Pharmacist-led interventions improve quality of medicine-related healthcare service at hospital discharge

Tina Hoff Duedahl,¹ Wiebke Boman Hansen,¹ Lene Juel Kjeldsen,² Trine Graabæk³

¹Hospital Pharmacy, Lillebaelt Hospital, Vejle, Denmark

²SAFE, Amgros I/S, Copenhagen, Denmark

³Department of Quality, Hospital of South West Jutland, Esbjerg, Denmark

Correspondence to

PhD Pharm Tina Hoff Duedahl, Hospital Pharmacy, Lillebaelt Hospital, Vejle Kabbeltøft 25, 7100 Vejle, Denmark; tina.hoff.duedahl@rsyd.dk

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ABSTRACT

Objectives This study aims to investigate the effects on quality of the medicine-related healthcare service provided at hospital discharge after implementing a pharmacist-led patient-centred discharge service.

Methods Medical in-patients ready for discharge and prescribed at least six medicines were eligible for inclusion in this descriptive intervention study. A ward-based clinical pharmacist provided a patient-centred discharge service which comprised medication review (including reconciliation if appropriate), medication counselling and verification of the medication discharge summary plans. Satisfaction with the pharmacist-led interventions was collected by questionnaires and follow-up telephone interviews. A quality audit on the medical information stated in the discharge summary plans was conducted.

Results A total of 313 medical records were prospectively reviewed by the clinical pharmacist, and 745 medicine-related problems each leading to a clinical recommendation were identified. The total rate of acceptance by the physicians was found to be 84%. The quality audit revealed a significantly higher quality of the medication discharge summary plans sent to primary care regarding content of updated lists of medication after the pharmacist's intervention. The involved physicians stated that contributions from the pharmacist had eased their workload and helped them to obtain a more rational prescribing practice. The interviewed patients felt secure and well-informed about their medicines.

Conclusions Contributions from clinical pharmacists can improve both the quality of and satisfaction with the medicine-related healthcare service provided at hospital discharge and secure continuity of medical care at transitions.

transitions between care settings for example, when discharging patients from hospitals.^{4,5} Adjustments in medication regimens often occur during hospitalisation and, if unattended, incomplete information, including medication discrepancies, may be transferred to primary care.^{5–9} This—in combination with an often unclear transfer of responsibilities among healthcare professionals in secondary and primary care—may result in medicine-related problems and lower quality of patient care.⁴ It is, thus, vital for post-hospital follow-up and, consequently, the quality of continuous medical care that updated medicine information is available and easily accessible.^{4,7,9,10}

Implementation of hospital-based pharmacist-led medicine management programmes such as medication reconciliation and medication reviews has shown a positive effect on medication use, health service use and costs.^{9,11,12} Clinical pharmacists trained in all aspects of medicine managements can by their participation in multidisciplinary clinical teams positively influence clinical practice and patient outcome as well as post-hospital healthcare use.^{9,13–15} An example is provision of educational counselling to discharge patients, which has been shown to increase patient knowledge and adherence to the prescribed medical treatment.^{16,17} In most hospitals in Denmark, pharmacist-led medication reconciliation and medication reviews have been well-implemented services for several years. However, as the services mainly have been conducted at hospital admission, data are lacking regarding effects on the medicine-related healthcare service provided when implementing such interventions at hospital discharge.

The aim of this study was to investigate the effects on the quality of medicine-related healthcare service provided at hospital discharge after implementing a pharmacist-led patient-centred discharge service.

INTRODUCTION

Suboptimal pharmacotherapy and inappropriate use of medicines can lead to medicine-related problems such as medication errors, adverse drug event or adverse drug reactions,^{1,2} which negatively affects patient safety, healthcare use and costs. In a systematic review from 2013, a median prevalence of hospitalisation resulting from medicine-related problems was found to be around 12%.³

The ongoing development of new medicines and treatment guidelines requires updated pharmacotherapeutic knowledge among healthcare professionals to address the increased complexity of medical treatment. The risk of introducing medicine-related problems is especially high at

METHODS

Study design

The study design was a descriptive intervention study with a historic control group.

Setting

The study was conducted at the general medical ward at Lillebaelt Hospital, Vejle, Denmark. An experienced clinical pharmacist (WBH) provided the clinical service on the ward on workdays during the intervention period from 01 February to 30 November 2012.

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Patient inclusion

Patients ready for discharge, prescribed at least six medicines and having a general practitioner situated in the municipality of Vejle were eligible for inclusion. The inclusion was done on a daily basis by the clinical pharmacist. If a patient was hospitalised and eligible for inclusion more than once during the intervention period, only data from the index admission were included in the analysis.

Pharmacist-led interventions

Medication review

A structured medication review, including medication reconciliation if appropriate, was conducted by the pharmacist in accordance to rational pharmacotherapy principals. The review was classified as type 2b according to the PCNE typology of medication reviews as information on the patient's medication history and clinical data were included.¹⁸ Choice of medicine, dosing, side effects, possible medicine-related interactions and length of therapy received special focus and if any incongruence in data, inappropriate prescribing or medicine-related problems were identified, the pharmacist wrote a clinical recommendation in the medical record. The attending physician was then responsible for taking further action, for example, clarification of correct medication status or alterations of the prescribed medicines, if appropriate, as pharmacist prescribing is not implemented in Denmark.

Medication counselling

Included patients, who usually administrated their medicines themselves, were offered medication counselling by the pharmacist on the day of discharge, if practical possible. The level of information provided was adjusted to meet each patient's needs and knowledge. During the counselling, the pharmacist attempted to clarify all medicine-related questions with special focus on indication, compliance and possible side effects. The counselling time was recorded in 5 min intervals. The patients received a follow-up telephone call from the pharmacist 1 week after discharge. The purpose was to elucidate any unanswered medicine-related questions and to assess the satisfaction with the pharmacist's service.

Verification of medication discharge summary plans

All medical data were available from the hospitals electronic patient record system. The medication status and plans for further medical treatment – as stated in the discharge summary plans for each patient – were read and verified by the pharmacist before sending to primary care. Specific focus was on securing adequate information about adjustments in medication made during hospitalisation, for example, dose adjustments, addition of new medicines or discontinuation of existing treatment. Also scheduled post-hospital medical follow-ups were emphasised. Finally, if the physicians had problems with correct completion of electronic prescriptions generated from the electronic patient records, these were clarified by the pharmacist before transferring to the community pharmacy.

Data collection and outcome measures

Patient characteristics

Demographic data, age and gender, were recorded for all included patients. It was noted if the patients have been transferred to the medical ward via the hospitals acute visitation unit, where pharmacist-led medication reviews on admission is an obligatory service.

Medicine-related problems

The number of prescribed medicines at discharge as well as all written clinical recommendations were entered in a Danish national database of medicine-related problems.¹⁹ Acceptance of the clinical recommendations, defined as documented alteration in the medication regimens done by the physicians, was assessed by post look-ups in the medical records. It was also noted if the physicians documented a clinical reason if not accepting the suggested clinical recommendation.

Satisfaction measures

Data from the medication counselling and telephone interviews were recorded. After the intervention period, the involved physicians anonymously completed an electronic questionnaire about their experience and contentment with having a clinical pharmacist as a member of the clinical team. The questionnaire was designed and pilot-tested by two authors (WBH and THD) with help from Centre for Quality in the Region of Southern Denmark.

Quality assessment

After the intervention period, a quality audit on medication status listed in the discharge summary plans was conducted by the pharmacist. A systematic audit tool with predefined criteria for evaluation according to national hospital guidelines for medicine reconciliation was applied to 40 randomly selected medical records. The audit included specification of adequate information on any medicine adjustments made during hospitalisation, precise information about indication and dose for each medicine prescribed and finally the presence of a plan for further medical follow-up in primary care.

Statistical analysis

All data were treated anonymously. The statistical analysis was performed using the STATA 13 software. A non-parametric approach using the Mann-Whitney U-test was used for not-normally distributed continuous or ordinal unpaired data, and the χ^2 test was used for categorical data. $p < 0.05$ was considered statistically significant. Data are presented as medians with IQRs or range, if appropriate. The statistical analysis was performed by the authors with help from the Institute of Regional Research, University of Southern Denmark.

RESULTS

Patient characteristics

The median age of the included patients was 77 years and 51% were female (table 1).

Table 1 Patient characteristics and data from the medication reviews

	Intervention group
Number of included patients	313
Age of patients, median (range)	77 years (29–98)
Females, n (%)	159 (51%)
Number of prescribed medicines reviewed	3515
Number of prescribed medicines per patient, median (IQR)	11 (8–14)
Number of clinical recommendations identified	745
Number of patients with at least one clinical recommendation	259 (83%)
Number of clinical recommendations per patient, median (IQR)	2 (1–3)

Figure 1 Distribution of identified clinical recommendations related to suboptimal pharmacotherapy or inappropriate prescribing, n=477.

Medication review

Medical records for 313 poly-medicated patients (prescribed 3515 medicines) were reviewed. In 259 records (83%), a total of 745 medicine-related problems were identified leading to a clinical recommendation (table 1). Medication reconciliation comprised for 36% (n=268) of all cases, with undocumented omission of one or more medicines used before admission being the most frequently observation. The remaining 477 medicine-related problems were all related to suboptimal pharmacotherapy or inappropriate prescribing with 'length of treatment' (n=124), 'dose' (n=80) and 'supplement to treatment' (n=68) being the three most frequently observations (figure 1). Most often, a date for discontinuation of temporary therapy, for example, with opiates or hypnotics, was missing in the discharge information. Prescription of doses either higher or below national guidelines (especially for hypnotics and inhalation therapy) was often observed, and finally, untreated indications, for example, addition of prophylactic acetylsalicylic acid for the prevention of thrombosis or missing calcium supplementation to patients with osteoporosis, were identified.

Of the included patients, 54% (n=169) were transferred from the acute visitation unit where they had received an additional medication review on admission. The remaining 46% (n=144) were admitted directly to the medical ward and received a medication review at discharge (table 2).

Although the total number of prescribed medicines at discharge was higher in the patient group who received two medication reviews during hospitalisation, the number of identified clinical recommendations was almost the same (371 vs 374, respectively) in the two groups. Percentage of patients with at least one clinical recommendation identified was lowest in the group with two medication review conducted (79% vs 87%, respectively) and statistical analysis showed significantly fewer clinical recommendations per prescribed medicine at discharge for this patient group compared with the other group (0.17 vs 0.23; $p=0.002$, table 2).

Medication counselling

Ninety-four patients (30%) usually administrated their medicines themselves at home, and of these, 22 (23%) were offered medication counselling with the pharmacist. Twenty patients (91%) participated. The median counselling time was 30 min (range=15–45 min).

Evaluation on satisfaction measures

Follow-up telephone interview

All patients who received medication counselling also received a post-discharge telephone call, and 18 patients (90%) participated in a semi-structured interview. All patients were positive

Table 2 Data from medication reviews conducted for patients who received either one or two medication reviews during their hospital stay, respectively

	Patients with one medication review conducted (at discharge)	Patients with two medication reviews conducted (on admission + at discharge)	
Number of patients	144 (46%)	169 (54%)	
Total number of prescribed medicines reviewed at discharge	1470	2045	
Median number of prescribed medicines per patient (IQR)	9 (7–12)	12 (9–14)	
Total number of clinical recommendations identified at discharge	374	371	
Number of patients with a least one clinical recommendation	125 (87%)	134 (79%)	
Median number of clinical recommendations per patient (IQR)	2 (1–4)	2 (1–3)	$p^*=0.030$
Median number of clinical recommendations per prescribed medicine (IQR)	0.23 (0.11–0.43)	0.17 (0.07–0.29)	$p^*=0.002$

*Mann-Whitney U-test.

Figure 2 Answers from the questionnaire about the physicians' contentment with the pharmacist-led interventions (reported as percentage of the responders). NA: the respondent could not answer the question.

about the pharmacist's involvement in the discharge service and felt secure and well-informed about their medicines. They especially emphasised their gratitude for the pharmacist's availability to explain medicine-related questions and the extra effort to ensure a high quality of their medication lists.

Acceptance from physicians

By post look-ups in the medical records, an initial acceptance rate of 77% was identified as 576 clinical recommendations were accepted and followed by adjustments in the medication regimen. Another 52 recommendations (7%) were also accepted but did, due to different clinical reasons, not lead to medicine adjustments. This resulted in a total acceptance rate of 84%. Finally, 18 recommendations (2%) were disseminated to follow-up in primary care, whereas no action could be identified for the remaining recommendations.

Questionnaire to the physicians

The electronic questionnaire was sent to 42 physicians and 26 (62%) responded. All responders had in some way collaborated with the pharmacist on the ward and rated conduction of structured medication reviews as the most valued and supportive activity. A total of 25 physicians (96%) answered that the pharmacist-led interventions had been highly or moderately helpful to them, increased the quality of the medication discharge plans and contributed to a more rational prescribing practice at discharge. Twenty-four physicians (92%) stated that the pharmacist-led interventions had eased their workload when discharging patients (figure 2).

Audit on quality assessment

Twenty medical records from the intervention group and 20 records from a historic control group were included in the audit. The two groups were comparable according to median number of prescribed medicines stated in the discharge summary plans: 13 (range=4–28) vs 12 (range=8–24), respectively. To minimise the risk of bias and other confounding factors, the medical records were extracted from the medical ward in October 2012 and October 2011, respectively, and it was secured that no organisational or patient-related changes in activity had been applied to the ward in the mentioned time period.

The main audit results showed a significantly higher percentage of medical records with medicine reconciliation conducted accordingly to guidelines in the intervention group compared with the controls: 85% (n=17) vs 30% (n=6),

respectively ($p<0.001$). Adequate information about medicine adjustments made during hospitalisation was found to be significantly more common in the intervention group compared with the controls: 60% (39 out of 65 changes) vs 36% (36 out of 99 changes), respectively ($p=0.003$). Finally, a plan for further medical follow-up in primary care was present in almost every discharge summary plan (20 vs 18, respectively), whereas presence of precise information about indication and dose for each prescribed medicine was higher in the intervention group 85% (n=17) than in the control group 60% (n=12), but the difference was not statistically significant ($p=0.077$).

DISCUSSION

In this study, a positive effect of a pharmacist-led patient-centred discharge service was found. A total of 745 medicine-related problems were identified, each leading to a clinical recommendation, of which more than three quarters led to adjustments in medication regimens. The discharge summary plans were found to be of a significantly higher quality after the pharmacist's intervention regarding content of updated lists of medication. Evaluation from the involved physicians and patients showed a high level of satisfaction with the pharmacist's contribution to the discharge service.

Medical records for 313 poly-medicated patients were critically reviewed by a clinical pharmacist, and in 83%, at least one medicine-related problem was identified. In-hospital medication lists with undocumented omission of one or more medicines used before admission were the most frequently observation. A plausible reason for this could be incomplete medication history taking at hospital admission and consequently inadequate medication reconciliation.^{4 20} Problems related to suboptimal pharmacotherapy such as untreated indications or inappropriate dosing regimens were also repeatedly identified. These findings correspond well with a characterisation from 2014 of medicine-related problems entered in a Danish national database.¹⁹ All clinical service in our study was provided by a single experienced clinical pharmacist (WBH) to give a consistent delivery of service, but this setup can, however, lower the generalisability of the results, which is a limitation in the study design. An attempt to minimise any potential bias concerns was to have the other authors (THD, LJK and TG) to do the interpretation and evaluation of data.

The high number of medicine-related problems identified at hospital discharge indicates poor quality of medication reconciliation processes during hospitalisation and expose problems

with inappropriate prescribing practise and updated pharmacotherapeutic knowledge among healthcare professionals. If these medication issues are not addressed and clarified at the time of discharge, they may carry over to primary care with poor post-hospital follow-up and decreased patient safety as a result.^{5,9} In our hospital, pharmacist-led medication reviews on admission is a well-implemented service at the acute visitation unit, where pharmacists support physicians in identifying and resolving medicine-related incongruence and problems. The main goal is to secure use of updated medication lists and minimise the risk of introducing medicine-related problems during hospitalisation. The results from the present study support the objective of the provided service, as significantly fewer clinical recommendations per prescribed medicine at discharge were identified for the group of patients who received an additional pharmacist-led medication review on admission compared with the patients who only received a medication review at discharge.

The quality audit on medication status listed in the discharge summary plans showed statistically significant differences in favour of the intervention group. Although the audit cohort was of a limited size, this was applicable both for the numbers of medical records with medication reconciliation adequately conducted, as well as for the quality of information stated about adjustments in medication regimens made during hospitalisation. The significantly higher quality of medication discharge information observed after the pharmacist's intervention indicates that, by securing a high quality of medical information obtained at hospital admission and thus of the in-hospital medication lists, the number of unintentional medicine-related problems at discharge could be reduced. This would inevitably increase both medication and patient safety as well as positively influence the continuity of medical care.¹⁰ Involvement of expertise from clinical pharmacists in this process has earlier been described to positively affect the quality of information stated in medical records,^{6,21} to which our study adds further evidence. The findings confirm the importance of a close teamwork between all healthcare professionals including clinical pharmacists to improve the medicine-related quality of healthcare service provided at hospital discharge and the continuity of care at transitions.

Evaluation of satisfaction measures revealed a high degree of contentment with the provided pharmacist-led interventions from both the physicians who answered the questionnaire and the interviewed patients. The contentment from the remaining physicians and patients is unknown. Pharmacist-led medication reviews were rated as the most valued and supportive activity by the physicians. This corresponds well with the high acceptance rate (84%) and demonstrates high clinical relevance of the pharmacist's input. Other clinical studies have reported acceptance rates varying from 39% to 100%,¹¹ which supports the importance of clinical pharmacist's contribution to ensure rational pharmacotherapy. It would have strengthened our results if evaluation from physicians in primary care also had been included, but this was due to practical circumstances not possible. A very high percentage of the physicians stated that contributions from the pharmacist had eased their workload and helped them to obtain a more rational prescribing practice when discharging patients. This statement is in concordance with results from a Swedish study from 2012, where implementation of a comprehensive pharmacist-led medicine management model improved quality of the medication processes and decreased time spent by involved healthcare professionals by at least 1 hour for each admitted patient.²²

Fewer patients than expected participated in the medication counselling as it turned out that many patients were rather deteriorated both physically and mentally, which complicated their ability to benefit from the counselling. In addition, the ward routine meant that patients were often discharged at the same time with the consequence that some were not offered a medication counselling due to lack of time from the pharmacist. This is of course a limitation in our study setup and could affect the results as the selection of patients could be biased. However, nearly a quarter of all patients who usually administered their medicines themselves at home participated in the medication counselling and the following post-discharge telephone interview. All interviewed patients stated that they felt secure and well-informed about their medicines both at the time of discharge and at home. They especially appreciated the extra quality assessment provided about their medication lists.

Patients play an important role in their own healthcare, and they should be seen as equal decision-making partners in all aspect of the healthcare system. To be able to take on this role, patients should be provided with appropriate and relevant information about their medical treatment and actual prescribed medicines to increase adherence and quality of the treatment.^{16,17} Our study shows that clinical pharmacists who have specialised pharmacological knowledge and are trained in providing patient information and counselling are an obvious group of healthcare professionals to be sharing the responsibility of providing this service.

CONCLUSION

Contributions from a clinical pharmacist can improve both the quality of and satisfaction with the medicine-related healthcare service provided at hospital discharge. Clinical pharmacists are strongly encouraged to play an active role in the multidisciplinary clinical teams around the patient to help secure the quality and continuity of medical care.

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Contributors Study design and practical planning: WBH and THD with inspiration from LJK. The Centre for Quality in the Region of Southern Denmark helped with designing the electronic questionnaire to the physicians. Providing of clinical service on ward/data collection: WBH. Statistical analysis: THD with help from the Institute of Regional Research, University of Southern Denmark. Data analysis and interpretation/evaluation: THD, LJK and TG. Drafting the manuscript: THD. Critical revision of the manuscript: LJK and TG. Final approval of the submitted manuscript: THD, WBH, LJK and TG.

What this paper adds

What is already known on this subject

- ▶ Suboptimal pharmacotherapy and inappropriate use of medicines may lead to medicine-related problems.
- ▶ The risk of introducing medicine-related problems is especially high at transitions in care settings.

What this study adds

- ▶ A pharmacist-led patient-centred discharge service can increase quality of medicine-related healthcare service and positively influence clinical practice.
- ▶ Participation of clinical pharmacists in multidisciplinary clinical teams is highly appreciated and contribute to secure continuity of medical care at transitions.

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Competing interests None declared.

Ethics approval The study was registered with The Danish Data Protection Agency. Approval of The Regional Committees on Health Research Ethics for Southern Denmark was not needed according to the Danish law.

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