Frequency of undocumented medication discrepancies in discharge letters after hospitalization of older patients: a clinical record review study

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Abstract: Transitions of care may result in medication errors, when information about a patient's medications is not communicated sufficiently. In this clinical record review study, we aimed to evaluate the frequency of undocumented medication discrepancies at discharge from hospital and evaluate which patient characteristics could be associated with undocumented medication discrepancies. Preadmission medication lists were compared against the medication list in the discharge letters, taking into account medication changes documented in the patient record throughout the inpatient stay and in the discharge summary. Out of 200 patients, 174 (87%) were affected by at least one undocumented medication discrepancy, mostly for regular medication. Of the 1972 medications used, 744 (38%) medications were changed without documentation in the patient record, the majority being over-the-counter supplements and herbal medications. Polypharmacy at admission and discharge was associated with increased undocumented medication discrepancies. This study indicates a lack of medication reconciliation during inpatient stay. Correct and complete medication lists at admission and discharge may resolve many of these discrepancies, supporting patient safety at transitions of care.

Introduction

Transition of care represents a vulnerable situation for the patient and can affect the medication safety. At discharge, 14–84% of patients experience at least one medication discrepancy.[1–10] Medication discrepancies after discharge can lead to increased hospital visits[6,7,11] or preventable adverse drug events.[12] Older patients are especially at risk, as polypharmacy, comorbidities, and longer hospital stays are associated with increased medication errors.[2,3,8–10,13] Furthermore, it has been shown that incomplete medication lists at admission can result in medication errors at discharge.[9,13,14]

Medication reconciliation has been shown an effective method for evaluating and resolving unintentional discrepancies.[15–17] To facilitate medication reconciliation, a national electronic shared medication portal (SMP) was implemented in Denmark in 2014.[18] It contains a list of the patient's current medications, updated by the physician who last treated the patient, together with a pharmacy registry, where every prescription filled at community pharmacies is shown.

A medication discrepancy arises when the discharge medication list differs from the preadmission medication list without any documented

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changes. It may be an intended discrepancy if the physician had a medical reason for the change; if not, the discrepancy is unintended. However, the intent behind a medication change during hospital stay will not reach the general practitioner if it is not documented in the discharge letter. It has not previously been investigated whether medication discrepancies in the discharge summary arise from documented or undocumented changes in the patient record.

Aim of study

The aim of this study was to examine the frequency of undocumented medication discrepancies in the discharge letter after hospitalization. This was done for both regular medications, as-needed medications, and over-the-counter supplements and herbal medications (hereafter called OTCs). Further, associations between the occurrence of undocumented medication discrepancies and patient-related variables were evaluated.

Methods

Study design

This clinical record review study was carried out in April 2016 at the Hospital of South West Jutland, Denmark.

Study population

The data provided in this study were obtained from a pool of 400 patients who all took part in the intervention arm of a randomized controlled trial conducted by one of the authors (TG) at the Hospital of South West Jutland from April 2013 to December 2014.[19] The SMP was launched at the hospital on 24 February 2014. Patients included in the randomized controlled trial were acutely admitted medical patients aged 65 years or above, whereas extremely ill, isolated and terminal patients, patients without a Danish social security number and patients unable to give informed consent were excluded. Patients could only be included in the study once, even if they were admitted multiple times.

In this study, two additional exclusion criteria were used on the legacy data: patients temporarily transferred to another hospital for more than 1 day and patients who died during hospitalization were excluded.

Reconciliation at admission

As part of the intervention arm in the randomized controlled trial, medication reconciliation at admission was conducted by a clinical pharmacist (TG). This was done in order to create the best possible medication list (BPML), listing all medications taken by the patient before admission.

A full description of the intervention is described elsewhere,[19] but described briefly here. During the reconciliation, the clinical pharmacist reviewed the electronic hospital patient record, SMP and correspondence notes from nursing homes and general practitioners when available. A structured patient interview was conducted at admission. Any information regarding prescription medications taken regularly, as needed and OTCs was gathered. When the medication prescribed at hospital was not in agreement with the medication actually taken, the pharmacist wrote an electronic record entry in the patient record to aid the physician in prescribing the correct medication during the intervention study.

Retrospective reconciliation

As part of this observational study, a retrospective reconciliation at discharge was conducted by two of the authors (BGT and KEL). The entire patient record was reviewed from the day of admission until discharge, noting any medication change made during hospitalization. The intent of every medication change was determined, based on whether or not the change was explicitly mentioned by physicians in the patient record. All intended medication changes were applied to the BPML, giving the best possible discharge medication list (discharge BPML).

The discharge BPML was compared against the actual medication list in the discharge summary. All discrepancies between the two lists were noted. Discrepancies for medications taken regularly, as needed and OTCs were registered separately. As the analysis was performed retrospectively, it was not possible to take action on the identified discrepancies.

Medication discrepancies and patient-related variables

All medication discrepancies were categorized according to the documentation in the text part of the discharge summary, as this is the only

written information the general practitioner receives from the hospital and were grouped by the following:

(1) Documented: an intended medication change was made during hospitalization and was documented in the discharge summary text;

(2) Partly documented: an intended medication change was made during hospitalization and documented by the physician in the patient record, but not in the discharge summary text;

(3) Undocumented: a medication change was made during hospitalization, with no documentation of the change in neither the patient record nor the discharge summary text. It is not possible to assess whether this change was intended or unintended.

Patient-related variables were categorized according to sex (male/female), age (under/above 80 years), polypharmacy at admission (more/less than five medications at admission), polypharmacy at discharge (more/less than five medications at discharge), long hospital stay (more/less than 2 days) and SMP (admission before/after launch). The definition of old age and long hospital stay were arbitrarily chosen.

For the first 10 patient records, the clinical record review was performed by both authors (BGT and KEL). The results from these patients were discussed with a third author (TG) until consensus was reached. For the remaining 190 patients the clinical record review was performed by either BGT or KEL.

Statistical analysis

Differences in proportion of patients with at least one undocumented medication discrepancy according to the patient-related variables were assessed using a chi-squared test (95% level of significance). Statistical analysis was performed using STATA IC v15.1 (StataCorp, College Station, TX, USA).

Ethics approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments[20] and Danish legislation.

Informed consent was obtained from all individual participants included in the randomized study.[19] The study protocol of the randomized study was approved by the Danish Data Protection Agency and the Regional Scientific Ethics Committees for Southern Denmark (registration number S-20110161). According to Danish law, data could be transferred to the clinical record review study after approval from the institutional board as the aim was in concordance with the aim of the randomized study.

Results

Study population

Patients were randomly selected from the pool of 400 intervention patients from the randomized controlled trial and assessed for inclusion according to the two new exclusion criteria until 200 patients were reached. Three patients were temporarily transferred to another hospital for more than 1 day and two patients died, resulting in screening of 205 patients. Patient characteristics are summarized in Table 1. Most patients had short hospital stays, with a median of 2 days [interquartile range (IQR) 2–5 days], but 11 patients were hospitalized for 14 days or more. The median number of regular pre-admission medications recorded for each patient was 5 (IQR 3–8).

Medication changes during hospitalization

During hospital stay, 199 out of 200 patients had changes in their medication and 1159 out of the 1972 medications of these patients were changed, see Table 2.

In total 174 (87%) patients were affected by at least one undocumented medication discrepancy. Of the 1972 medications used, 744 (38%) medications were changed without documentation in the patient record, see Table 2. The proportion of patients affected by undocumented medication discrepancies was largest for regular medication, whereas the percentage per medication was largest for OTCs, see Table 2. For the 338 undocumented discrepancies in regular medications, 26% was medication for the cardiovascular system, 18% was medication for the alimentary tract and metabolism, 14% was medication for the nervous system and 9% was medication for the respiratory system.

Table 1. Characteristics for the included patients.

Patient characteristics	*n* = **200**
Male, *n* (%)	93 (47)
Age, median (IQR)	74 (69–80)
Medications at admission according to BPML in total, median (IQR)	8 (5–12)
Regular medications at admission according to BPML, median (IQR)	5 (3–8)
Discharge medications in total according to discharge BPML, median (IQR)	9 (6–13)
Regular medications at discharge according to discharge BPML, median (IQR)	6 (4–9)
Length of hospital stay in days, median (IQR)	2 (2–5)
Patients admitted before launch of SMP, *n* (%)	75 (38)

BPML, best possible medication list; IQR, interquartile range; SMP, Danish national electronic Shared Medication Portal.

Table 2. Medication discrepancies per patients with at least one medication discrepancy and per medications with discrepancies during hospitalization.

	All types of medication *n* = **200**	Regular medications *n* = **198**	As-needed medications *n* = **155**	OTCs *n* = **133**
Patients with at least one medication discrepancy, *n* (%)	199 (100)	184 (93)	135 (87)	115 (86)
Documented*	115 (58)	109 (55)	12 (7.7)	8 (6.0)
Partly documented*	78 (39)	67 (34)	25 (16)	5 (3.8)
Undocumented*	174 (87)	140 (71)	119 (77)	106 (80)
	All types of medication *n* = **1972**	Regular medications *n* = **1367**	As-needed medications *n* = **349**	OTCs *n* = **256**
Medication with discrepancies, *n* (%)	1159 (59)	693 (51)	262 (75)	204 (80)
Documented	247 (13)	223 (16)	16 (4.6)	8 (3.1)
Partly documented	168 (8.5)	132 (9.7)	29 (8.3)	7 (2.7)
Undocumented	744 (38)	338 (25)	217 (62)	189 (74)

*One patient can have discrepancies in each category; therefore, the percentages do not total the percentage stated above.
OTCs, over-the-counter supplements and herbal medications.

Associations between patient characteristics and discrepancies

Table 3 shows the association between patient characteristics and undocumented medication discrepancies. Significantly more patients with polypharmacy both at admission and at discharge experience at least one undocumented medication discrepancy with regard to all types of medication (*p* = 0.000 at admission, *p* = 0.005 at discharge) and regular medications (*p* = 0.014 at

Table 3. Association between the study variables.

Variables	All types of medications (n = 200)		Regular medications (n = 198)		As-needed medications (n = 155)		OTCs (n = 133)	
	Patients with at least one undocumented discrepancy (n = 174) n/n in group (%)	p value	Patients with at least one undocumented discrepancy (n = 140) n/n in group (%)	p value	Patients with at least one undocumented discrepancy (n = 119) n/n in group (%)	p value	Patients with at least one undocumented discrepancy (n = 106) n/n in group (%)	p value
Male	78/93 (84)	0.220	59/92 (64)	0.058	57/68 (84)	0.066	40/54 (74)	0.182
Female	96/107 (90)		81/106 (76)		62/87 (71)		66/79 (84)	
Age ⩾ 80	47/55 (85)	0.689	39/54 (72)	0.774	34/43 (79)	0.675	29/39 (74)	0.324
Age < 80	127/145 (88)		101/144 (70)		85/112 (76)		77/94 (82)	
Preadmission drugs > 5	133/144 (92)	**0.000**	80/102 (78)	**0.014**	114/150 (76)	NA	105/132 (80)	NA
Preadmission drugs ⩽ 5	41/56 (73)		60/96 (63)		5/5 (100)		1/1 (100)	
Discharge drugs > 5	147/163 (90)	**0.005**	93/119 (78)	**0.005**	113/149 (76)	NA	104/131 (79)	NA
Discharge drugs ⩽ 5	27/37 (73)		47/79 (59)		6/6 (100)		2/2 (100)	
Length of stay > 2 days	86/98 (88)	0.756	75/98 (77)	0.075	64/79 (81)	0.203	53/69 (77)	0.390
Length of stay ⩽ 2 days	88/102 (86)		65/100 (65)		55/76 (72)		53/64 (83)	
Before SMP launch	66/75 (88)	0.745	54/74 (73)	0.588	43/54 (80)	0.538	37/55 (67)	**0.003**
After SMP launch	108/125 (86)		86/124 (69)		76/101 (75)		69/78 (88)	

Bolded numerals indicate statistical significance.
The association between the variables sex, age, number of pre-admission drugs, number of discharge drugs, length of hospital stay and hospitalization before launch of the SMP, and whether or not patients experienced an undocumented medication discrepancy in regular, as-needed or OTC medications.
NA, not applicable, less than five observations in one or more of the groups; OTC, over-the-counter supplements and herbal medications; SMP, Danish national electronic Shared Medication Portal.

admission, $p = 0.005$ at discharge). For the other variables, no significant differences were observed, except for more patients experiencing at least one discrepancy in OTCs after the implementation of the SMP ($p = 0.003$).

Discussion

Frequency of undocumented medication discrepancies

This study investigated documentation of medication changes at discharge. A relatively high frequency of undocumented medication discrepancies was found (38% for all types of medication) and a high percentage of patients (87%) were affected by at least one undocumented medication discrepancy. This is in the higher end compared with other studies.[1–7,10]

This difference in findings according to other studies may be due to variation in methods used, baseline characteristics of populations, inclusion or exclusion of OTCs and different definitions of discrepancies. The method used for assessing medication discrepancies in this study was by manual review of the entire patient record. This is a very thorough and time-consuming process but may provide more comprehensive data. In similar studies, the intent of medication discrepancies

was judged by the physician,[2–6,8–10] and that is likely to reduce the number of unintended medication changes. As this study was performed *post hoc*, relying on the information provided in the patient record, the physicians involved had no influence on the assessment, thereby making it not possible to assess whether the undocumented discrepancies were intentional or not.

Patients included in this study were 65 years or older (median 74 years; IQR 69–80) as in comparable studies,[2,6,10] while other studies also included younger patients.[3–5,7–9] The frequency of undocumented medication discrepancies would be expected as higher in studies of older patients, as polypharmacy is high in this group.[21,22] The inclusion of OTCs in this study probably increased the number of discrepancies found; therefore, data are presented separately for regular medications, as-needed medications and OTCs. It is not common practice to document all OTCs in the SMP in Denmark; however, focus is on this currently, as home nurses are dispensing medication from the SMP and therefore cannot dispense OTCs legally, if they are not listed in the SMP.

Associations with patient characteristics

An *a priori* assumption was that patients receiving more medication have more medication errors than patients receiving fewer or none.[1,2] This is in line with the finding in this study of a statistically significant higher proportion of undocumented medication discrepancies found in patients receiving more than five medications at both admission and discharge.

When patients are hospitalized longer, more than one physician often sees the patient and several medication changes may occur. The discharging physician may have difficulty grasping the number of patient record entries made during the hospitalization. Therefore, an association between length of stay and proportion of undocumented discrepancies was expected.[2,10] The reason this was not found could be due to the small sample size, as a nonsignificant trend towards increased medication discrepancies in regular medications with longer stay was observed.

No associations were found between age or sex and the risk of undocumented discrepancies. This could be due to the fact that this study only included patients aged 65 or older. Likewise, no difference was found for patients hospitalized before or after the launch of the SMP, except for OTCs. One can expect that the implementation of a national electronic medical portal would reduce the frequency of reconciliation errors both at admission and discharge. However, this does not seem to be the case here and may be the result of SMP not being implemented by all general practitioners at the time of the study; therefore, the trustworthiness of the SMP was unsure throughout the period.

Strengths and limitations

As this study focuses on documentation of medication changes, the intent behind the change was not considered. Furthermore, as it was a retrospective study, the intent behind the change could not be judged by the physician. A limitation to this study is therefore that it is unknown whether the undocumented changes found represent actual medication errors or not. In future studies, the intent behind the medication change could be assessed to clarify this.

Patients included in this study were all part of the intervention groups of a randomized controlled trial. One can assume that the medication reconciliation conducted as part of the intervention would reduce the number of medication discrepancies. In the intervention study, the pharmacist was not able to change the medication by herself, but had to rely on a physician to implement the suggested changes; however, 57% of the suggestions in the intervention study were accepted.[19] The medication review as part of the intervention could in fact contribute to the high frequency of undocumented (although intended) discrepancies; if the pharmacist, for instance, wrote a record entry about inappropriate medications and the physician thereafter withdrew those medications without reasoning it in the patient record.

This study was conducted in a single hospital, limiting the ability to generalize to other hospitals. The patient interview during reconciliation at admission may introduce recall bias since patients may not be able to recall their medication scheme correctly. The fact that the pharmacist had reviewed the electronic medication information available (e.g. in the SMP and the medical chart) before the interview could make over-representation of medications more likely to be found in these systems, such as regular medications.

Clinical relevance of discrepancies

This study has focused on documentation of medication discrepancies in the patient record. The method of assessment has not allowed evaluation of whether the undocumented discrepancies were intended or not. Intended medication changes should not pose a problem, as they have a medical reason. However, the information about the intent still does not reach the general practitioner when it is not noted in the discharge summary, leading to doubt whether to carry on with this change in primary care. A former Danish study has shown that only 64% of medication changes introduced in hospital were continued in primary care.[23]

When patients are discharged, the general practitioner receives the discharge letter with information about medication changes during hospital stay and a list of discharge medications. Before the SMP was launched in the hospital, it could not be known for certain if the BPML at admission reflects the medication list in general practice. Therefore, even if all medication changes during hospital stay were documented, the general practitioner could still experience medication discrepancies. After the launch of the SMP, the BPML reflects the medication prescribed by the general practitioner better, as this is a shared system between general practice and hospital. However, the BPML at admission would still contain information from the patient interview about compliance and OTCs which could alter the medication list from the SMP.

The clinical significance of the undocumented medication discrepancies was not evaluated in this study. Therefore, we do not know if these discrepancies would have resulted in patient harm. Other studies have shown that most discrepancies were of minimal or moderate risk for causing adverse effects[3] and that 15–51% of unintentional discrepancies had the potential to cause patient harm.[2,4,5,9,24]

Medication reconciliation is a method of assuring accuracy in medication information. It is a process that ensures a complete and comprehensive list of the medicines a patient is supposed to receive, both at admission to hospital and after discharge. At transitions of care (i.e. discharge from hospital to home) clearly documented medication reconciliation could be an important tool to ensure the correct medication use due to the documentation of all medication changes. This can contribute to the general practitioner being informed and confident in their patient's medical treatment after hospital stay. Systematic reviews have shown that medication reconciliation is able to reduce unintended medication discrepancies,[15,16] thereby supporting patient safety at transition of care.

Conclusion

This retrospective study showed a high frequency of medication discrepancies, reflected by the finding that three in four patients were affected by at least one undocumented discrepancy in their regular medication upon discharge. Polypharmacy at admission and discharge was associated with increased undocumented medication discrepancies. This study highlights a lack of medication reconciliation during inpatient stay. Correct and complete medication lists at both admission and discharge may resolve many of these errors. In this way, medication reconciliation as an integrated part of hospital care throughout hospitalization may contribute to ensuring patient safety at transition of care.

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Conflict of interest statement

The authors declare that there is no conflict of interest.

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