The hospital LIMM-based clinical pharmacy service improves the quality of the patient medication process and saves time

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Introduction

Drug errors and other drug-related problems (DRPs) are commonly associated with patient injury [1,2]. The Swedish government estimates that 3,000 people die every year as a result of DRPs, and that 6-16% of hospital admissions are drug related. [3] The cost of avoidable medication-related injuries is estimated at 0.6-2.7 Billion €/year.

There is evidence that clinical pharmacy interventions reduce unnecessary costs [4]. The Lund Integrated Medicines Management (LIMM) model [5] includes systematic activities for medication reconciliation and review, education for the care team, and information and guidelines for communication with the patient in order to identify, resolve and prevent DRPs. In brief, at admission the pharmacist prepares a current medication list and identifies patient problems in the areas of knowledge, practical management, attitudes and adherence. The nurse evaluates the patient's symptoms and the pharmacist carries out a medication review. Subsequently, the team prepares a care plan based on identified DRPs. At discharge, the physician writes up the discharge information (LIMM-DI) containing a current medication list and a medication report on any changes. This LIMM-DI is given to the patient and sent to their primary care representative. The LIMM model, which has been investigated in four PhD theses and 14 studies, improves the appropriateness of medications and the number of transmission errors and halves medication-related contacts with healthcare [5-10]. The pharmacist's role and actions are seen as important [6,10].

Aims of the study

The aims were to investigate estimated time utilisation by physicians and nurses and the quality of the medication process with and without support from the LIMM model, and the time spent by LIMM pharmacists.

Methods

The questionnaires were tested before use on small groups. The quality of the LIMM-based medication process vs standard care was evaluated on a 5-point scale: much better, somewhat better, no improvement, somewhat worse, much worse. Time utilisation was evaluated by calculating the difference in time spent on work activities with and without LIMM support and by direct questioning of the workers' perceptions.

The hospital questionnaires focused on medication-based activities by physicians and nurses at the Lund unit of Skåne University Hospital, where the LIMM model has been used since 2006, and a clinic in the Malmö unit of the same Hospital (control).

The primary-care nurse questionnaire focused on the distribution of drugs to patients after their discharge from hospital. Standard care, without information from the hospital, was compared with support from LIMM-DIs containing either no or one deliberate discrepancy. The nurses were asked who they contacted to clarify any problems. The questionnaire for the general practitioners (GPs) asked how often they were contacted by the nurse to clarify problems.

The number of interventions and time spent per patient by four pharmacists performing LIMM-based activities on seven wards in Lund hospital during a week in March 2010 was also evaluated and compared with the number of recorded pharmacy interventions, and work rosters, for the fourth quarter of 2010.

Data is presented as medians and quartiles and the paired t-test were used.

Results

Responses were received from 12 (100%) physicians and 16 (100%) nurses at Lund and 12 (20%) physicians and 27 (28%) nurses in Malmö. In primary care, responses were received from 77 (78%) GPs and 133 (62%) community nurses.

Table 1 summarises the estimated time hospital physicians and nurses spent or would have spent for each activity. In Malmö, physicians and nurses estimated that they spent 48 minutes per patient at admission and during hospitalisation (preparing a current drugs list and medication review). Most thought that LIMM support would be an improvement (much better 60%; somewhat better 37%). The physicians thought that these activities should take a maximum of 23 minutes, while the nurses thought 26 minutes. In Lund, all the doctors and nurses thought that the pharmacists' activities were important and should continue, and estimated that they saved 69 minutes at admission and during hospitalisation. The doctors thought the process should take 75 minutes at most, and the nurses said 50 minutes.

Table 1. Time utilisation by physicians and nurses for various medication processes in hospital. The Malmö unit provided standard care and the Lund unit provided LIMM-based care. The results for Lund are the estimated times it would have taken if a pharmacist had not performed the activities. The times given are the median total times for a normal patient in minutes (25th and 75th quartiles).

	Malmö (Non-LIMM)		*Lund (LIMM)*	
	Physician	*Nurse*	*Physician*	*Nurse*
Time to produce an accurate medication list at admission	7 (5-10)	3 (0-5)	19 (14-30)	10 (0-25)
Time to perform a medication review*	30 (23-45)	8 (2-13)	20 (9-34)	20 (0-34)
Time related to medications at discharge**	15 (10-16)	49 (30-60)	15 (7-20)	15 (8-30)
Time for any patient questions related to medications after discharge	10 (5-10)	15 (10-30)	10 (4-10)	13 (5-20)
Total time	62 (42-81)	75 (42-108)	64 (33-94)	58 (13-109)
Total time per unit	137 (84-188)		122 (46-203)	

* Defined as a systematic review to identify, resolve and prevent the patient's drug-related problems (adverse drug reactions, inadequate treatment effects, unnecessary or unsuitable medications, etc.) during the total hospital stay.
** Includes dispensing of medications by a nurse for the following seven days; one container for each medication.

In Lund, they all stated that the LIMM-DI was time-saving, and estimated that it would save them 53 minutes at and after discharge (vs 89 minutes at Malmö).

It was calculated that the GPs saved 10 minutes with the LIMM-DI (n = 61, range 5.5-15 minutes, p = 0014 vs standard care) if they didn't contact the hospital, and 20 minutes if they did (n = 11; range 15-26 minutes; p = 0.002). On direct questioning, they thought they had

saved 15 minutes (n = 68; range 10-30 minutes) regardless of whether the patient had no, had community care help with medication or lived in a nursing home. Only 11 of 72 doctors (15%) chose to contact the hospital to seek help for the problem. These were the same physicians who indicated that they saved the most time with LIMM-DI. When the LIMM-DI did not have discrepancies, the nurse did not need to contact the GP, and no extra GP time was needed. With one discrepancy, the GPs spent 14 minutes per patient. Without the LIMM-DI, they spent 22 minutes per patient.

It was calculated that the LIMM-DI saved the community nurses 21 minutes (n = 126, range 3.0 to 31 minutes, $p < 0.001$). On direct questioning, they thought they had saved 30 minutes (n = 116, range 20-52 minutes) if the patient's LIMM-DI had one discrepancy and 39 minutes (n = 124, range 30-60 minutes) if the LIMM-DI was correct.

The proportion of GPs who relied on the medication list increased from 11 to 48% when a LIMM-DI was issued; 72% stated that the LIMM-DI was much better and 23% that it was somewhat better. The corresponding results for community nurses were 71% and 27%.

During the three months of the study, 1126 patients were admitted to seven wards with LIMM pharmacists. The time spent per patient based on the quarterly statistics (60 minutes) and the time survey (65 minutes) corresponded very well.

Discussion

This study indicates that LIMM-based pharmacist activities take one hour per patient. Physicians and nurses at hospitals and in primary care asserted that the use of this tool improves the quality of the patients' drug therapy. In addition, the model resulted in major time savings for both physicians and nurses (of at least two hours per patient) in all the areas listed in Table 2. Additional primary-care time savings can be expected if the LIMM-DI is accurate, i.e. has been reviewed by a pharmacist [6, 7]. The LIMM tool also reduces the number of drug-related healthcare contacts and re-hospitalisations, and appears to be cost-effective [5,8,9].

Table 2. Summary of calculated and estimated time savings as a result of using the LIMM model (in minutes).

	Calculated	Estimated
At admission and during hospital stay		
Hospital physician	37	39
Hospital nurse	11	30
At and after discharge		
Hospital physician	25	25
Hospital nurse	30*	28
GP [one discrepancy] and correct	[8] 22	[15] 15**
Community nurse [one discrepancy] and correct	[21] 30	[30] 39
Totals (range)	132-155	167-176

Time utilisation for discharge has been adjusted to value given by nurses in Lund (Table 1).
**Not given in the study. Same value as with one discrepancy is given.

Of the GPs, 85% chose not to contact the hospital to seek help for errors in the medication lists provided at discharge when these were queried by the nurse. The consequences of this were not investigated in this study, but previous work has shown that there is an average of

two errors per medication list at every discharge, and that this is reliably reduced to one when the LIMM medication report is issued [5-8]. The problem partly stems from errors in the drug lists at admission, and partly from changes during the hospital stay not being documented or communicated to the patient and subsequent care providers. The LIMM model solves this by the pharmacist preparing an accurate medication list for the physician at admission and the discharging physician preparing a LIMM medication report of the changes made. The physician and nurse in primary care can then compare the patient's drug list prior to admission with that at discharge, with discrepancies between the lists reported in the LIMM medication report. We introduced a deliberate discrepancy in LIMM-DIs to highlight the improvement in quality with the LIMM method. Use of the LIMM-DI decreased the total time spent by GPs and nurses by 29 minutes if there was one discrepancy and 52 minutes if the LIMM-DI was correct (Table 2).

The unexpectedly large time savings in hospitals may have been the result of being studied, i.e. the Hawthorn effect, although we tried to minimize this by using two methods to estimate the time saved: estimated and calculated (Table 2). The calculated results in primary care were obtained from the differences between LIMM reports or not and with no or one discrepancy, while those in hospital care were derived from the two very similar units of the same clinic, from two cities. The low response rate from Malmö, in contrast to the 100% response rate in Lund, limits the study. However, this low response rate is not considered critical because the estimated times and time savings were similar between the units, indicating that the responses from Malmö were representative of the entire clinic.

Conclusion

The LIMM model improves the quality of medication processes and saves at least one hour per patient in hospital and primary care. These and previously identified benefits will be the basis of a future pharmacoeconomics study.

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