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Problematic drugs in elderly patients presenting to a European emergency room

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Abstract

Background: Elderly patients are at an increased risk of developing complications from taking medication. Little is known about the inappropriate use of medication in elderly patients presenting to the emergency room, especially in very old patients. *Methods:* A random sample was drawn from patients aged 60 years or older who had been discharged from a medical emergency room. Charts were analyzed retrospectively. Potentially inappropriate medication was defined according to the 1997 Beers criteria. *Results:* At presentation, 24 (12.3%) of 195 patients aged 60 years and older were taking potentially inappropriate medications. Of 65 patients aged 80 years or older, 27.7% presented with potentially inappropriate medication, as compared to 4.6% in 130 patients aged 60–79 years. Patients older than 80 years were six times more likely than those aged 60–79 years to take problematic medication, despite similar average numbers of medications per patient. Emergency department physicians added potentially inappropriate drugs in three cases (1.5%). *Conclusions:* Among elderly patients presenting to the emergency department, one in 10 takes at least one problematic drug. Very old patients are at the greatest risk. Presentation of elderly patients to the emergency department offers an opportunity to review and optimize drug prescriptions.

Keywords: Medication errors; Adverse drug reaction; Emergency department

1. Introduction

Morbidity and mortality from adverse drug reactions (ADR) are iatrogenic and preventable, at least in part. Prevention of ADR includes modification of system factors, processes, and standards of care. Effective prevention depends on analysis of factors contributing to ADR, such as inappropriate prescription.

Elderly patients are at an increased risk of developing complications from taking medication. The aging process affects drug excretion, metabolism, and distribution, as well as drug action at receptor sites [1]. Increasing age is associated with increasing numbers of diagnoses and of medications. In Austria, elderly out-patients take an average of 3.8 medications [2].

Inappropriate medication prescription to the elderly has been studied in nursing home and community settings. Less is known about the appropriateness of geriatric medication in the emergency department (ED). The ED is a particularly challenging setting. Elderly patients contribute a significant fraction to ED volume. Care in the ED aims at fast throughput, with an emphasis on the main complaint, even though the elderly may have multiple problems. The majority of patients are unknown to the ED physician. Training of ED physicians rarely includes specific geriatric issues.

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With respect to the use of medication, the ED is still a largely unexplored segment in the continuum of care for the elderly. We therefore examined the frequency of prescribing potentially inappropriate medication for elderly patients in the ED of a European university hospital. We also studied the potential differences between classes of age and the most common drugs involved.

2. Patients and methods

2.1. Setting

Our emergency department (ED) is associated with the Department of General Internal Medicine at Innsbruck University Hospital, Austria. Patients in our seven-bed unit are cared for exclusively by physicians specialized in internal medicine, including house officers supervised by senior registrars. More than 12,000 patients are seen each year, almost exclusively patients aged 18 years or older with non-traumatic conditions. More than 30% of the patients are 60 years or older. Thirty-eight percent are admitted for in-hospital treatment.

2.2. Study population

All patients aged 60 years or older and discharged from the ED during a 12-month period were considered eligible to participate in the study. Of all the eligible patients, a sample was drawn using a random number generator. Non-elderly patients (age <60 years) were randomly selected, matching the same day as an elderly patient included in the study.

We excluded records if (1) patient was transferred to another hospital for possible admission or further evaluation, (2) the record was unreadable, or (3) the medication history was described as incomplete in the physician's record.

2.3. Data source

Data were extracted from ED charts and documents, including nurses' and physicians' notes, results of investigations, and written discharge information given to the patient. For all patients included, ED files included a medication history taken by a physician, drugs administered during the ED visit, and medication prescription at discharge.

We did not gather details regarding the physician who prescribed the medication, such as professional background or awareness of individual drug risks, nor did we record duration or dosage of individual drugs. ED physicians documented these details only rarely.

2.4. Inappropriate medication

Inappropriateness of medication was defined by the 1997 Beers criteria for the ambulatory elderly [3]. The Beers criteria define drugs that should generally be avoided because they are ineffective or introduce risks, specifically for the elderly, and drugs that are appropriate for elderly patients only with specific dosing, frequency, or duration.

Potentially adverse drug–disease interactions: the Beers criteria also include drugs that should not be used in the elderly with specified conditions or diseases. For example, in a patient with asthma, beta-blockers are considered inappropriate.

We excluded the corticosteroid–diabetes interaction since data on duration of therapy was not collected (inappropriate only if corticosteroids were recently started). According to recent changes in recommendations for drug therapy for chronic heart failure, we also excluded the interaction of beta-blockers with heart failure [4].

2.5. Data analysis

Elderly patients were separated into two groups: those aged 60–79 years and the very old (aged 80 and older). The younger control group was only used to compare the total number of medications per patient since the Beers criteria apply to elderly patients only.

Data were entered into standard spreadsheet tables. Computations were performed using commercial software: SPSS v.11.0.1 from SPSS (Chicago, IL, USA) and StatsDirect v.2.2.3 from StatsDirect (Herts, UK).

In bi- and multivariate analyses, we used chi-square tests for categorical variables and the Wilcoxon–Mann–Whitney rank sum test for continuous variables.

3. Results

3.1. Population characteristics

The study population comprised 423 adults (186 males and 237 females) with a mean age of 57±21 years (range 17–95 years). The most common conditions leading to presentation at the ED were hypertension, syncope, bronchitis, arrhythmia, chest pain, and diarrhea.

3.2. Medication at presentation

At presentation to the ED, the average number of medications used was 2.4±2.5 (mean±S.D.; range 0–13). The agents most frequently reported at presentation were platelet function inhibitors, angiotensin-converting enzyme inhibitors, antianginals, and benzodiazepines.

Patients older than 60 years used significantly more drugs (mean 3.8±2.7 per patient) than younger patients (1.1±1.6, $P<0.0001$). Average use of medication was

Table 1
Number of medications used at presentation

	All patients	Subgroups by age		
		<60	60–79	≥80
Group size	423	228	130	65
Number of medications used				
Mean±S.D.	2.4±2.5	1.1±1.6	3.7±2.8†	4.0±2.4†
	%	%	%	%
0	32	51	10	8
1	17	20	16	11
2	13	13	13	12
3	10	8	13	12
4	9	3	15	17
5	6	3	8	11
6	5	1	8	14
7	3	1	4	6
8	3	0	7	6
9	2	0	3	3
≥10	1	0	3	0
0	32	51	10	8
1–2	30	33	29	23
3–5	25	14	36	40
>5	14	2	25	29‡

Numbers in the lower rows represent percentages of respective groups taking the specified number of medications. †$P<0.0001$ as compared to age group <60 years. ‡$P<0.0001$ in chi-square analysis for distribution of medication number classes by age groups.

highest in the oldest patients, but this was not statistically significant when compared to patients aged 60–79 ($P=0.27$). Over 25% of elderly patients took more than five different medications concurrently at presentation, as compared to 2% of patients below the age of 60 (Table 1).

3.3. Medication in the ED

Additional medication was administered to 69.5% of the patients during their visit to the ED, amounting to 508 drug administrations during the 423 patient visits (range 0–5 per visit). The most commonly prescribed medications in the ED were nonsteroidal anti-inflammatory agents, antispasmodics, mineral products, antianginals, and angiotensin-converting enzyme inhibitors. Drugs were used at similar frequencies in 65% of those younger than 60 years, and in 75% of those over 60 years of age (difference not significant statistically). Drug frequency was also similar in those with fewer than three medications at presentation, as compared to those having three or more medications at presentation (64% vs. 72%). At least one medication was discontinued by the ED physician in 31 cases (7.3%).

3.4. Potentially inappropriate medication

Overall, the choice of medication was potentially inappropriate 27 times (in 13.8% of cases) in patients aged 60 years and older. This occurred 24 times (12.3%) at presentation. Inappropriate medication was most often administered to the oldest patients (80 years and older, in 27.7% of cases) as compared to in 4.6% of those aged 60–79 ($P<0.0001$, Table 2). Three potentially inappropriate drugs were given to three patients in the ED (Table 2). No new problematic drugs were recommended at discharge.

At presentation, the five drugs responsible for the most inappropriate prescriptions were ergotamine, amitriptyline, digoxin >0.125 mg, ticlopidine, and dipyridamole. In the ED, anticholinergic antispasmodic drugs and diazepam were found to be inappropriate (Table 3).

Table 2
Inappropriate medication used by elderly patients at presentation

Age (years)	Group size *n*	At presentation		In the ED		At discharge	
		n	%	*n*	%	*n*	%
60–79	130	6	4.6	2	1.5	1	0.8
≥80	65	18	27.7†	0	0	0	0
Total	195	24	12.3	2	1.0	1	0.5

†$P<0.0001$ when compared to age group 60–79.

Table 3
Inappropriate medications in patients over 60 years of age presenting to the emergency department. Numbers represent absolute numbers of inappropriate medications

	Presentation	In ED	Discharge
Amitriptylin	3	0	0
Diazepam	0	1	0
Digoxin >0.125 mg	3	0	0
Dipyridamole	2	0	0
Ergotamine	5	0	0
Iron supplements >325 mg	1	0	0
Oxybutinin	1	0	0
Phenylbutazone	1	0	0
Reserpine	1	0	0
Ticlopidine	3	0	0
Zolpidem >5 mg/day	2	0	0
Anticholinergic antispasmodics	1	1	1
Anticholinergic antihistamines	1	0	0
Total	24	2	1

Potentially adverse drug–disease interactions were present in 3% (6/195) of patients aged 60 and older (Table 4), all exclusively at presentation to the ED. No potentially adverse interactions were introduced by the ED physicians. The medications responsible for possible adverse disease interactions were benzodiazepines, beta-blockers, acetylsalicylic acid, and tricyclic antidepressant drugs. Potentially adverse drug–disease interactions were observed in patients with chronic obstructive pulmonary diseases, blood clotting disorders, syncope, and arrhythmia (Table 4).

4. Discussion

One out of eight elderly patients took at least one problematic medication when presenting to the medical ED of our university hospital. The oldest patients—octogenarians and older—were at the highest risk: one of three presented with at least one potentially inappropriate drug. This risk was lower by a factor of 6 (4.6%) in the younger elderly (age 60–79 years), despite similar average numbers of medications per patient.

Table 4
Medications associated with potentially adverse drug–disease interactions in patients over 60 years of age presenting to the ED. Numbers represent absolute numbers of inappropriate medications

	Age 60–79 $n=140$	Age ≥80 $n=65$	All elderly $n=195$
Chronic obstructive lung disease			
Diazepam	1	0	1
Beta-blockers	1	0	1
Blood clotting disorders			
Aspirin	1	1	2
Syncope and falls			
Long-acting benzodiazepines	1	0	1
Arrhythmia			
Tricyclic antidepressants	0	1	1
Total	4	2	6

In contrast, the proportion of patients to whom drugs were administered in the ED did not differ between age classes, nor did the proportion prescribed new medication at discharge. Potentially inappropriate medication was discontinued in the ED in all cases; new inappropriate medication was introduced in only a small fraction.

We gathered our data by reviewing patient charts. Retrospective design implies lower data quality and ability to generalize than a prospective study.

Our study most likely underestimated the impact of problematic medication prescription in the elderly as we only included patients discharged from the ED. Those admitted were probably more severely ill and may have included some patients with frank adverse drug reactions resulting from inappropriate medication [5,6]. In addition, we did not take into account the additional risk of potentially adverse interactions of multiple medications. As reported previously by our group [2], adverse interactions are also much more prevalent in elderly patients than in younger patients. Thirdly, self-reported medication history, as in our study, tends to bias results, in this case underestimating them, due to unreliable memory, especially in the elderly. The incidence rate of problematic medication of 12.3% in our ED is similar to rates reported in out-patient settings, which range from 10.6% to 23.5% [7–10]. The only other study that analyzed medication in elderly patients in an ED using the Beers criteria [7] reported a similar number of potentially inappropriate medications at presentation (10.6%), but a somewhat higher rate of problematic prescription in the ED (3.6% vs. 1.5% in our study) or upon discharge (5.6% vs. 0). These transcontinental differences may be due to different ED patient populations and staffing. All patients in our ED are cared for exclusively by physicians specialized in internal medicine. Emergency rooms in the USA are staffed with emergency physicians, a medical specialty not implemented in Europe. No further studies have been published on the use of medication in the elderly presenting at an ED.

The number of drug–disease interactions was very low—6/195 (3.1%, Table 4)—which is 16% of all problematic medications in our study. Numbers this low make it difficult to make any generalizations. The impact of manifest adverse drug reactions on ED presentation and hospital admission has been the focus of a number of studies [7–9], including two publications with an elderly study population. In Malhotra et al.'s study [6] of 578 patients above the age of 65, 14.4% of presentations were attributed to drug effects. In another study [5], 1.7% of 62,216 admissions were attributed to problems with medication; 33% of these patients were older than 65 years.

In our study, potentially inappropriate medication was defined according to the 1997 Beers criteria [3]. These criteria were developed by a panel of six North American

experts in geriatrics, clinical pharmacology, pharmacoepidemiology, clinical pharmacy, and psychopharmacology. To our knowledge, these criteria have not been validated for Europe.

The elderly population is underrepresented in clinical trials. Therefore, the definition of appropriateness of medication in elderly patients has a limited evidence base. Some patients may tolerate a potentially inappropriate medication for years. Continued use may thus be appropriate. Also, it may be acceptable to give patients certain potentially inappropriate drugs if the patients are thoroughly monitored or followed up, or if the drugs are administered in low doses or prescribed for a short time only. New evidence may outdate components of inappropriateness criteria, e.g. the use of beta-blockers in heart failure [4] or of cardioselective beta-blockers in reactive airway disease [11].

To minimize the risk of inappropriate medication, further evidence is needed. A new generation of quality of care criteria in geriatrics is exemplified by the ACOVE project (Assessing Care Of Vulnerable Elders) [12]. Appropriateness criteria may be improved by studies prospectively linking the use of medication with clinical outcome. In particular, the potential of integrated electronic data management to link medication and patient outcome should be probed by appropriate studies.

In summary, our study's findings indicate that, among the elderly, octogenarians and those even older are particularly affected by inappropriate medication prescription. ED visits offer a good opportunity to update elderly patients' medications to a safer standard.

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