

# Clinical outcomes from the use of Medication Report when elderly patients are discharged from hospital

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**Abstract** *Objective* The objective of this study was to investigate whether a Medication Report also can reduce the number of patients with clinical outcomes due to medication errors. *Method* A prospective intervention study with retrospective controls on patients at three departments at Lund University Hospital, Sweden that were transferred to primary care. The intervention group, where patients received a Medication Report at discharge, was compared with a control group with patients of the same age, who were not given a Medication Report when discharged from the same ward one year earlier. For patients with at least one medication error all contacts with hospital or primary care within 3 months after discharge were identified. For each contact it was evaluated whether this was caused by the medication error. We also compared medication errors that have been evaluated as high or moderate clinical risk with medication errors without clinical risk. *Main outcome measures* Need for medical care in hospital or primary care within three months after

discharge from hospital. Medical care is readmission to hospital as well as visits of study population to primary and out-patient secondary health care. *Results* The use of Medication Report reduced the need for medical care due to medication errors. Of the patients with Medication Report 11 out of 248 (4.4%) needed medical care because of medication errors compared with 16 out of 179 (8.9%) of patients without Medication Report ( $p = 0.049$ ). The use of a Medication Report significantly reduced the risk of any consequences due to medication errors,  $p = 0.0052$ . These consequences included probable and possible care due to medication error as well as administrative procedures (corrections) made by physicians in hospital or primary care. *Conclusions* The Medication Report seems to be an effective tool to decrease adverse clinical consequences when elderly patients are discharged from hospital care.

**Keywords** Clinical outcomes · Discharge planning · Drug-related problems · Medication errors · Seamless care · Sweden

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## Impact of findings on practice as a heading

- Medication Report is a simple and effective tool to communicate changes in drug treatment during a patient's hospital stay.
- Medication Report reduces the risk of clinical outcomes due to medication errors and the need for administrative corrections by health care professionals.

## Introduction

Elderly people often use many drugs even if there are great variations between elderly individuals in the number of

drugs [1]. Drug-related problems (DRP) are however common in elderly patients [2]. Drug-related problems has been defined as “an event or circumstance involving drug treatment that actually or potentially interferes with a patient’s experiencing an optimum outcome of medical care” [3]. One example of DRP is medication error. In our study we used the definition of medication error proposed by Leape [4]. With this definition medication error is any error in the process of prescribing, dispensing, or administering a drug, whether there are adverse consequences or not. The risk of medication errors is increased with the number of medications when elderly patients admitted to or discharged from hospital care [5]. While most such errors are minor, a small proportion results in an injury or adverse drug event (ADE). In a study on medication errors in hospitals, about one in 100 medication errors actually resulted in an ADE, although about seven per 100 had the potential to do so [6]. Although most medication errors have little potential for serious harm, they are undesirable and problematic for the patient, and may cause morbidity and for the health care professionals cause extra workload and stress.

Medication errors may occur in hospital, primary care and in the interface between these care levels. Medication administration errors are frequent during hospital care [7]. In another study in a hospital medication errors of several types were common, such as: ordering, transcription, dispensing, administration, and errors in discharge summaries [8]. There are many transfers that could be associated with risks of medication error, e.g., when patients are transferred between hospitals or between different GPs and when patients are discharged from hospital. It is important to minimise the number of medication errors due to errors in transfer of information. These alterations were a cause of ADEs.

When patients are admitted to hospital, accurate information on drug use prior to hospital care is important also because it may uncover reasons for patients’ illnesses, such as ADEs.

When patients are discharged from hospital there is a need for correct transfer of information on medications in order to fulfil the intentions of the hospital physicians. Lack of information from hospital to general practitioner is a common contributory factor and sometimes the principal reason for unplanned readmission of elderly patients to hospital [9]. In several studies medication errors at discharge from hospital were shown to be common [10–12]. In one of these studies on elderly patients that were transferred from hospital to primary care we found that the use of a medication report reduced the number of medication errors significantly [12]. Of 248 patients with Medication Report 79 patients had in total 241 errors (0.97 per patient), whereas of the 179 patients in the control

group 118 patients had in total 397 medication errors (2.22 per patient). Thus, 169 patients (68%) in the intervention group and 61 (34%) in the control group had no medication errors at all. The most common medication error was that medications were erroneously added. Other types of errors were erroneous change in dosage and omission errors.

Medication Report, together with a medication list is included in the discharge summary and describes all medication changes and the reasons for these during hospital care (Fig. 1). The Medication Report is an integrated part of the discharge summary including a short description of reasons for admission, actions taken and planned, and also a structured updated list of the patients’ current medication based on available information. This report is made by the hospital physician and is sent to the GP, the nurse in the community health care or nursing home at the day of discharge, and given to the patients themselves. The Medication Report does not include counselling.

Before the introduction of a Medication Report there was no structured way that information on changes in medications were transferred. In the present study, we evaluated whether the use of a Medication Report led to a decrease in clinical. Clinical outcomes were defined as need for hospital or primary care within three months after discharge from hospital.

### Aim of the study

The aim of this study was to investigate whether a Medication Report can reduce the number of patients with clinical outcomes due to medication errors when elderly patients are discharged from hospital.

### Method

#### Subjects

All patients 65 years or older with at least one defined medication error who were discharged from the departments of internal medicine, neurology, or infectious diseases, a total of seven wards, at Lund University Hospital during September 1–November 30, 2004 or February 1–March 31, 2005 were eligible if the patients after discharge from the hospital would be treated by a GP and receive their medications from a nurse either in their own home or in a nursing home. December and January were not included due to staff shortages. The control group consisted of patients 65 years or older with at least one defined medication error who had received hospital care in any of the participating departments during September 1–November 30, 2003 or February 1–March 31, 2004 [12].

**Fig. 1** Example: Medication Report

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 Born: 12 Dec 1912  
 Name: Sven Svensson

 Physician during hospital care: Lydia Holmdahl  
 General practitioner: Patrik Midlöv

Hospital care: 1 Feb 2005 – 8 Feb 2005

## DISCHARGE SUMMARY

You have been in hospital care because of fever and respiratory insufficiency. X-ray examination confirmed a diagnosis of pneumonia. There were also signs of heart failure. You have been treated with antibiotics and diuretics.

You will be transferred to a nursing home, Sunny Hill in Eslöv, and your General Practitioner will visit you there within the next week.

**Medication report**

- Furosemide has been increased from 1 to 2 tablets per day due to increased heart failure.
- Spironolactone has been added due to low potassium level.
- Doxycycline (antibiotic) has been added for another week due to pneumonia.

MEDICINE preparation, dose	Effect	Morning	Noon	Evening	Night	Note
Tabl Furosemide 40 mg	Diuretic	1	1			
Tabl Spironolactone 25 mg	Diuretic and to retain potassium	1				
Tabl Digoxin 0.13 mg	Against atrial fibrillation	1				
Tabl Zolpidem 5 mg	Sleep				1	
Tabl Doxycycline 100 mg	Antibiotic	1				Until 15 February
Mixt Lactulose	Against constipation	20 ml				
Tabl Paracetamol 500 mg	Against pain	1	1	1		
Tabl Cobalamin 1 mg	Vitamin B 12	1				

We only included patients that lived in a nursing home or received their medications from a community health care nurse. Since these patients receive their medications from a nurse we know exactly what medications the patients took before, during, and after hospital care.

## Data assessment

*Identification of errors*

We identified if there were any errors in the transfer of information, i.e., if the drugs were not the same as before the transfer. Medication errors were defined as discrepancies that were not mentioned in the medical records or any other written information at the GPs' or community nurses'. Incorrect dosage interval was not considered an error if the total dosage/24 h had not been changed. Change of medication to a generic drug or withdrawal of drugs with long dosage interval, e.g., once monthly, was not regarded as an error. If drugs were added, withdrawn, or the dosage had changed without any documentation in charts, medical records, or medication lists, it was considered an error. The lists from community nurses were always considered to be

the correct one since patients received all medications from a nurse according to these lists.

Clinical risks, as a theoretical consequence of the errors, were evaluated for each patient with an error, separately by two physicians (P.M. and L.H.). Clinical risks were defined as a possible need for hospital or primary care due to medication errors. Clinical risk is thus something that the physicians evaluated without knowledge of any actual event, whereas clinical outcome is what actually happened to the patient. We then documented all contacts that these patients had had with primary care or hospital care.

A patient administrative database was used to investigate where and when the patients with medication errors had been in contact with hospital or primary care. In this database all contacts with public hospitals or primary care are registered. All medical records were collected from hospital departments and GPs for each patient that had been in contact with primary or hospital care within three months after discharge from hospital. We estimated that a clinical outcome caused by a medication error should appear within a 3-month period after the hospital discharge. For all included patients all information on each contact was collected and prepared by a pharmacist (ED) for

evaluation in a multiprofessional study group. Contacts that were planned before hospital care were not evaluated by the group. For each remaining contact, the group evaluated all written information from medical records in hospital and primary care in order to evaluate whether the visit, admission to hospital, etc. was caused by the medication error. The study group consisted of a GP, a senior consultant in internal medicine, a clinical pharmacologist, and a clinical pharmacist. The probability that medication errors had caused the clinical outcome or need for administrative corrections was estimated according to the WHO's criteria as certain, probable, possible, unlikely, and no [13, 14]. Administrative corrections were defined as notes in medical records that indicated an effort to correct the medication error but where the error did not cause the patient any clinical consequence.

### Statistical analyses

Since power estimation was not possible, we could not predict the number of patients in each group to obtain statistically significant data ( $p < 0.05$ ). Hence, all patients from a previous study [12] with identified medication error were included in the analyses.

The results are generally given as frequencies, means, and 95% confidence intervals (CI). The relative risk of clinical outcome between patients with and without Medication Report was calculated. We tested if there was a significant difference in clinical outcomes caused by medication errors between the patients with and without Medication Report. In these calculations missing data (no medical records or unclassifiable, Table 1.) were considered to have the same frequency of errors as the rest of the group. All statistical analyses were performed using computer software R (ver 2.5.1, Vienna Technical University, Vienna, Austria).

### Ethics

The evaluation of the ethics committee at Lund University was that no formal approval was necessary. For the patients the only difference was that they received written information on their medication. Their medical care was not affected.

### Results

No errors were evaluated as certain cause of medical care. The use of Medication Report reduced the need for medical care due to medication errors classified as probable or possible,  $p = 0.049$ . Relative risk is 0.47 (CI: 0.22–1.00).

The use of a Medication Report significantly reduced the risk of any consequences due to medication errors,  $p = 0.0052$ . Relative risk is 0.45 (CI: 0.26–0.79). These consequences included probable and possible care due to medication error as well as administrative procedures (corrections) made by physicians in hospital or primary care. For patients with Medication Report 8.3% (CI: 5.1%–12.5%) had any such consequence compared with 17.9% (CI: 12.4%–24.5%) for patients without Medication Report.

The classification of all consequences due to medication errors in active and control group is presented in Table 1.

The correlation between evaluated clinical risk, as a theoretical consequence of error, and the need for medical care due to medication error is presented in Table 2. Medication errors evaluated as moderate or high clinical risk had a higher probability of consequence than errors evaluated as without clinical risk,  $p < 0.001$ . When only need for medical care due to medication error was included the relative risk is 0.19 (CI: 0.07–0.56). When administrative corrections by health care professionals also are included the relative risk is 0.26 (CI: 0.13–0.48).

**Table 1** Number of patients (%) and the evaluation of consequence due to medication error

Need for medical care or administrative correction by health care professionals due to medication errors	With medication report	Without medication report
Certain	0 (0.0)	0 (0.0)
Probable	5 (2.0)	9 (5.0)
Possible	6 (2.4)	7 (3.9)
Unlikely	3 (1.2)	4 (2.2)
No	50 (20)	73 (41)
Administrative correction	9 (3.6)	14 (7.8)
Unclassifiable	2 (0.8)	2 (1.1)
No medical records	4 (1.6)	9 (5.0)
Total number of patients with medication errors	79 (32)	118 (66)
Number of patients without medication error	169 (68)	61(34)
Total number of patients	248 (100)	179 (100)

**Table 2** The correlation between evaluated clinical risk, as a theoretical consequence of error, and the need for medical care due to medication error presented as number of patients with medication errors (%)

Probability of consequence due to medication error	Patients with medication error evaluated as without clinical risk	Patients with medication error evaluated as moderate or high clinical risk
Probable	3 (2.9)	11 (12)
Possible	2 (1.9)	11 (12)
Unlikely	4 (3.9)	3 (3.2)
No	81 (79)	42 (45)
Administrative correction	6 (5.8)	17 (18)
Unclassifiable	2 (1.9)	2 (2.1)
No medical records	5 (4.9)	8 (8.5)
Total	103 (100)	94 (100)

## Discussion

We found that a Medication Report reduces the need for health care due to medication errors. This intervention thus reduces morbidity among older people. For the health care system the use of Medication Report decreased the clinical and administrative workload. This workload is, for example, correction of incorrect medication lists, efforts to reach the hospital physician in order to find out correct prescriptions. Adverse drug events (ADEs) have been shown to contribute to the morbidity and mortality associated with the treatment of disease as well as the cost of care [15, 16]. Preventable ADEs are often the result of medication errors [17]. Thus, efforts to reduce medication errors may prevent ADEs.

In this study, we also show that the evaluation of medication errors is a predictor of clinical outcome due to medication error, i.e., evaluated clinical risk, as a theoretical consequence of error is a predictor of the need for medical care due to medication error (Table 2).

Such evaluation could thus be used to concentrate on reducing errors that are most likely to cause clinical consequences to patients.

A possible weakness in this study is that we did not conduct a randomised-controlled study. It seemed impossible that physicians should make structured information for one patient and then forget all about that with the next patient. We therefore used a retrospective control group. We cannot be sure that there are no differences between intervention and control group. Patients in the control group had on average the same number of drugs and were of same age as in the intervention group.

We do not know if all care givers or the patient himself had considered the medication report. We merely evaluated whether the use of medication report could reduce the number of patients with clinical outcomes due to medication errors.

We cannot be sure that all clinical outcomes are detected in this study. We do not have access to medical records from independent physicians. There are however no private hospitals in this part of Sweden and the vast majority of

visits to GPs are made within the public primary health care system.

We have in this study not measured cost-effectiveness. The decrease in need for medical care and also the decrease in extra administrative workload due to medication errors are however noted. A future study might evaluate the cost-effectiveness of interventions that reduce the number of medication errors.

In another study inpatient pharmaceutical counselling combined with use of medication and discharge summaries reduced unplanned visits to the physician and re-admissions [18]. Other studies have also shown effective methods to reduce number of medication errors though not evaluating any clinical effects [19, 20]. The introduction of Medication Report seems to be an effective tool in reducing morbidity due to medication errors. It is important that effective and correct transfer of information between care levels do have clinical implications to patients. In the same way that new treatments should be evidence-based new working methods should. Once they are, as the Medication Report, they should be implemented in clinical practice. At the University Hospital of Lund, where this study was conducted, the Medication Report will be used in all clinical departments.

## Conclusion

The Medication Report seems to be an effective tool to decrease adverse clinical consequences when elderly patients are discharged from hospital care. The use of Medication Report also reduces the need for administrative corrections due to medication errors.

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