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Letter to the Editor

Determinants for medication reconciliation interventions on hospital admission and discharge: An observational multi-centre study[☆]

MR is the process of creating and maintaining an, as accurate as possible, overview of patient's actual medication use, in order to prescribe and provide correct medication to the patient at all transition points and avoid unintended medication discrepancies [1]. However, MR services are time consuming and only a relatively small proportion of patients are affected by clinically significant unintended discrepancies [2,3]. This makes a MR service difficult to implement. Targeting high risk patients might increase the efficiency of MR services facilitating implementation. Determinants for high risk patients are however sparsely available. Therefore, we executed a large, multi-centre, retrospective cohort study to assess determinants for MR interventions both on admission and discharge. Secondly, the type and frequency of MR interventions was determined.

We selected six hospitals with at least five years of experience in MR, both on admission and discharge. Included wards varied with respect to their MR activities (orthopaedics, general surgery, pulmonary diseases, internal medicine, cardiology and geriatrics). From August–November 2012 all consecutive patients with chronic medication, were included. Patients incapable of being interviewed, were excluded. We aimed to include 150 patients per hospital (total 900). The basic MR process is described elsewhere in detail [4,5]. In short, pharmacy technicians performed four steps (1) information collection from the community pharmacy, (2) comparison with hospital medication list to identify discrepancies, (3) discussion with the patient or his/her proxy to assess actual medication use, and (4) discussion with the physician to resolve any discrepancy. Differences per hospital and deviations of the standard MR process as described above are presented in S1.

Here, interventions are defined as corrections to resolve unintended medication discrepancies between a patient's actual medication use at home and medication prescribed during admission or discharge [6]. If a physician did not accept a suggested intervention, this was regarded as an intentional medication change.

Determinants were selected if they could be measured in routine care: the number and type of medication intended for chronic use, the use of high risk drugs, having had an admission interview and admission type (acute versus elective). Furthermore age, gender, social circumstances, social class (resp. via deprived neighbourhoods as registered by the Dutch Healthcare Authority (NZa) and postal code, instead of patient understanding of medication, which is not measured in daily practice [7]. The determinant length of stay was included upon discharge. Two types of high risk medication classification criteria were used separately: the Central Medication Registration alerts

(CMR) and Better Outcomes for Older adults through Safe Transitions (BOOST) [5,8].

We assessed (1) the number and proportion of patients with one or more MR interventions on admission and discharge, respectively, (2) (patient) determinants associated with MR interventions and (3) types of MR interventions.

Mean (standard deviation) or median (range) were determined dependent on the distribution of data. Differences in proportions were tested using the Pearson Chi-square test. Primary outcome measures, i.e. presence or absence and number of interventions on admission and discharge, were analysed using generalized linear mixed effects models and multi-level Poisson regression with random factor hospital accounting for internal hospital correlation and determinants as independent variables.

1. Results

We included 899 patients, 765 (85%) had an MR interview on hospital admission. A total of 134 patients had no interview (69 (51%) of these were admitted to hospital E and met their exclusion criterion), 44 (25%) were incapable of being interviewed without the presence of a caregiver or had a language barrier and 21 (16%) of which had the MR interview upon discharge due to a short length of stay.

Upon discharge, 632 (70%) patients were interviewed and included. Patients from hospital F ($n = 150$, 16%) were excluded due to incomplete documentation regarding intervention performance, 117 patients (15%) were missed due to an unexpected discharge.

The mean age of interviewed patients on admission and discharge was 65 years (SD), gender and high/low social class was equally distributed and approximately 10% lived in a deprived area. Most patients were admitted to internal medicine-, lung disease- and surgical wards and acute and elective admissions were equally distributed. >65% of included patients used high risk medications as defined by BOOST and CMR.

Overall, 2309 interventions were accepted: 1646 on admission (for 765 patients with an admission interview) and 445 upon discharge (for 632 patients with a discharge interview). The mean number of interventions was 2.2 per patient on admission (SD 2.4) and 0.7 (SD 1.2) upon discharge (Fig. 1). Start and dosage interventions occurred most frequently on admission, whereas start interventions reached the highest number upon discharge. The number of interventions in acutely admitted patients was twice as high compared to the elective admissions and dependent on the number of admission medications (in contrast to the elective patient group).

Binary analysis on number of patients with at least one MR-intervention resulted in 570 patients (74.5%) (range 1–15) on admission. Upon discharge, 226 of 632 patients (35.7%) had at least one intervention (range 1–8). In the adjusted mixed model analysis of interventions on admission, admission type (adjusted OR = 2.11; 1.33–3.35), number of admission medications (OR = 1.10; 95% CI, 1.05–1.16) and age (adjusted OR = 1.01; 95% CI, 1.00–1.03), were significantly associated

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Fig. 1. Mean number of interventions per patient on admission (n = 765) and discharge (n = 632) by intervention type.

Table 1

Generalized mixed model analysis on interventions in interviewed patients on hospital admission, (n = 765).

Determinants	Descriptive	≥1 discrepancy n (%)	Analysis	
			Unadjusted OR (95% CI)	Adjusted ^a OR (95% CI)
Gender, n	Male (n = 334) Female (n = 431)	246 (74) 324 (75)	Ref 1.18 (0.81–1.71)	
Age, mean (SD)	66 (14)		1.02 (1.00–1.03)	1.01 (1.00–1.03)
Social class ^b , n	High (n = 144)	99 (69)	0.71 (0.42–1.20)	
	Intermediate (n = 251)	179 (71)	0.80 (0.52–1.23)	
Deprived area, n	Low (n = 363)	287 (79)	Ref	
	Yes (n = 68)	58 (85)	1.22 (0.51–2.94)	
Admission type, n	No n = (697)	512 (73)	Ref	
	Acute (n = 416)	335 (81)	2.05 (1.31–3.20)	2.11 (1.33–3.35)
Ward type, n	Planned (n = 349)	235 (67)	Ref	Ref
	Surgical (n = 343)	230 (67)	Ref	
Number admission medications, median (range)	Non-surgical (n = 422)	340 (81)	1.57 (0.96–2.58)	
	8 (1–27)	9 (1–27)	1.11 (1.05–1.17)	1.10 (1.04–1.16)
Number of high risk medications, median (range)	BOOST 1 (0–6)	796 (11)	1.23 (1.05–1.45)	
	CMR 1 (0–13)	723 (10)	1.23 (1.04–1.46)	

BOOST = Better Outcomes for Older adults through Safe Transitions.

CMR = Central Medication Registration alerts on high risk medications.

^a Final model contains the variables Age, Admission type and Number of admission medications.

^b 7 missing.

with patients having at least one intervention (Table 1). This means a 10% increase in the odds of interventions for every extra medicine in use and twice the odds of interventions for acutely admitted patients as compared to planned admissions.

A generalized mixed model analysis of the total number of interventions as dependent variable upon admission revealed 47% more interventions for acute admissions (adjusted HR = 1.47; CI95; 1.24–1.74), 17% more interventions on female patients compared to male patients (adjusted HR = 1.17; CI95; 1.04–1.32), and 7% more for CMR medications (adjusted HR 1.07; CI95; 1.03–1.11) as significant correlations.

A significant negative association between the number of admission medications and number of interventions upon discharge was revealed: 4% less interventions with each extra medicine (CI95; 0.92–0.99). Each extra discharge medication showed 11% more interventions (CI95; 1.07–1.15). Upon discharge, the number of discharge medications (adjusted OR = 1.11; 1.05–1.16) showed a significant correlation (S3).

2. Discussion

Three-quarters of patients admitted to hospital needed at least one pharmacy intervention on unintended medication discrepancies. These interventions mostly involve acutely admitted patients (double risk), with higher numbers of admission medications, in females and with high risk medication in use. Upon discharge, the number of discharge medications influenced the occurrence of at least one intervention: a decrease of interventions upon discharge was observed with

every extra admission medication. The latter may be explained by the interception of discrepancies on admission and possibly extra attention of the pharmacy team and/or other healthcare professionals on patients discharged with a higher amount of medications.

A quarter of the interviewed patients had no recorded intervention after MR. Upon discharge, these figures were the other way around: the majority had no intervention.

This is the first study designed to establish determinants in daily practice on this subject in six different hospitals, creating a robust cohort. This study found in 75% of patients at least one intervention, which makes it difficult to prioritize. However, if hospitals forced by resource shortages, need to prioritize reconciliation activities, they should focus on female, acutely admitted patients with a higher number of CMR medication.

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