**2.3**	1.8	**2.7**	1.3	**1.1**	1.3	**3.0**	7.5	**11.2**
C	23	**31**	1.3	**2.1**	2.1	**2.8**	3.4	**3.4**	1.6	**0.9**	3.0	**0.5**	11.4	**9.7**
D	6	**5**	3.0	**1.6**	2.5	**4.4**	3.2	**5.8**	0.8	**0.2**	6.0	**4.6**	15.5	**16.6**
F	3	**3**	3.3	**2.7**	2.3	**6.0**	3.7	**7.0**	0.0	**0.0**	8.0	**8.7**	17.3	**24.4**
J	7	**4**	2.3	**1.5**	1.2	**1.5**	1.4	**1.8**	0.0	**0.8**	5.9	**2.0**	10.8	**7.6**
K	19	**5**	3.5	**3.4**	2.1	**1.8**	1.8	**2.6**	1.1	**1.0**	9.7	**9.0**	18.2	**17.8**
L	6	**3**	3.8	**3.7**	3.8	**1.3**	3.8	**2.3**	2.7	**0.3**	10.3	**6.0**	24.4	**13.6**
Q	8	**5**	2.1	**2.2**	0.9	**0.8**	2.4	**2.6**	0.6	**0.6**	0.5	**0.2**	6.5	**6.4**
S	7	**8**	3.1	**2.6**	2.4	**2.5**	3.7	**2.6**	0.1	**0.0**	7.3	**3.0**	16.6	**10.7**
Total	115	**131**	2.6	**2.3**	2.1	**2.6**	2.9	**3.4**	0.9	**0.6**	5.8	**3.9**	14.3	**12.8**

and quality was expected. This is of course a great disappointment and a threat to patient safety [2, 16].

It was previously shown that the medication report included as one part of discharge information is halving errors and the need for patients or their carers to contact healthcare providers because of discrepancies in discharge medication [4, 14]. For that study, seven wards were chosen and implementation was followed continually and reported back to the physicians responsible for the care of the patients. When discussing the low implementation rate from period 1 with the head of departments, the clear impression was that improving the implementation of LIMM-DI was of high priority for the majority and that the implementation rate would improve significantly, heading towards 100%, which was the ultimate goal. However, this goal was far from being attained, and the seven wards described above actually produced 137 of the 163 (84%) LIMM-DI documents in period 2. It is disappointing that the physicians on other wards do not consider LIMM-DI of sufficient importance and that their interest is so low. The reasons for this are not clear but it seems that the head of the departments and the individual physician responsible for the discharge need help to prioritise the writing of LIMM-DI for the patients. This is most evident in the surgical departments, which only produced one single discharge document during both periods. The experience, as shown above, with continuous follow-up and reporting, as in the previous study [4, 14], can be a way forward for improvement. Also, it is necessary to simplify support of producing LIMM-DI in electronic medical records. The quality of LIMM-DI was generally low and did not improve between the periods. Also, there was no obvious trend that the seven wards described above had fewer errors or better quality scores. Clearly there is also a need to investigate how this can be improved.

The strength of the method in this study is that medication errors and quality problems can be measured easily and compared using the method described and the checklist. This can also be used in other settings and can be used for quality control between hospitals. This strength is also the limitation of this study. Despite instructions and checklists, training and close collaboration between the student investigators and the senior researcher, there can be mistakes in the collection and evaluation of data and errors. Individual evaluations and comparisons before consensus could be beneficial, but this is time-consuming. A study focusing on individual evaluations and comparisons validating the approach at SUS-L would strengthen the validity of this study. As discussed above, the intervention strategies could also be much improved; this is the major limitation of this study and the main problem.

To help organisations and clinicians ensure complete medication reconciliation in a standardised manner, several national organisations around the world have now

produced guidance and help. This includes the US [2] and Sweden [16]. According to the US Institute for Healthcare Improvement, the healthcare provider should, at discharge, consult the patient's home medication list and current medications orders, and also compare them with the discharge medications orders to ensure that medicines are appropriately continued, resumed or discontinued. They should also share the list with the patient and the next care provider or coordinator of care for that patient [2]. This is in total agreement with the SUS-L approach. Reconciling medicines is also stated to be a team process. All disciplines must be involved and complete portions of the process. Each discipline has a role in the medication system. In addition, hospitals should design a process that capitalises on existing staff and optimises the role of each. Previously, it was believed that the physicians must be responsible for LIMM-DI as well as face-to-face discharge information. However, the SUS-L experience has shown that pharmacists' quality control and feedback on errors and problems in LIMM-DI to the responsible physician before patient discharge decreased errors by 45% [17]. In the authors' opinion, pharmacist control and feedback before patient discharge can best be performed as occasional quality control and when pharmacists are closely involved in patient care during the patients' hospital stay as described by the complete LIMM model where LIMM-DI is one of three parts [17–20]. In general, the authors also believe that the physicians must be trained properly and take responsibility for their discharge notes.

However, because most physicians do not prioritise writing LIMM-DI and also because the quality is low, a dedicated and responsible person for this task in each department could be necessary. This could be a physician, a nurse or a clinical pharmacist. Based on the SUS-L experience, a study to investigate if a clinical pharmacist could be part of the solution, and also other aspects of quality and cost-effectiveness in the process, is now planned.

Conclusion

Despite evidence for patient and healthcare provider benefits, hospital protocols and guidelines, no general or large improvement was observed in the use, error rate, and quality of LIMM-DI. There is a need to investigate why physicians and, especially, surgeons do not consider this of sufficient importance and whether additional support and alternative solutions, such as involving clinical pharmacists, would be of benefit.

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Appendix 1: Example of a patient specific discharge information leaflet

Ward 1, Emergency Department
University Hospital
221 85 Test City
Phone 046-171000

19 121212-1212
Test Testsson
Test Street 11
21748 Test City

Discharge Information

Discharge physician: Jan Jansson
Responsible physician: Lisa Larsson
Family doctor: Sven Svensson. Testpark Health Central
Admitted: 2009-03-08 – 03-14

About your disease

You have been admitted to hospital because of fever and shortness of breath and treated in ward 8. An X-ray of the lungs showed pneumonia. Fluid in the lungs is a sign of worsening heart failure. You have been treated with antibiotics and diuretics during your hospital stay.

Plans and follow-up

You will be admitted to the nursing home for further care. Your family doctor will contact you within 4–5 weeks for control of your heart and lungs.

Medication report

- Furosemide has been increased from 1 to 2 tablets because of increased heart failure.
- Spironolactone has been added because of low potassium levels and heart failure.
- Doxycyline (antibiotic) added for another week.
- Imporal has been substituted for lactulose because of nausea.
- Tramadol has been deleted because of nausea and no further need.
- Digoxin dose has been decreased from 0.25 mg to 0.13 mg, because the blood level was high.

Medication	Effect	Morning	Lunch	Evening	Night	Comment
Furosemide tablets 40 mg	Diuretic	1	1			
Spironolactone tablets 25 mg	Potassium sparing diuretic	1				
Digoxin tablets 0.13 mg	For the heart	1				
Stilnoct tablets 5 mg	For sleeping				1	As needed
Doxycyline tablets 100 mg	Antibiotic	1				Till March 16
Imporal powders	Against constipation	1				
Paracetamol tablets 500 mg	Against pain	1	1	1		