Effects of an outpatient multifaceted medication review in older patients on the prevalence of emergency department visit and hospital admission

Anne Zwietering (annezwietering@hotmail.nl)
Zuyderland Medical Centre Sittard-Geleen: Zuyderland Medisch Centrum Sittard-Geleen
https://orcid.org/0000-0003-0573-8621

AEMJH Linkens
Maastricht University Medical Centre+: Maastricht Universitair Medisch Centrum+

PHM van der Kuy
Erasmus Medical Centre: Erasmus MC

H Cremers
Zuyderland Medical Centre Sittard-Geleen: Zuyderland Medisch Centrum Sittard-Geleen

N. van Nie-Visser
Zuyderland Medical Centre Sittard-Geleen: Zuyderland Medisch Centrum Sittard-Geleen

KPGM Hurkens
Zuyderland Medical Centre Sittard-Geleen: Zuyderland Medisch Centrum Sittard-Geleen

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Abstract

Background. The prevalence of medication related emergency department visit and acute hospital admission is significant in older patients due to the high prevalence of multimorbidity and associated polypharmacy.

Aim. To explore whether a multifaceted outpatient medication review could alter the overall prevalence of an emergency department visit and acute hospital admission.

Method. All new patients visiting our geriatric outpatient clinic had a multifaceted medication review (evaluation by a geriatrician, pharmacist and clinical decision support system). Subsequently we analysed the number of and reason for emergency department visit, acute hospital admission and readmission in the year prior to and following the index-date (date of first presentation and medication review).

Results. The mean number of acute hospital admissions per patient in the year before and after medication review did not differ (0.3 ± 0.6 vs. 0.4 ± 0.6, p=0.153), as did the 30- and 180-day readmission rate (p=0.69 and p=0.83). There were no differences in reasons for acute hospital admission before and after medication review, but there was a significant difference in the number of potentially medication related emergency department visits (38.9 vs. 19.6%, p<0.01).

Conclusion. There was no beneficial effect of an outpatient clinic multifaceted medication review on the overall rate of acute hospital admission or readmission during 12 months follow-up. There was however a reduction of 20% in potentially medication related emergency department visits after medication review.

Introduction

Acute hospital admissions represent around 50% of all hospital admissions in the Netherlands [1, 2]. In total, approximately 2 to 30% of these acute hospital admissions are thought to be attributable to medication related problems [3-5]. The risk of the latter seems to be even greater in older patients [6], which is not surprising given the high prevalence of multimorbidity and associated polypharmacy in this population [6, 7]. Medication related hospital admissions present a complex and expensive public health problem [4, 8]. Previous literature suggests that older patients, who experienced a first medication related hospital admission are more susceptible to a repeat medication related hospital admission [9]. Hospital readmissions (an unplanned hospital admission within 30 days after discharge) in general are highly prevalent in the older population [10, 11] and cause a burden on patients and an increase in already high healthcare costs [12]. At the same time, polypharmacy and an increased number of medications have been recognized as important risk factors for medication related hospital readmissions, thus making the older population more susceptible [9, 13]. Previous literature provided no evidence that in-hospital medication reviews reduce hospital readmissions, but could possibly reduce emergency department contacts [14-16]. In the majority of these studies, a medication review was performed by a single individual, particularly a pharmacist [14].

Aim of the study

Our current aim is to explore whether a multifaceted medication outpatient medication review could possibly alter the overall prevalence of acute hospital admission, readmission and the number of emergency department (ED) visits.

Ethics approval

The study was approved by the Medical Ethical Testing Committee (METC) of Zuyderland (study 16-N-115). Obtaining informed consent of patients was not required due to the nature of the study.

Method

Setting

This study was performed in the Zuyderland Medical Centre, a large 980-bed teaching hospital in the South of the Netherlands with three main locations. It is the second largest hospital in the Netherlands and treats roughly 190,000 patients at the outpatient clinic per year.

Data collection and analysis

Between May and July 2016, all new patients who visited the geriatric outpatient clinic were included for this study (n = 200). There were no specific in- or exclusion criteria. All these patients had a multifaceted medication review on the day of presentation, which consisted of an evaluation by a geriatrician, a pharmacist and a clinical decision support system (CDSS) called the Clinical Rule Reporter (CRR). We collected patient characteristics (i.e. age, gender), number of medications in use and categorized to ATC (Anatomical Therapeutic Chemical Classification System) code from the electronic patient file and medication system [17]. The remarks on medication were categorized by the research team in seven pre-established categories based on possible pharmacotherapeutic problems. The methods of data collection are explained in more detail in our previous article [18]. Subsequently we analysed how often a patient was hospitalized the year prior to and the year following the index-date (date of first presentation and medication review) and what the reason for admission was. Only acute hospital admissions were included in this analysis. Moreover we analysed 30-day and 180-day hospital readmission rates. Finally, we analysed how often a patient visited the ED the year prior to and the year following the index-date (date of first presentation and medication review) and what the reason for presentation was. For the ED visits we identified if the reason for presentation was potentially medication-related based on previously described adverse drug events (ADEs) [19].

Clinical rule reporter (CRR)

The CRR is a CDSS that is developed in the Zuyderland Medical Centre. It continuously reviews medication profiles of all hospitalized patients and in addition medication related data of outpatient populations can be imported and reviewed. The CDSS combines patient characteristics (e.g. age and

renal function) and medication related information (e.g. dosage, interactions) to obtain specific advice based on clinical rules (i.e. algorithms). These are clearly defined rules, that include the latest version of the STOPP/START criteria and utilize triggers to identify the need to discontinue or add medication, or aim for dose-reduction [20, 21]. The set of clinical rules is updated constantly based on insights from professional networks, research and guidelines [18].

Statistical analysis

We calculated the sample size based on previously reported numbers of medication related hospital admissions and emergency visits and anticipated a 10% decrease in prevalence. Statistical analysis of the data was performed with IBM SPSS Statistics 23. Wilcoxon Signed-Rank test was used to analyse continuous variables such as number of admissions and length of in-hospital stay. Chi-square Fisher's exact test was used to analyse categorical variables. Continuous variables are reported as means (± standard deviation (SD)) and categorical variables as percentages(%). A Poisson regression was run to predict the chance of acute hospital admission based on the use of certain medication. A p-value smaller than 0.05 was considered statistically significant.

Results

Overview

In this group of mainly octogenarians, who presented to the outpatient clinic for the first time (n=200) 59% was female. The mean age of the population was 82 (±6) years. The mean number of medications in use before medication review was 8 (±4) versus 8.2 (±3.9) after medication review, including over-the-counter (OTC) medications ($p<0.05$). Categorizing medication to ATC code, there is frequent use of antihypertensive agents, vitamin D, statins, proton pump inhibitors (PPIs) and anticoagulants (*Appendix 1*). More than 20% of the patients used drugs for constipation, calcium supplements, cardiac therapy, analgesics other than opioids and hypnotics (mainly benzodiazepines). Adjustments in medication profiles were done in 120 patients. Table 1 shows an overview of the study results.

Table 1

Hospital admission

Focusing on the reason for admission to the hospital there are no statistical differences between reasons for admission before and after medication review. Especially electrolyte disorders, falls and haemorrhage, did not differ significantly (*Table 2*).

Table 2

Emergency department visit

The total number of emergency department (ED) visits in our population did not differ significantly before and after medication review. However there was a major difference in the number of potentially

medication related ED visits before medication review (38.9%) vs. after medication review (19.6%) (p<0.01). Moreover there was a trend towards less fall incidents (and associated fractures) after medication review (n=34 vs. n=23, p=0.06). On the other hand there was also a trend towards more intracranial haemorrhages (4 spontaneous and 1 post-traumatic) after medication review (p=0.06)(*Table 3*).

Table 3

Medication in use

Overall, the use of diuretics and antiparkinson drugs was significantly higher in patients that had an acute hospital admission before medication review (p<0.05)(*Table 4*). These differences were no longer present after medication review. In addition, there was a trend towards slightly more frequent use of insulin and dementia drugs in patients that had an acute hospital admissions before medication review (p = 0.08 resp. p=0.09). After medication review these differences were no longer present. Regression analysis showed that diuretic drugs (p<0.05) increased the likelihood of acute hospital admission before medication review and that there was a trend towards increased likelihood for opioid use (p=0.06) and antidepressants (p=0.07). These differences were no longer present in analysis after medication review.

Table 4

Discussion

Key findings and interpretation

The purpose of this study was to explore whether an outpatient clinic multifaceted medication review could possibly alter the overall prevalence of acute hospital admission, readmission and ED visits. First, we did not note a difference between the number of patients admitted nor the number of acute hospital admissions per patient before and after medication review. This is in line with the systematic review and meta-analysis of Huiskes et. al, that showed no effect of medication review on clinical outcomes[22]. It should be stated however, that the mean follow-up in the research by Huiskes et al. was only 5.2 months. This follow-up period could have affected their results, because in our study most patients were admitted 6–12 months after medication review. One of the reasons we did not find any differences in the number of acute hospital admissions after medication review, could be the frailty of the study population that in general is prone to hospital admission because of old age, polypharmacy and comorbidity like dementia, chronic heart failure and Parkinson's disease. Prior research indicated that age (≥ 65 years), number of medications and comorbidity were all associated risk factors for acute hospital admission[23]. Moreover, all patients in our study visited the outpatient clinic with specific clinical problems such as falling or cognitive decline, indicating a higher a priori risk of hospital admission.

Second, there was no difference in the rate of 30-day and 180-day readmission. There is previous literature with low-quality evidence, suggesting an impact of pharmacist-led medication review on medication-related readmissions [24, 25]. Ravn-Nielsen et al. however showed that the combination of medication review, motivational interviewing with the patient and follow-up in primary care, had a significant effect on lowering the rates of readmission at 30 and 180 days [25]. This suggests that solely an in-hospital medication review is not sufficient to have an effect on readmission rates, but in particular clear communication with and smooth transfer to primary care is of importance. In our study there was written communication to primary care, but due to the nature of the study, there was no control on the continued adherence to advices following from medication review. Therefore it is hypothetically possible, that less favourable medication was represcribed in primary care during follow-up, that could lead to medication-related readmission. In contrast to readmission, a review by Christensen et al. suggested that medication review might reduce the number of ED visits [14]. Our study showed a reduction of about 20% of potentially medication related ED visits after medication review, which is in line with previous numbers estimating a reduction of 27% (ranging from 45% reduction to 3% increase in visits)[14].

Finally, analysis of the medication in use before medication review by patients that had an acute hospital admission, showed significantly higher use of diuretics and antiparkinson drugs and a trend towards more frequent use of insulin, dementia drugs, opioids and antidepressants. The underlying diseases associated with some of these drugs, in particular dementia, Parkinson´s disease and chronic heart failure are obviously predictors of hospitalization on their own [26–28]. Our findings therefore indicate an underlying frailty in the study population because of comorbidity. On the other hand, diuretics, blood glucose-lowering agents, opioids and drugs working on the central nervous system (CNS) are in the top 10 of potentially preventable ADEs such as electrolyte disturbances, hypoglycemia and falls [29–31]. In our study diuretics, especially thiazide diuretics were regularly discontinued because of hyponatremia and falls.

Strengths and weaknesses

The strengths of this study are that we analysed the effect of a multifaceted medication review in the geriatric outpatient clinic, whereas most of previous literature focused on hospitalized patients. Moreover the follow-up was 12 months, which is longer than most studies on medication review.

This study is limited by the number of patients enrolled and the fact that it partially based on retrospective data (previous hospital admissions).

Further research

In further research we will perform a randomized trial where we analyse the effects of medication review on outcome (mortality, adverse events, length-of stay) of acutely hospitalized older patients.

Conclusions

Our study did not show an effect of an outpatient clinic multifaceted medication on the overall rate of acute hospital admission or readmission during 12 months follow-up. Our study did show a reduction of 20% in potentially medication related ED visits after medication review.

Declarations

Impact of findings on practice statements

- Outpatient multifaceted medication review could alter the prevalence of medication related emergency department visits
- Older patients could benefit from outpatient medication review

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Conflicts of interest

The authors have no relevant financial or non-financial interests to disclose.

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Tables

N=200

	Before medication review		After medication review		p-value
Total number of patients admitted	41		56		0.10
Number of patients with repeat admission (%)	9 (22.0)		13 (23.2)		ns^
Total number of admissions	55		72		0.09
Number of admissions per patient (%)	0	145 (72.5)	0	128 (64.0)	0.09
	1	39 (19.5) 10 (5)	1	55 (27.5)	0.08
	2	4 (2)	2	15 (7.5)	ns
	3	1 (0.5)	3	2 (1.0)	ns
	4	1 (0.5)	4	0	ns
	5		5	0	ns
Mean number of admissions per patient (±SD)	0.3 ± 0.6		0.4 ± 0.6		ns
Mean length of in-hospital stay (days) (±SD)	10.5 ± 10.2		13.1 ± 17.8		ns
Rate of readmission (n)					
30 day	4		2		ns
180 day	11		13		
Number of ED* visits	90		97		ns
Potentially medication-related (%)	35 (38.9)		19 (19.6)		*<0.01*
Mean number of ED visits per patient (±SD)	0.5 ± 0.7		0.5 ± 0.9		ns

**ED= emergency department ^ns = not significant*

Table 2. Reason for hospital admission

n(%)	Before medication review (n=55)	After medication review (n=72)	p-value
Electrolyte disorders	2 (3.6)	-	0.19
Neurological disease			
ú TIA/stroke*	9 (16.4)	10 (13.9)	0.80
ú Delirium/confusion	1 (1.8)	3 (4.2)	0.63
ú Neuritis vestibularis	-	1 (1.4)	1.0
Infection/sepsis	11 (20)	18 (25)	0.53
Falls (incl. associated fractures)	7 (12.7)	13 (18.1)	0.47
Cardiovascular disease			
ú Acute coronary syndrome (ACS)	4 (7.3)	2 (2.8)	0.40
ú Heart failure	4 (7.3)	1 (1.4)	0.17
ú Cardiac arrhythmias	4 (7.3)	6 (8.3)	1.0
ú Pulmonary embolism	2 (3.6)	-	0.19
ú Vascular disease	1 (1.8)	1 (1.4)	1.0
Pulmonary disease	4 (7.3)	6 (8.3)	1.0
Gastro-intestinal disease	1 (1.8)	1 (1.4)	
Haemorrhage			
- Intracranial	-	5 (6.9)	0.07
- Gastro-intestinal	-	1 (1.4)	1.0
- Urogenital	1 (1.8)	1 (1.4)	1.0
Musculoskeletal disease	1 (1.8)	1 (1.4)	1.0
Kidney injury	2 (3.6)	-	0.19
Inflammatory disease	1 (1.8)	-	0.43
Other	-	2 (2.8)	0.51

**TIA= transient ischemic attack*

Table 3. Reason for emergency department visit

n(%)	Before medication review (n=91)	After medication review (n=96)	p-value
Electrolyte disorders	5 (5.4)	1 (1.0)	0.11
Neurological disease			
ú TIA*/stroke	10 (11.0)	12 (12.5)	0.82
ú Delirium/confusion	3 (3.3)	8 (8.3)	0.21
ú Other	2 (2.2)	8 (8.3)	0.10
Infection/sepsis	10 (11.0)	15 (15.6)	0.40
Falls (incl. associated fractures)	34 (37.4)	23 (24.0)	*0.06*
Surgical	1 (1.1)	2 (2.1)	1.00
Cardiovascular disease			
ú Acute coronary syndrome (ACS)	3 (3.3)	5 (5.2)	0.72
ú Heart failure	3 (3.3)	2 (2.1)	0.68
ú Cardiac arrhythmias	6 6.6)	3 (3.1)	0.32
ú Pulmonary embolism	1 (1.1)	-	0.49
Pulmonary disease	1 (1.1)	4 (4.2)	0.37
Gastro-intestinal disease	2 (2.2)	1 (1.0)	0.61
Haemorrhage			
- Intracranial	-	5 (5.2)	*0.06*
- Gastro-intestinal	-	1 (1.0)	1.00
- Urogenital	1 (1.1)	1 (1.0)	1.00
- Other	1 (1.1)	-	0.49
Musculoskeletal disease	4 (4.4)	1 (1.0)	0.20
Urological	2 (2.2)	2 (2.1)	1.00
Other	2 (2.2)	2 (2.1)	1.00

**TIA=transient ischemic attack*

Table 4. Medication in use in patients that were hospitalized before (BMR) and after medication review (AMR)

No. of patients (%)	No acute hospital admission BMR (n=161)	Acute hospital admission BMR (n=39)	p-value	No acute hospital admission AMR (n=145)	Acute hospital admission AMR (n=55)	p-value
ATC code						
A10A (insulins and analogues)	9 (5.6%)	6 (15.4%)	0.08	11 (7.5%)	4 (7.2%)	1.00
B01 (antithrombotic agents)	100 (62.1%)	28 (72%)	0.35	90 (62.0%)	38 (69.1%)	0.41
C01 (cardiac therapy)	34 (21.1%)	13 (33.3%)	0.14	32 (22.0%)	15 (27.3%)	0.46
C02 (antihypertensive drugs)	5 (3.1%)	-	0.59	5 (3.4%)	-	0.33
C03 (diuretics)	59 (36.7%)	25 (64.1%)	*0.002*	63 (43.4%)	21 (38.2%)	0.53
C07 (beta blocking agents)	63 (39.1%)	19 (48.7%)	0.28	56 (38.6%)	26 (47.3%)	0.33
C08 (Ca-channel blockers)*	29 (18%)	8 (20.5%)	0.82	25 (17.2%)	12 (21.8%)	0.54
C09 (agents acting on RAS)#	74 (46%)	22 (56.4%)	0.29	73 (50.3%)	23 (41.8%)	0.34
G (genito-urinary system)	21 (13%)	6 (15.4%)	0.79	18 (12.4%)	9 (16.4%)	0.35
N02A (opioids)	30 (18.7%)	7 (17.9%)	1.00	25 (17.2%)	12 (21.8%)	0.54
N04 (antiparkinson drugs)	3 (1.8%)	4 (10.3%)	*0.03*	6 (4.1%)	1 (1.8%)	0.68
N05A (antipsychotics)	6 (3.7%)	3 (7.7%)	0.38	6 (4.1%)	3 (5.5%)	0.71
N05C (hypnotics and sedatives)	41 (25.5%)	12 (30.1%)	0.55	39 (26.9%)	14 (25.5%)	1.00
N06A (antidepressants)	31 (19.2%)	5 (12.8%)	0.49	24 (16.6%)	12 (21.8%)	0.41
N06D (dementia drugs)	3 (1.9%)	3 (7.7%)	0.09	3 (2.1%)	3 (5.5%)	0.35

**Ca = calcium #RAS = renin-angiotensin system*