

Insufficient communication about medication use at the interface between hospital and primary care

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Background: Lack of updated and uniform medication lists poses a problem for the continuity in patient care. The aim of this study was to estimate whether hospitals succeed in making accurate medication lists congruent with patients' actual medication use. Subsequently, the authors evaluated where errors were introduced and the possible implications of incongruent medication lists.

Methods: Patients were visited within one week after discharge from surgical or medical department and interviewed about their use of prescription-only medication (POM). Stored drugs were inspected. Medication lists in hospital files and discharge letters were compared with the list obtained during the interview. The frequency of incorrect medication use and the potential consequences were estimated.

Results: A total of 83 surgical and 117 medical patients were included (n=200), 139 patients (70%) were women. Median age was 75 years. Six patients stored no POM, 194 patients stored 1189 POM. Among the 955 currently-used POM, 749 POM (78%) were registered at some point during hospitalisation but only 444 (46%) were registered in discharge letters. 66 POM users had no medication list in their discharge letter. Local treatments (skin, eyes, airways) were registered less frequently than drugs administered orally. In total, 179 of the currently-used POM (19%) were not mentioned anywhere in hospital files, probably because of insufficient medication lists made at admission, and the prescribed regimen was unclear. At least 63 POM (7% of currently-used POM) were used in disagreement with the prescribed regimen.

Discussion: Approximately one fifth of used POM is unknown to the hospital and only half of used POM registered in discharge letters. Insufficient medication lists hamper clarifying whether or not patients use medication according to prescription. In order to prevent medication errors a systematic follow-up after discharge focusing on making an updated medication list might be needed.

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Polypharmacy is increasing.¹ The request for individualised treatments of not only manifest diseases but also numerous risk factors is likely to further increase multidrug regimens.² An important cause of medication-prescribing errors leading to adverse drug events is polypharmacy combined with lack of knowledge of patients' medication use at time of prescribing.^{3–5}

Upon hospitalisation the patient is often the primary source of information about a prescribed medication regimen. However, due to patients' recall bias supplementary information is often needed from district nurses, general practitioners or pharmacies.^{6–7} The lacking update of written registrations and the frequent involvement of several healthcare professionals hamper the overview of the currently-prescribed drugs; medication lists may also be inconsistent.^{7–11} The frequent changes in prescribed medications during hospitalisations combined with erroneous discharge letters further add to the problem.^{12–13} This lack of updated and uniform medication lists poses a problem for the continuity in patient care with the risk of less effective treatment and adverse drug reactions.²

To evaluate clinical drug effects it is important to know the patient's current medication use.^{14–15} The patient does not always follow the prescribed regimen—either accidentally, due to misunderstandings, or deliberately.^{2–16} Medication reconciliation is a multistep process verifying variance between medical records and the patient's actual medication use followed by rectification of errors.^{17–18} Valid information about current medication use can best be collected when visiting patients in their own homes: the inspection of stored drugs combined with interviews about medication use reduces recall bias.^{19–21} However, this strategy has been used only to a limited degree as a method to verify the information on drug use available in hospital files related to hospitalisation.⁷

We wanted to investigate whether a hospital had succeeded in making medication lists congruent with patients' actual medication use. Previous studies have primarily focused on either the admission medication list^{22–24} or the medication list in the discharge letter^{12–25} and we wished to do both, to differentiate where errors had been introduced. We collected information about patients' medication use after hospitalisation during home visits one week after the discharge. Patients' reported use was compared with the written registrations in (1) the discharge letter and (2) the full hospital file. Discrepancies were noted and the possible consequences evaluated. Incongruent lists might indicate a need for systematic medication reconciliation upon hospitalisation or a systematic follow-up and evaluation of patients' medication use after discharge.

MATERIAL AND METHODS

This cross-sectional survey was conducted from November 2002 to March 2003 in a surgical and a medical department at a University hospital in Copenhagen, Denmark. The surgical department specialises in gastrointestinal diseases and the medical department in endocrine, gastrointestinal and pulmonary diseases. The Regional Ethics Committee and the Danish Registry Board approved the study. The drug company Pharmacia/Pfizer financially supported the study. However, the company was not involved in data collection, data analysis or manuscript preparation, and the authors had full ownership of the study data.

Patients scheduled for discharge were identified every weekday at 9 am and 12 noon. Patients were eligible for inclusion if they lived in their own home (sheltered housing

Abbreviations: ATC, Anatomical Therapeutic Chemical Classification System, ATC; POM, prescription-only medication

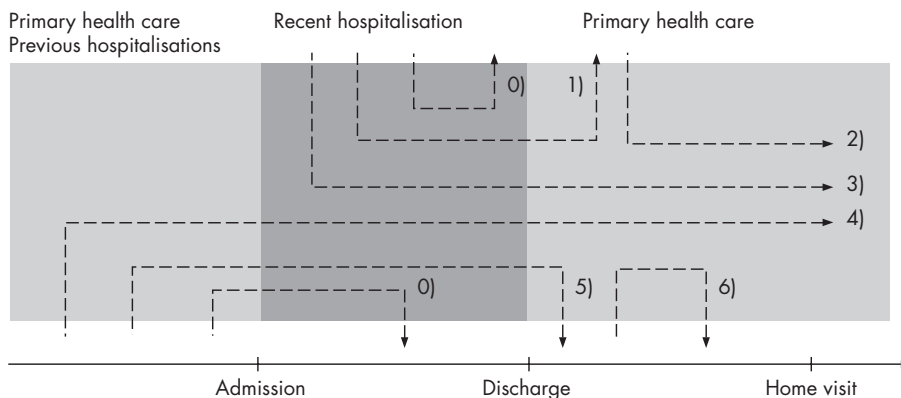


Figure 1 Schematic presentation of ordering and discontinuation of drugs in primary and secondary health care. The prescription-only medication (POM) described in the present article were all used during the week following discharge. The duration of use might be subdivided into: 1. POM prescribed during hospitalisation and used at discharge but not used during home visit. 2. POM prescribed after discharge and used during home visit. 3. POM prescribed during hospitalisation and used during home visit. 4. POM prescribed before hospitalisation and used during home visit. 5. POM prescribed before hospitalisation and discontinued after discharge. 6. POM prescribed after discharge and discontinued before home visit. POM discontinued during hospitalisation (arrows 0) are not described.

included) and were able to speak Danish or English. After informed consent was obtained (written and verbal), patients were included consecutively until 200 home visits had been carried out.

The patients were interviewed in their home within the first week after discharge. The aim of the interview was to clarify the patient’s medication use during the time period from hospital discharge until the home visit and to establish the duration of use of individual drugs. Some drugs used at discharge had been discontinued, new drugs were added, etc (fig 1). The interviewer asked the patients to present all their stored medications, and a structured drug interview lasting approximately one hour was performed. Packages and containers were inspected and the following information was recorded: drug name, prescription date, schedule and dosage. The patients were questioned about the prescriber of individual drugs and about the duration of drug use. Additionally, patients were asked to specify their current medication use and their medication use immediately following discharge. To make the patient as comfortable as possible, questions about drug use were asked in a non-judgemental way. The interviewing physician had not been involved in patient care during the hospitalisation. If inconsistencies were noted in patient’s drug regimen the patient was recommended to seek advice from treating physicians.

Below only data regarding POM are presented, with POM defined as medications only available by prescription as apposed to over-the-counter products.

Current medication use was defined as the regimen the patient used at the time of the home visit. We used the following categories:

1. Used daily: POM used every day according to a regular schedule
2. Used on demand: POM used within the last month in response to specific symptoms
3. Not currently used: stored POM not used in the preceding month.

The drug regimen prescribed by the hospital was established from the medication lists in the discharge letter. Additional information on in-hospital knowledge of drug use was established by scrutinising the drug lists registered upon admission and during hospitalisation. These overall registrations on prescribed drug regimen (arrows 1, 3, 4, 5 in fig 1) were compared to patients’ reported POM use immediately after discharge and discrepancies noted.

STATISTICS

The use of medications was reported using descriptive statistics. We used χ^2 tests (for categorical data) and two-sample *t* tests (for continuous data) for comparison of independent groups of data. Cut-off level for statistical significance was 0.05. The statistics were calculated with SAS 9.1.

RESULTS

Overall, 256 patients were screened for inclusion. Of these, 56 patients were excluded due to readmission (n = 7), withdrawn

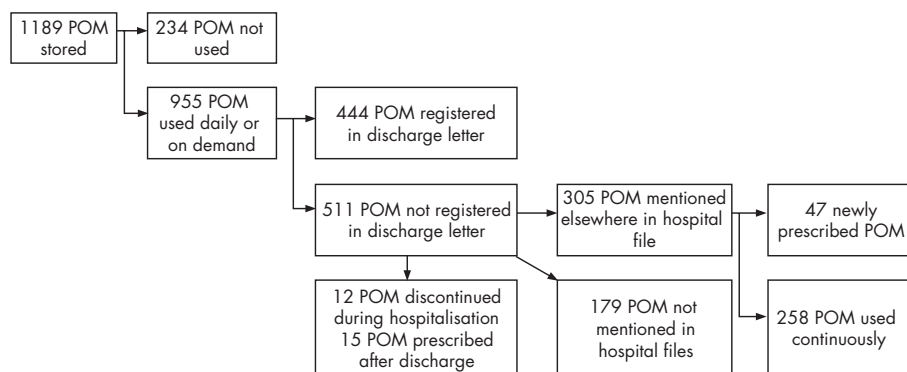


Figure 2 Prescription-only medication (POM) storage and use at home visit. Registration of used drugs in hospital files and discharge letters.

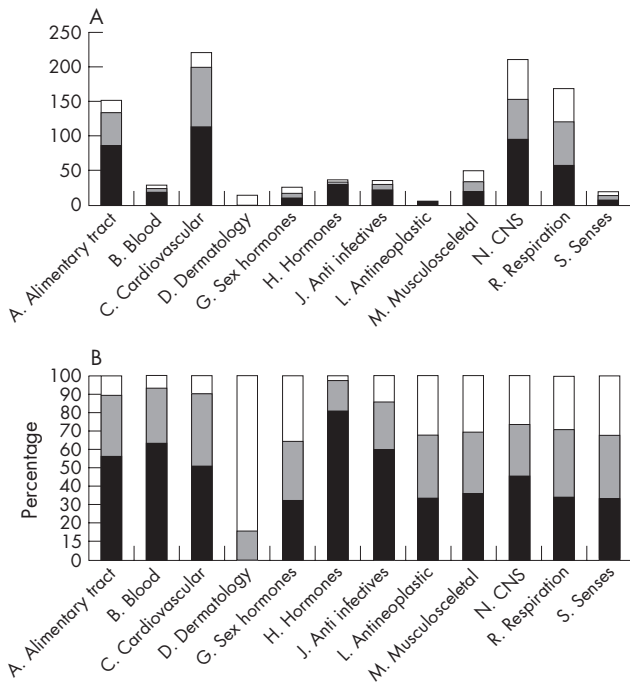


Figure 3 (A) Total number of prescription-only medication (POM) used at time of home visit (n = 955) subdivided by ATC code. Black bar: POM registered in discharge letter. Striped bar: POM registered elsewhere in hospital files. White bar: POM not registered in hospital files. (B) Percentage of POM in each ATC group registered in discharge letter or elsewhere in hospital file subdivided by ATC code. Black bar: Percentage of POM registered in discharge letter. Striped bar: Percentage of POM registered elsewhere in hospital files. White bar: Percentage of POM not registered in hospital files.

consent (n = 47) or death within one week after discharge (n = 2). The included and excluded patients were similar regarding age (mean 72 v 70 years, p = 0.36) and sex (women/men 139/61 v 41/15, p = 0.59).

A total of 200 home visits were conducted. Eighty three patients (42%) had been discharged from the surgical department and 139 (70%) were women. The median age was 75 years (range 24–100 years). Overall, 171 patients (86%) were retired or receiving social security. One hundred and twenty eight patients (64%) personally dispensed all drugs. District nurses assisted in 51 cases (26%) and relatives assisted in 21 cases (11%). The median length of hospital stay was 7 days (range 1–155 days) for surgical and 7 days (range 2–38 days) for medical patients. The primary diagnoses as recorded in the

discharge letters were pulmonary diseases (n = 65, 33%), gastrointestinal diseases (n = 62, 31%), malignant diseases (n = 21, 11%), diseases of the liver, pancreas or bile ducts (n = 18, 9%) or other diseases (n = 34, 17%). One hundred and fifty eight patients (79%) had been admitted to hospital due to acute illnesses.

A total of six patients stored no POM and the remaining 194 patients (97%) stored 1189 POM in their homes (median 5 POM per patient, range 0–19) of which 955 POM were currently used daily or on demand (median 4 POM per patient, range 0–19) (arrows 2, 3 and 4, fig 1) (fig 2). The 955 POM included 15 POM prescribed after discharge (arrow 2, fig 1); 14 POM had been used at discharge but were discontinued at the home visit (arrows 1 and 5, fig 1). All patients had a discharge letter from recent hospitalisation. A systematic examination of all registrations in hospital files, discharge letters, etc showed that 444 of the used POM (46%) were registered in discharge letters and another 305 POM (31%) were registered elsewhere in hospital files giving an overall registration of 78%. The overall registration (discharge letter or hospital file) and the registration in the discharge letter was significantly higher among medical compared with surgical patients (p < 0.001). A total of 80 patients had no medication list in the discharge letter at all, including 14 patients reporting no POM use at discharge and 66 patients (55 surgical and 11 medical patients) reporting use of one or more POM at discharge.

Figure 3A shows used POM subdivided by Anatomical Therapeutic Chemical Classification System, ATC-code.²⁶ Proton pump inhibitors (A02), diuretics (C03), strong analgesics (N02), anxiolytics (N05) and inhalation therapies in obstructive airway disease (R03) were the drugs used most frequently. As shown in figure 3A and B incongruent registrations were present in all ATC groups. Oral blood glucose lowering drugs (A10), antithrombotic drugs (B01), cardiovascular drugs (C), hormones (H02 corticosteroids, H03 thyroid therapy) and antibiotics (J) were the categories most frequently having congruent registrations estimated as per cent of total. Strong analgesics (N02), anxiolytics (N05) and sex hormones (G03) had congruence rates below 50% in the overall registrations (specific data not shown). Among medical patients the congruence was lower for local treatments (eye drops, inhalation therapy and dermatological treatments) compared to systemic treatments (for example, tablets, suppositories) (p < 0.001). The surgical patients had low congruence irrespective of the administration route (p = 0.07). When comparing the drug regimen prescribed in the hospital files/discharge letters to the regimen followed by patients obvious discrepancies were noted in 63 POM (34 patients): 11 prescribed drugs were not used at all (table 1), 12 drugs discontinued during recent hospitalisation were still used

Table 1 Eleven prescription-only medications prescribed in discharge letter but not used during home visit: potential implications

Sex	Age (years)	Drug	Indication	Implication of non-use
Male	92	Zopiclone	Insomnia	Limited
		Budesonide inhalation	COPD	Limited
Female	88	Codeine	Analgesic	Limited
Female	54	Esomeprazole	Gastric ulcer	Lacking prophylaxis
Female	83	Tiotropium inhalation	COPD	Limited
Female	64	Clonazepam	Anxiety	Limited
Female	62	Budesonide inhalation	COPD	Limited
Male	78	Formoterol inhalation	COPD	Limited
Female	85	Dipyridamole	Apoplexia cerebri	Lacking prophylaxis
Female	63	Budesonide inhalation	COPD	Limited
Female	66	Salmeterol inhalation	COPD	Limited

COPD, chronic obstructive pulmonary disease.

Table 2 Twelve prescription-only medications discontinued during hospitalisation but still used by patient: potential implications

Sex	Age, years	Drug	Indication	Reason for discontinuation	Implication of use
Male	62	Codeine	Analgesic	Acetaminophen prescribed instead	Risk of constipation. Patient with resected colon
Female	91	Trandolapril	Not stated	No reason stated	Risk of harmful effects of an unnecessary treatment
		Bendroflumethiazide	Not stated	No reason stated	Risk of harmful effects of an unnecessary treatment
		Tramadol	Analgesic	No reason stated	Risk of harmful effects of an unnecessary treatment
Female	61	Diazepam	Muscular relaxant,	No reason stated	Risk of misuse
		Ibuprofen	analgesic Analgesic	No reason stated	Risk of harmful effects of an unnecessary treatment
Female	77	Terbutaline	COPD	Ipratropium/fenoterol combination treatment prescribed instead	Limited
Female	66	Salbutamol	COPD	Salmeterol/fluticasone combination inhalation prescribed instead	Unnecessary double treatment
		Salmeterol	COPD		Limited
Female	75	Digoxin	Atrial fibrillation	Sinus rhythm	Risk of harmful effects of an unnecessary treatment
Female	88	Metformin	Diabetes	Stable blood sugars	Risk of hypoglycaemia
		Spironolactone	Diuretic	Renal insufficiency	Risk of hyperkalaemia

COPD, chronic obstructive pulmonary disease.

(table 2), and 40 POM were used in other doses or regimens than prescribed (table 3). The POM not used by patients consisted of inhalation therapy in obstructive airway disease, analgesics and sedatives. These POM are mainly used as symptom-limiting therapy and the clinical implications of incongruent use are likely to be minor. One patient did not use prescribed esomeprazole in ulcer disease and one patient had discontinued prescribed dipyridamole—both causing lack of preventive effect. Among the 12 POM discontinued during hospitalisation but still used by patients were nine POM administered as tablets with potentially harmful effects due to use of an unnecessary and unmonitored treatment.

For example, the 91-year-old female still using trandolapril, bendroflumethiazide and tramadol explained dissatisfaction with the medication list provided from the hospital after discharge as several of the regularly-used drugs were omitted. She considered this as a mistake and resumed the treatment. She lived with her husband and did not wish to receive help with medication dispensing from a district nurse. However, according to the hospital file the drugs were discontinued during hospitalisation due to confusion, dehydration and low sodium level. As shown in table 3 the incongruent use of, for example, cardiovascular and psychotropic drugs implied the risk of either under- or overtreatment. A 76-year-old woman

using glimepiride 6 mg daily and hospitalised as a result of coma caused by hypoglycaemia exemplifies this. The treatment with glimepiride was reduced to 3 mg daily during hospitalisation to be continued after discharge, but the patient resumed her customary dosing of 6 mg. However, none of the patients reported daily-used doses higher than recommended by the Danish Medicines Agency.²⁷ The patients reported continuous use of 179 POM before and after hospitalisation which was not registered anywhere in the hospital files. As this lack of registration rendered it difficult to establish whether the patients used the drugs according to prescription, these drugs were not included in the above evaluation of congruence.

Regarding the 955 POM patients used at the time of the home visit, the patients reported that 691 POM had been prescribed before recent hospitalisation (269 (28%) by a hospital physician, 355 POM (37%) by general practitioners, 67 drugs (7%) by other physicians), 143 (15%) had been prescribed during recent hospitalisation and 15 drugs (2%) had been prescribed after discharge. The patients could not recall the prescribers of 106 POM (11%). Among the 143 POM prescribed during recent hospitalisation (79 patients, median 0 POM per patient, range 0–5), 47 POM covering various drug categories (for example, 10 antibiotics, 6 sedatives, 7 analgesics, 7 POM to treat gastric ulcer) were not mentioned in the

Table 3 Forty prescription-only medications used in different doses or regimens than prescribed in discharge letter

Sex	Age (years)	Drug	Prescribed use	Actual use	Indication for use	Implication of incongruent use
Female	85	Nifedipine	60 mg × 1	60 mg × 2	Hypertension	Risk of hypotension
Female	76	Glimepiride	3 mg × 1	6 mg × 1	Diabetes	Risk of hypoglycaemia
Male	62	Terbutaline	7.5 mg × 1	7.5 mg × 2	COPD	Risk of side effects
Female	82	Isosorbide dinitrate	80 mg × 1	80 mg × 2	Angina pectoris	Risk of hypotension
Female	64	Citalopram	20 mg × 1	10 mg × 1	Depression	Risk of insufficient treatment
Female	58	Citalopram	90 mg × 1	60 mg × 1	Depression	Unprescribed but probably relevant dose reduction
Female	79	Levothyroxine	0.1 mg × 1 and 0.15 × 1 on alternate days	0.1 mg × 1 and 0.2 × 1 on alternate days	Hypo-thyroidism	Dose reduced during hospitalisation. Poorer regulation of myxoedema
Male	57	Phenobarbital	100 mg × 1	100 mg × 2	Epilepsy	Risk of side effects
Female	88	Allopurinol	100 mg × 2	100 mg × 1	Gout	Risk of insufficient treatment
Male	79	Verapamil	240 mg × 1	240 mg × 2	Heart arrhythmia	Risk of hypotension
Female	91	Nitrofurantoin	50 mg × 1	25 mg × 1	Chronic cystitis	Risk of insufficient treatment
Female	52	Omeprazole	20 mg × 2	20 mg × 3	Ulcer	Risk of side effects
Female	79	Esomeprazole	40 mg × 1	20 mg × 1	Ulcer	Risk of insufficient treatment

COPD, chronic obstructive pulmonary disease.

Other prescription-only medication used in different doses and/or regimens than prescribed: inhalation therapy in obstructive pulmonary disease (11 patients), analgesics (6 patients), diuretics (2 patients), sedatives (6 patients), others (2 patients).

discharge letter (34 patients). Drugs prescribed by general practitioners were registered less frequently in hospital files/discharge letters than drugs prescribed by hospital physicians (69% v 89%, $p < 0.001$).

DISCUSSION

In this study, performed among surgical or medical patients recently discharged from hospital, one out of five drugs used by patients after hospitalisation were unknown to the hospital. In particular, drugs prescribed by general practitioners were not registered in hospital files. Frequently, information was lost at time of discharge and only half of used POM were mentioned in the discharge letters. The missing registrations made it very difficult to conclude whether patients used POM as prescribed, but a number of obvious inconsistencies with potential harmful effects were noted.

Knowledge of any drugs the patient is using is a prerequisite of the proper evaluation of patients, irrespective of the setting in either hospitals or primary health care.⁴⁻⁵ Drug interactions, adverse drug effects or drug interference with the underlying disease can be the consequences of errors in medication histories²⁸ and errors of omission may lead to overprescribing.²³⁻²⁹

Patients recently discharged from hospital must be expected to have updated medication histories. During hospitalisations a natural part of patient treatment is the evaluation of former drug treatment and further indication, and the prescription of new drugs. However, as illustrated in figure 1, this process is quite complicated with multiple prescribers being involved at different time-points. Therefore, in the present study we wished to estimate whether the hospital had succeeded in making an updated medication list—and whether this list was successfully communicated to general practitioners in the discharge letter. We also wanted to detect if missing registrations in the discharge letter was the results of either the drug being completely unknown to the hospital or to insufficient registrations of known drugs at the discharge stage.

In Denmark the only written communication between hospital and primary health care at discharge is the discharge letter. Hence this communication is essential to ensure continuity in care.²⁵⁻³⁰⁻³² Local or hospital pharmacies are not involved in discharge planning. All discharge letters should describe current medication use and reasons for major changes in previously-used medications (Copenhagen Hospital Corp. Discharge Summary—Policy, 2003). It is estimated that 20% of discharges lead to readmissions, partly because of lack of communication between hospitals and primary care.²⁵ Our finding that half of used drugs are not registered in discharge letters is not surprising and in congruence with previous studies.⁶⁻²⁴⁻²⁸ The discharge letters were inadequate especially among surgical patients and 55 of 83 surgical patients (66%) had no medication list in the discharge letter. Serious errors of omission were medications prescribed during hospitalisation not registered in the discharge letter. It is however surprising that the overall registrations in hospital files included nearly 80% of used drugs. Thus, much information was lost at time of discharge.

The 19% of POM not known to hospitals were more frequently prescribed by general practitioners. This illustrates a lack of communication between healthcare sectors. Such omission errors are most likely introduced on admission due to patient recall bias and perhaps insufficient effort to collect information from general practitioners and other treating physicians. Patients' resumption of use after discharge may lead to overprescribing or adverse effects.³¹

At least 5% of POM were used differently than prescribed. Discontinued drugs still used by patients were a particular

matter of concern due to potential lack of monitoring. The incongruence found in psychotropic medications and analgesics may be perceived as intelligent non-adherence: the patient discontinues medication when a condition improves.²⁻³³⁻³⁴ However, such practise may be problematic as patients unintentionally under- or overdose if they autonomously alter doses and regimens.³⁵⁻³⁶

This study has some limitations. Errors of commission (that is, drugs recorded by physician but not used by patient)²⁸ were not included in the evaluation of medication lists in hospital files and discharge letter. Patients were interviewed about their general medication use; day-to-day variations and adherence rates were not recorded. Data regarding drug use depend on patients' verbal information and it is possible that disagreements between the prescribed and used POM regimen was underestimated due to underreporting. Furthermore, we did not distinguish between incongruent use due to misunderstanding and miscommunication versus patients deliberately not following prescriptions. We defined incongruence as any inconsistency between the actual uses of drugs in contrast to the regimen prescribed according to the hospital files. This reflected our viewpoint that medication lists should reflect patients' actual actions. If patients are non-adherent to drugs, for example because they do not find the drugs effective or the drugs have side effects, drug lists should be corrected correspondingly. However, some authors find it more relevant to compare patients' *understanding* of the prescribed drug regimen to medication lists in order to separate non-adherence from the perceived regimen.²

Wide improvements must be made in this area—sufficient drug lists upon admission to hospital, during hospital stay and lastly in the discharge letter are essential to ensure an updated and correct medication list. On admission secondary interviews, collection of information from general practitioners and pharmacies has proven effective in complementing drug lists.²³⁻²⁴ Systematic medication reconciliation applied at hospital admission or discharge may prevent medication errors and adverse events.³⁷⁻³⁸ The process of reconciliation includes comparison of available medication lists (for example, from general practitioners, district nurses, pharmacy records) to patient's current medication use. This is followed by a clinical decision and communication of a new, common list to the patient and caregivers. In Denmark, pharmacy records on POMs handed out from a Danish pharmacy in the preceding two years are now available directly online by use of a digital signature.³⁹ Such data may reduce recall bias and thus improve information on used medications, and the direct access to the records makes them also useful outside of a research setting.⁴⁰

In the current study, much information otherwise available in the hospital files was lost at discharge. Electronic medication lists are now available in some Danish hospitals; these lists implemented at discharge could be beneficial. Medication reviews and systematic counselling by nurses or pharmacists are other ways to improve the lists.³⁸⁻⁴¹⁻⁴² Joint formularies and standard lists used between healthcare sectors, perhaps in an electronic form linking to pharmacy records, are other ways to improve continuity in care. However, less is known about the cost effectiveness of these interventions to reduce medication errors.⁴²

Follow-up after discharge may be needed especially if patients are not well informed about medication changes. The setting could be in the patient's own homes, the general practitioner's office or in a hospital ambulatory setting.²⁰⁻²¹ Interview accompanied by the inspection of medication containers facilitates a medication list congruent with patient's actual medication use and possible misunderstandings may be rectified. This would improve the information on not only used POM but also over-the-counter products.⁴⁴⁻⁴⁵

In summary, our data show that the hospital has no knowledge of one fifth of used POM and reports only half of used drugs in the discharge letter. Erroneous medication lists are most likely introduced because of insufficient registrations at admission and omissions at discharge. It is important to address these issues further and to improve the communication between primary and secondary care in order to prevent inappropriate medication use and adverse drug effects. Systematic follow-up after discharge focusing on an updated medication list might be effective in reducing medication errors.

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