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The potential role of clinical pharmacists in elderly patients during hospital admission

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The aim of this study was to show the potential impact of services directed by clinical pharmacists, including medication reconciliation and medication review, on the hospital admission process for elderly patients. This study was conducted in an internal medicine ward between April 24 and July 25, 2014. Patients hospitalized due to any reason were eligible if they were 65 years or older and regularly used at least one medication at home. The clinical pharmacist evaluated potentially inappropriate medications (PIM), medication related problems (MRPs) and medication discrepancies at the time when these eligible elderly patients were admitted to the hospital. The physician acceptance rate as related the clinical pharmacist's recommendation was evaluated retrospectively. A total of 133 elderly patients (mean age 76.62 ± 8.12 years old; 70 female) were included in the study. Out of 394 medication discrepancies, 88.32% were found to be unintended discrepancies among 111 elderly patients upon hospital admission. PIM was found in 19.55% of these cases. A total of 396 MRPs among 115 patients were identified, with the most common being that the drug had not been taken/administered at all. The doctor acceptance rate of the clinical pharmacist's recommendation was found to be 85.60%. In conclusion, it was found that medication related problems and inappropriate medication utilization at admission could be prevented at a high rate of success by clinical pharmacist-driven medication reconciliation and medication review services.

1. Introduction

Medication reconciliation is a way of gathering accurate medication history that is typically generated by soliciting the name, dosage, and frequency and administration method of all medications (Cornish et al. 2005; Champbell et al. 2007; Institute for Health Improvement 2013). It is a standardized process intended to formally prevent medication errors by detecting any discrepancies between previously used medications and the current medication list; especially upon admission to or discharge from a hospital (Allende Bandrés et al. 2013; Fitzgerald 2009). Additionally, the frequency of adverse drug reactions, medication related problems and drug interactions could be decreased if one has knowledge of the complete medication history obtained from a medication reconciliation program (Carter et al. 2006; Helström et al. 2012).

There have already been some studies that investigated the influence of the medication reconciliation conducted by clinical pharmacists on hospital readmissions and medication errors (Reeder and Mutnick, 2008; Jack et al. 2009). Compared to physicians, pharmacists can more easily obtain the history of a patient's home medications, allergies, and vaccinations as well as identify any medication discrepancies that arise during the medication reconciliation process (Hatch et al. 2011). Nester and Hale (2002) found that clinical pharmacists could make more effective interventions in medication errors than nurses while providing medication reconciliation. Moreover, as a member of a multidisciplinary team, a pharmacist has an essential role in reducing adverse drug events and improving patient safety (Buckley et al. 2013; Sen et al. 2014). Interventions by pharmacists can also prove to be applicable for patient care, after the outcome of admission medication reconciliation has been analyzed (Beckett et al. 2012). Elderly patients who use many medications due to co-morbidities are more likely to be seen with medication discrepancies after a medication reconciliation service has been provided to them (Cornu et al. 2012). In addition to this, altered physiologic conditions and co-morbidities cause medication related problems in geriatric populations (Hanlon et al. 2001). Multiple medications, adverse drug reactions, drug-drug interactions, poor compliance and inappropriate medications are the main factors that result in medication related problems in elderly patients (Hanlon et al. 2001; Frazier 2005; Fulton and Allen 2005).

In line with these previous studies, the aim of this study was to assess the potential impact of a clinical pharmacist who conducts medication reconciliation services, looking especially for potentially inappropriate medication (PIM) and medication related problems (MRPs) during a medication review upon hospital admission of elderly patients to the internal medicine ward.

2. Investigations and results

A total of 133 elderly patients were included in this study. The study population consisted of 70 females and 63 males with a mean age of 76.62 ± 8.12 years. Most of the patients were only

Table 1: Characteristics of study participants

	n (%)
Female	70 (52.63%)
Age (Mean ± standard deviation)	76.62 ± 8.12
Primary admission diagnosis	
Infectious diseases	26 (19.50%)
Cardiovascular disorders	16 (12.00%)
Renal disorders	30 (22.6%)
Neurologic/psychiatric disorders	5 (3.80%)
Hematologic disorders	18 (13.50%)
Endocrinologic disorders	10 (7.50%)
Respiratory disorders	15 (11.30%)
Gastrointestinal disorders	13 (9.80%)
The number of home medication (median [25-75 percentiles])	8 [6-9]
The number of prescribed medication at admission (median [25-75 percentiles])	9 [6-11]
The number of chronic disease (median [25-75 percentiles])	4 [3-5]
Co-morbidities	
Hypertension	94 (70.68%)
Diabetes mellitus	58 (43.61%)
Education level	
Illiterate	47 (35.30%)
Primary	53 (39.80%)
Secondary	14 (10.50%)
High school	6 (4.50%)
University or higher degree	13 (9.80%)
GFR≤30 ml/min/1.73m^2	34 (30.10%)
Polypharmacy (5 or more medication utilized)	121 (91.00%)

n: number of patient; GFR: Glomerular filtration rate

educated up to primary school (39.8 %), while only a few of them were educated through high school (4.5 %). Of them, 42.1 % had at least five co-morbidities and the most common chronic disease was hypertension (70.7 %). Cardiovascular diseases like atrial fibrillation and heart failure were the most common co-morbidities, with a percentage of 90.0 %. Diabetes mellitus was the second most common disease, with a percentage of 43.6 %. Furthermore, 66.2 % of the patients were able to take their medications without any help from others (Table 1).

The main source of patients' medication history was their pillboxes (68.4 %). Patients' relatives (62.4 %), patients' self-declaration (53.6 %) and previous prescriptions (3.0 %) were also used to complete the medication history. 61.9 % of the patients had impaired renal function with less than 50 ml/min GFR; 30.1 % of them even had less than 30 ml/min GFR, which requires dose adjustment for most of the medicines (Table 1). According to our analysis, 47.4 % of patients started using more medications after they were admitted to the internal medicine ward. When evaluating the number of medications used after hospital admission, 34.6 % used less medication and 18.0 % used the same amount. Poly-pharmacy exposure was determined for 91.0 % of the study population (Table 1). According to statistical analyses, poly-pharmacy exposure was more likely to be seen in females (95.7 %) than males (85.7 %).

Frequency of the drug-drug interactions was categorized by gender. The total percentage of determined interactions for these patients was 38.4 %. According to the clinical pharmacist's evaluation, 47.1 % of women and 28.6 % of men were exposed to clinically important drug-drug interactions. According to Medscape® Drug Interaction Checker, most of the medications being taken needed to be monitored closely (63.9 %). Of these medications, 26.0 % needed to be used as alternative medications instead of the current medication and a few of the medications were ranked as minor interactions (10.7 %).

Utilization of high alert medications was seen in 77.4 % of the patients. The most common high alert medications in our study population were low molecular weight heparins (LMWHs) (55.3 %), insulin (31.1 %), magnesium sulfate infusion (12.6 %), parenteral nutrition preparations (11.7 %), and oral anti-diabetic agents (10.7 %). Potentially inappropriate medication was found in 19.5 % of the elderly patients. These medications have been classified in Table 2 with respect to the Beers Criteria. Sliding scale insulin was the most potentially inappropriate medication (34.5 %).

Table 2: Potentially inappropriate medications according to Beers' Criteria

Drug name	n*	%
Insulin sliding scale	10	34.49
Digoxin	5	17.25
Inhaled anticholinergic	2	6.89
Metoclopramide	2	6.89
Quetiapine	2	6.89
Verapamil	1	3.45
Spironolactone	2	6.89
Hyoscyamine	1	3.45
Haloperidol	1	3.45
Amiodarone	1	3.45
Olanzapine	1	3.45
Nitrofurantoin	1	3.45

* Twenty nine potential inappropriate medications utilized have been detected among 26 patients.

A total of 394 medication discrepancies were detected and classified as either intended or unintended discrepancies. Of these discrepancies, 88.3 % were unintended and resulted from the fact that the medication was unsuited to the goals of the therapeutic plan. The rate of intended discrepancies that were in accordance with patients' therapeutic plan was nearly eight times lower than unintended discrepancies (11.7 %). All medication related problems were classified according to PCNE Classifi-

Table 3: Medication related problems and causes

Problem	n	%
Wrong effect of drug treatment	180	45.45
Untreated indication	215	54.29
Adverse drug event (allergic)	1	0.26
Cause		
Inappropriate drug	17	3.90
No indication for drug	2	0.46
Inappropriate combinations of drugs	7	1.60
Inappropriate duplications of therapeutic group or active ingredient	1	0.23
Indication for drug-treatment not noticed	2	0.46
New indication for drug treatment presented	2	0.46
Drug dose too low	2	0.46
Drug dose too high	25	5.73
Dosage regimen too frequent	1	0.23
Drug not taken/administered at all	215	49.31
Wrong drug taken/administered	1	0.23
Other cause: Drug-drug interactions	161	36.93

n: number of medication related problems and causes

cation V6.2, and the most common problems were 'untreated indication' and 'drug not administered/taken at all'. The other reasons were 'drug-drug interactions' and 'drug dose too high according to patient's GFR' (Table 3).

The clinical pharmacist presented a total of 396 recommendations to the physician on the ward and the physician accepted 85.6 % of them. According to our analysis, there was a mild correlation between low GFR and poly-pharmacy ($r = 0.215$), female gender and utilization of high alert medication ($r = 0.192$), female gender and poly-pharmacy ($r = 0.174$). The mean of high alert medication utilization in females was found to be high when compared with that of males (1.47 ± 1.06).

3. Discussion

A total of 394 medication discrepancies were detected, with 88.3 % of them considered unintended discrepancies. Of these, 86.5 % were exposed to at least one unintended discrepancies. Another study conducted in a geriatric ward had nearly the same result as ours, with a percentage of 81.9 % (Cornu et al. 2012). On the other hand, one study, carried out in an internal medicine ward with elderly patients, reported that 33.2 % of the patients were found to have had unintended discrepancies (Quélennec at al. 2013).

Although they were performed on different wards and at different times of the hospital stay such as admission, discharge or transfer, most of the studies in the literature found the most common reason of discrepancies to be omission of medication, which is also supported by our results (Buckley et al. 2013; Beckett et al. 2012; Quélennec et al. 2013). The rate of unintended discrepancies was between 25 % and 48 % of the patients (Buckley et al. 2013; Quélennec et al. 2013; Lopez-Martin et al. 2014). It is concluded that studies that worked with elderly patients have yielded a higher rate of unintended discrepancies. Our study showed that 77.40% of the study population was using high alert medications listed by ISMP at hospital admission. This rate was higher compared to that found in a retrospective study carried out in internal medicine, cardiology and surgery wards; which found the usage of high alert medication to be at 19.0 % (Unroe et al. 2010).

When we applied the Beers Criteria for evaluating PIMs in our study, we found that 19.5 % of the patients were using their medications inappropriately. A study with the same criteria reported that PIMs were used by 42.7 % of the patients. When evaluating the most common PIMs in previous studies, it depended on the study setting, country where it was conducted, and also the availability of the listed medications on the market (Faustino et al. 2013; Nishtala et al. 2014).

According to our results, untreated indication due to the purpose of the medication was the most common medication related problem. It was found that some of the medications were not taken within 48 h after admission. Because most of the patients had been transferred from the emergency department, taking their medication histories was difficult in some cases. Thus, the recommendation of adding medication to the doctor's orders was the most common recommendation made by pharmacists in the present study, according to the classification in PCNE V6.2. Another, similar study conducted with elderly patients had the same results as the present study regarding the recommendations made by the clinical pharmacist (Chan et al. 2012). A total of 396 MRPs were determined in 86.5 % of the study population and 85.6 % of the recommendations were accepted by the physician in our study. Another study that used the same version of PCNE and was conducted by clinical pharmacist had less physician acceptance rate than ours, with a percentage of 76.0 %. On the other hand, the rate of the patients that had at least one MRP (85.0 %) was nearly the same when compared with the results of the present study (Nielsen et al. 2013). Contrastingly, 49.0 % of elderly patients had MRPs in another study, and also the rate of the accepted recommendations was found to be 90.0 % (Raimbault-Chupin et al. 2013). In a study conducted on a geriatric ward, the accepted recommendation rate was recorded as 72.3 % (Cornu et al. 2012).

In the present study, we did not calculate how much time was spent per patient, because a variety of sources were used to collect medication history such as pillboxes, statements from patients' relatives, and patients' self-declaration. Since the present study was performed only in one ward and spanned a limited time frame, the medication related problems and their causes were not as diverse as might be found in other instances. Another limitation of our study was that it was performed retrospectively at admission to the ward. Thus, it was not possible to quantify the clinical pharmacist's intervention before and after admission. Despite these issues, the results of the present study showed the potential influence of medication reconciliation programs and medication review conducted by pharmacists to prevent problems related to medications in elderly patients. The influence of clinical pharmacist driven services such as medication reconciliation on the quality of patients' health care could be assessed in further studies.

4. Experimental

This study was performed in an internal medicine ward between April 24 and July 25 2014 with the permission of Marmara University Institute of Health Science Ethics Committee and the Istanbul Anatolian North Community Hospitals Union. Elderly patients were eligible if they used at least one medication at home, were 65 years or older and were admitted to the internal medicine ward. Patients who were hospitalized for less than 24 h and could not be communicated with or did not have any relative present who could discuss medication history if there was no other medication history source available were excluded.

The clinical pharmacist in the internal medicine ward conducted medication reconciliation procedures only on weekdays. Medication history including prescribed and OTC medications was taken from the patient, their relatives, written prescriptions, and medication boxes. Home medication history taken by the clinical pharmacist and the admission prescription was compared regarding drug doses, dosage forms, method of administration, and additions or omissions of medication to identify discrepancies. Medication

discrepancies were determined and divided between intended and unintended discrepancies. All medications on the list published by the Institute for Safe Medication Practices (ISMP) were recorded (Institute for Safe Medication Practces). This list contains the medications that will most likely cause harm to the patient during the therapy if they are used in the wrong way. The Beers Criteria that was updated in 2012 was used for determining the appropriateness of medication utilization in the elderly (American Geriatrics Society 2012). Only admission orders were evaluated according to the Beers Criteria.

All medication related problems were determined regarding home and hospital medications according to Pharmaceutical Care Network Europe's (PCNE) 'Drug Related Problems Classification, vol. 6.2' in Turkish (Pharmaceutical care Network Europe). This classification has four sections including problems, causes, interventions and outcomes. Validated Turkish translations of these classifications were applied to the data gathered on the elderly patients. Patients' GFR were calculated by Cockcroft-Gault Formula and drug-drug interactions were determined by Medscape® Drug Interaction Checker (Medscape). Clinically important drug-drug interactions according to the clinical pharmacist's opinion or the patient's situation and medications used in inappropriate dosage for GFR were reported as a medication related problem.

The clinical pharmacist's recommendations from all evaluations including intended and/or unintended discrepancies and medication related problems were written with the existing relevant scientific literature as a guide and were presented weekly to the appropriate physician in the ward. After that step, acceptance rate of recommendations were retrospectively evaluated.

Continuous variables are presented as mean ± standard deviation whereas ordinal and nominal data are presented in n (%). Categorized data has been analyzed with the chi square test. For continuous variable data following normal distribution, ANOVA or Student t-test was used, while for data not following normal distribution non-parametric tests such as Kruskal-Wallis or Mann-Whitney U tests were applied. The results have been evaluated at the 95% confidence interval with $p < 0.05$. For all statistical analyses, SPSS 11.0 statistical software was utilized.

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