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ORIGINAL ARTICLE

Pharmacologically inappropriate prescriptions for elderly patients in general practice: How common?

Baseline data from *The Prescription Peer Academic Detailing (Rx-PAD) study*

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Abstract

Objective. To assess Norwegian general practitioners' (GPs') level of potentially harmful drug prescribing for elderly patients. **Design.** Prescription data for 12 months were retrospectively retrieved from the Norwegian Prescription Database (NorPD). Data were assessed in relation to 13 prescription quality indicators. **Setting.** General practice. **Subjects.** A total of 454 GPs attending continuous medical education (CME) groups in Southern Norway, 85 836 patients ≥ 70 years who received any prescription from the GPs during the study period. **Main outcome measures.** Number of prescriptions assessed in relation to pharmacological inappropriateness based on a list of 13 explicit prescription quality indicators. **Results.** Some 18.4% of the patients (66% females with mean age 79.8 years, 34% males with mean age 78.7 years) received one or more inappropriate prescriptions from their GP. An NSAID in a potentially harmful combination with another drug (7%) and a long-acting benzodiazepine (4.6%) were the most frequent inappropriate prescriptions made. Doctor characteristics associated with more inappropriate prescribing practice were old age and working single-handed with many elderly patients. **Conclusion.** The study reveals areas where GPs' prescribing practice for elderly patients can be improved and which can be targeted in educational interventions.

Key Words: Drug safety, elderly, family practice, general practitioner, prescribing

Elderly people are the major drug users in the community [1]. Although appropriate medication can alleviate symptoms and reduce elderly patients' morbidity and mortality, drugs also represent a potential danger, due to possible adverse effects. Several characteristics of ageing, such as decreased renal function and altered fat and water distribution, as well as mental impairment, make elderly persons particularly vulnerable to drug-related harm [2]. The WHO defines an adverse drug event as a detrimental response to medication that is undesired and unintended, excluding therapeutic failure, poisoning, and overdose [3]. In the elderly, between 10% and 20% of hospital admissions are drug-related [4]. A comprehensive Norwegian study

Specific drugs or combinations of drugs imply a particularly high risk of side effects in elderly patients.

- Norwegian GPs made one or more pharmacologically inappropriate prescriptions to 18% of patients ≥ 70 years receiving prescriptions during a one-year period.
- Use of NSAIDs in potentially harmful combinations with other drugs and sustained use of a long-acting benzodiazepine were most frequently reported.
- Older doctors working single-handed with many elderly patients made more inappropriate prescriptions.

found that one out of six deaths in a medical department was caused by drug treatment rather than by illness [5].

Sub-optimal drug use may be listed in three different categories: over-use or polypharmacy, under-use, and inappropriate use [6,7]. Under-utilization may imply under-prescribing of potentially beneficial therapies because of poor diagnostics or "ageism" [7]. Polypharmacy can be defined either as concomitant use of multiple drugs, or use of more medications than indicated [8]. Patients with major polypharmacy (five or more drugs) run an increased risk of adverse drug interactions. Inappropriate drug treatment includes use of drugs with strong potentials for side effects, use of drugs with poor safety records when safer alternatives are available, as well as combinations of drugs which can lead to dangerous interactions [9]. The prevalence of inappropriate prescribing for elderly patients in general practice has been reported as between 14% and 23% of all prescriptions [10–13]. However, direct comparison is hampered because the studies apply different criteria for inappropriateness [14]. A study among elderly patients receiving home care in eight European countries found that close to 20% used at least one inappropriate medication [15], and a recent Swedish study among nursing home residents found that as many as 70% had one or more potentially inappropriate prescriptions [16].

We developed a set of explicit criteria for pharmacological inappropriateness for Norwegian GPs' prescribing to elderly patients. The main purpose of the criteria was to serve as quality indicators during an educational intervention: the Prescription Peer Academic Detailing (Rx-PAD) Study [17], aimed at improving GPs' prescribing for elderly patients. In this paper we report the baseline prevalence of GPs' pharmacologically inappropriate prescribing according to these criteria, and identify physician characteristics predictive of prescribing patterns.

Material and methods

Participants

In Norway specialist GPs renew their specialty every five years. In this process, participation in a peer continual medical education (CME) group is compulsory (some non-specialists attend the CME groups on a voluntary basis). CME groups in Southern Norway were invited to this study. Of 250 groups 81 (comprising 454 GPs) accepted the invitation.

The Norwegian Prescription Database (NorPD)

Since 1 January 2004 the Norwegian Institute of Public Health has recorded information on all prescription drugs dispensed at pharmacies to individual patients in ambulatory care [18]. This nationwide database, the Norwegian Prescription Database (NorPD), includes detailed drug information and characteristics of prescribers linked to the Norwegian health personnel registry digit code. In this study we analysed prescription data from the 454 GPs who had accepted the invitation to participate in the Rx-PAD study. All their prescriptions for patients ≥ 70 years for one year preceding the Rx-PAD study were included.

Quality indicators

Quality indicators are explicitly defined items used to measure specific aspects of clinical care [19–22]. Indicators differ from guidelines as they do not provide defined answers but, rather, indicate potential problems. They are not suitable for evaluating a single physician's care of one particular patient, as this involves further aspects such as patient's preferences, comorbidity, or wider clinical judgement.

In the US, the Beers criteria [12,19] have been used to define drugs and combinations of drugs not recommended for elderly people. The Beers criteria have also been used in several recent pharmacoepidemiological studies in Europe [15,23,24]. However, a large share of the drugs to be avoided on that list is not regularly used in Scandinavia. This is why, for example, the Swedish National Board of Health and Welfare has published a corresponding list tailored for its setting [20]. For our present setting (an educational intervention aimed at CME groups in Norwegian general practice) we have elaborated and validated a list of drugs and combinations of drugs that in general should be avoided in elderly people for reasons of pharmacological inappropriateness [17]. Our list of quality indicators had to be feasible for its purpose: it had to be relevant in GPs' daily work and could not be too comprehensive. The indicators were chosen based on three different sources: (1) Beers criteria with updates [12,19], (2) the Swedish recommendations [20], and (3) previous Norwegian studies [11]. Finally, the relevance of the criteria was validated by a panel of specialists in geriatrics, clinical pharmacology, or general practice in a modified Delphi study [25].

Statistics

SPSS version 14 was used for statistical analyses. The unit of analysis was each doctor's level of inappropriate prescription per 100 patients ≥ 70

Table I. The Prescription Peer Academic Detailing (Rx-PAD) study: Characteristics of participating general practitioners (n = 454).

	Males (n = 312)	Females (n = 141)
Age, mean (SD)	50.3 (8.0)	45.4 (7.4)*
Years licensed, mean (SD)	20.4 (8.7)	14.9 (8.0)*
Patients ≥70 years, mean (SD)	212.7 (89.4)	137.5 (67.6)*
Group practice, %	90.7	94.3
Specialist GP, %	89.7	76.6**

*p < 0.01 (two samples t-test); **p < 0.01 (chi-squared test).

years. Bivariate comparisons were examined by two sample t-test (continuous variables) and a chi-squared test (categorical variables). Bivariate correlations between continuous variables were assessed by Pearson's correlation coefficient. Multiple linear regression analyses were performed to assess the impact of several variables on prescription level.

The level of statistical significance was chosen as 5% ($p \leq 0.05$).

Ethics

Participation and data extraction were based on written, informed consent from all physicians. The project has been accepted by the Regional Committee for Research Ethics. Approval from the Norwegian Social Science Data Service has been obtained, and the Directorate for Health and Social Affairs has accepted a dispensation from the Health-Professional Secrecy regulations.

Results

Characteristics of the 454 participating GPs are given in Table I. One-third were female, who tended to be younger and less specialized compared with their male counterparts. They also had made fewer prescriptions to elderly patients. Doctors working

Table II. Prevalence of inappropriate drug prescriptions (Rx) issued for patients ≥70 years by 454 Norwegian general practitioners.

Drugs or combinations of drugs to be avoided for elderly patients for reasons of safety	Mean (95% CI) Rx/100 patients ≥70 years
Tricyclic antidepressants (<i>amitriptyline, doxepin, trimipramine, clomipramine</i>)	2.2 (2.0–2.3)
Anticholinergic effects, better alternatives exist	
First-generation (low potency) antipsychotics (<i>chlorpromazine, chlorpromazine, levoprometazine, prochlorperazine</i>)	2.6 (2.4–2.8)
Anticholinergic effects, extrapyramidal effects, risk of falls and cognitive impairment	
Long-acting benzodiazepines (<i>nitrazepam, flunitrazepam</i>)	4.6 (4.3–4.9)
Risk of accumulation, prolonged sedation, falls and fractures	
Strong analgesics (<i>propoxyphene, pethidine, opioids with spasmolytics</i>)	1.1 (1.0–1.2)
Poorly tolerated by elderly, propoxyphene has narrow therapeutic width	
Risk of sedation, confusion, falls and fractures	
First-generation antihistamines (<i>dexchlorphenamine, promethazine, alimemazine, hydroxycitin</i>)	2.5 (2.3–2.6)
Anticholinergic effects, risk of "hangover"	
Long time oral use of theophylline	0.5 (0.5–0.6)
Risk of cardiac arrhythmias	
No documented effect on COPD or asthma in the elderly, better alternatives exist	
Carisoprodol (muscle relaxant)	1.0 (0.9–1.1)
Anticholinergic effects, poorly tolerated by elderly, risk of muscle weakness, falls and fractures	
Beta blocking agent + unselective calcium channel blocker	0.6 (0.5–0.6)
May lead to AV block and myocardial depression	
NSAID + warfarin (any concomitant use)	0.3 (0.3–0.4)
Risk of gastrointestinal bleeding due to impaired platelet function	
NSAID + ACE inhibitor or A2-blocker (any concomitant use)	3.4 (3.2–3.6)
Risk of drug induced renal failure	
NSAID + SSRI (any concomitant use)	0.8 (0.7–0.9)
Increased risk of gastrointestinal bleeding	
NSAID + diuretic (any concomitant use)	2.4 (2.2–2.5)
Reduced effect of diuretics	
Three or more psychotropic drugs (analgesics containing opioids, psycholeptics, hypnotics, antidepressants) for ≥3 months	2.8 (2.6–3.0)
Total	24.7 (23.7–25.6)

Table III. Determinants for level of inappropriate drug prescription to patients ≥ 70 years among 454 Norwegian general practitioners.¹

	Prescriptions per 100 patients ≥ 70 years Mean (SD)		p-value
Doctor's sex (male/female)	25.7 (10.3)	22.3 (10.4)	0.001
Group practice (no/yes)	31.1 (11.0)	24.1 (10.2)	<0.001
Specialist general practitioner (yes/no)	25.8 (9.9)	17.8 (11.0)	<0.001

Note: ¹Bivariate analyses, categorical variables: Two samples t-test.

single-handed were generally older compared with those working in group practices, but there was no difference regarding their level of specialization.

During the one-year period, the 454 GPs made one or more prescriptions to almost 86 000 patients ≥ 70 years. Close to 22 000 of the prescriptions were pharmacologically inappropriate according to the chosen criteria, corresponding to around 25 per 100 patients ≥ 70 years (Table II). About 7% of the elderly patients had been prescribed a tricyclic antidepressant, a 1st generation antipsychotic or a first-generation antihistamine. Nearly 5% of them regularly used a long acting benzodiazepine, while 7% were issued a non-steroidal anti-inflammatory drug (NSAID) in a potentially harmful combination with warfarin, a diuretic, a serotonin reuptake inhibitor (SSRI), or an angiotensin converting enzyme (ACE) inhibitor. During a three-month period 2.8% used three or more psychotropic drugs simultaneously.

In total, 15 790 individual patients (18.4%) had received one or more of the potentially harmful prescriptions (data not shown in table). Of these, 74.5% received one, 19.6% two, 4.6% three, and 1.2% four or more different inappropriate prescriptions during the one-year period. Some 66% of the patients were female with mean age 79.8 years (SD 6.4). For male patients mean age was 78.7 years (SD 6.0). There were no significant differences regarding sex or age for patients receiving one compared with more than one inappropriate prescription.

The five most prevalent combinations of unfavourable prescriptions were: NSAID+ACE inhibitor or A2-blocker as well as diuretic (n=752), NSAID+ACE inhibitor or A2-blocker as well as SSRI (n=184), tricyclic antidepressant and long-

acting benzodiazepine (n=144), long-acting benzodiazepine as one of three or more psychotropic drugs (n=128), and SSRI as one of three or more psychotropic drugs in combination with NSAID (n=122).

In bivariate analyses, for a doctor to make less inappropriate prescriptions correlated with female gender, working in group practice, not having completed vocational training (Table III), as well as having worked few years since licence and having prescribed to few patients ≥ 70 y (Table IV). When these variables were entered into a regression model, the doctors' sex lost significance, while few years since medical licence, not yet being a specialist, and working in group practice with few elderly patients still correlated with a lower proportion of pharmacologically inappropriate prescriptions (Table V).

Discussion

In our study 18.4% of patients ≥ 70 years received one or more potentially harmful prescription from their GP during the one-year study period. In a previous Norwegian study Straand and Rokstad considered 13.5% of 16 774 prescriptions for elderly patients to be inappropriate [11]. Stuck et al. reported that 14% of 414 patients older than 75 years used at least one inappropriate drug [12], while Willcox et al. found that potentially inappropriate drugs were prescribed for 23.5% of 6171 patients ≥ 65 years [13]. A review of eight studies based on Beers criteria found a rate of inappropriate prescription of 14% in community-dwelling elderly and 40% in nursing home residents [10].

In a study of 70- to 74-year-old community dwelling persons in Western Norway, close to 30% reported not to take medications on a regular basis [26]. Nearly one-third used three or more, and one in 10 five or more daily drugs. In the present study we counted each doctor's inappropriate prescriptions, divided them by the number of patients ≥ 70 years who had received a prescription from this doctor, and found an average of one potentially inappropriate prescription for every fourth person. In reality, the group of patients receiving these prescriptions was smaller, because one fourth of them had been given more than one potentially

Table IV. Determinants for level of inappropriate drug prescription to patients ≥ 70 years among 454 Norwegian general practitioners.¹

	Prescriptions per 100 patients ≥ 70 years	
	Pearson's correlation coefficient	p-value
Years since licence	0.344	0.001
Patients ≥ 70 years	0.272	<0.001

Note: ¹Bivariate analyses, continuous variables: Pearson correlation.

Table V. Determinants for level of inappropriate drug prescription to patients ≥ 70 years among 454 Norwegian general practitioners.¹

	Unstandardized B (SE)	p-value
(Constant)	13.91 (3.46)	<0.001
Doctor's sex	0.23 (1.1)	0.83
Years licensed	0.26 (0.06)	<0.001
Group practice	5.62 (1.64)	0.001
Specialist GP	-3.75 (1.48)	0.01
Patients ≥ 70 years	0.02 (0.006)	<0.001

Note: ¹Multiple linear regression, dependent variable is number of inappropriate prescriptions per 100 patients ≥ 70 years.

harmful drug or drug combination. Elderly persons using multiple drugs run the highest risk of receiving inappropriate prescriptions, and frail patients with multiple diseases are the ones who are especially vulnerable to harmful side effects.

Being a young doctor, undergoing vocational training, working in a group practice with few elderly patients correlated with a more appropriate prescription pattern in our study. Several of our quality indicators were related to "old-fashioned" drugs: tricyclic antidepressants, first-generation antipsychotics and antihistamines, and other drugs where safer alternatives are now available. It is likely that recent medical education has introduced more modern treatment possibilities. Table V shows that having worked 10 years longer in practice implicates 2.6 additional inappropriate prescriptions per 100 patients ≥ 70 years. It seems that elderly doctors to a certain extent stick to medications they are used to instead of switching to newer and often safer drugs, and that implementing new guidelines for prescription is difficult [27].

It was somewhat surprising that doctors undergoing vocational training were doing better than those who were already specialists, after adjustment for years since licence. Specialization in general practice is not compulsory in Norway, but around 55% of physicians working in general practice have completed formal vocational training. The majority of young doctors entering general practice now enter specialist training [28]. Our study targeted CME groups, participation in which is compulsory for specialists, and our sample thus comprised 84% specialist GPs. These were representative of Norwegian specialist GPs regarding age and sex [29]. The 64 non-specialists participating in the CME groups on a voluntary basis were probably doctors undergoing vocational training, as few of them had worked for more than 10 years since gaining their licence, and more than half five years or less. These doctors generally had more appropriate prescription patterns, which may reflect that present participation

in vocational training [28] in itself improves quality of care.

The identification of areas in need of quality improvement, however, is only the first step towards better practice. GPs are eager to follow EBM guidelines in order to maximize patient benefit in drug prescription [30]. Several educational strategies have been used to improve GPs' clinical practice, but substantial effects are only rarely reported [27,31,32]. More activating educational strategies, such as outreach visits, audits, and personal feedback, may be effective. Even here the effects are generally moderate, but are shown to be larger where baseline adherence to recommended practice is low [33–35]. We have developed an intervention aimed to improve GPs' prescribing for patients ≥ 70 years (the Rx-PAD study) as a cluster-randomized controlled trial to assess the effectiveness of the intervention [17]. The baseline data presented here indicate that the selected criteria for pharmacological inappropriateness are relevant for disclosing areas in need of quality improvement. A lower prevalence of such prescriptions for elderly patients will probably enhance the patients' quality of life and reduce their drug-related morbidity.

Competing interests

The authors declare no competing interests.

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