

ORIGINAL ARTICLE

A study of medication reviews to identify drug-related problems of polypharmacy patients in the Dutch nursing home setting

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SUMMARY

Background: Little is known about the extent of drug-related problems of polypharmacy patients in Dutch nursing homes.

Objectives: We investigated the feasibility of teams of hospital pharmacists and nursing home physicians carrying out medication reviews. We aimed to identify the number and nature of drug-related problems of nursing home patients receiving more than nine drugs (polypharmacy).

Methods: The study was carried out in five Dutch nursing homes ($n = 742$ beds) between October 2005 and May 2006. Ninety-one polypharmacy patients, (average age 80 years) were included. A medication review was carried out by teams consisting of one hospital pharmacist and the patient's nursing home physician with a follow-up meeting of the same team 6 weeks later.

Results: A total of 323 drug-related problems were identified (mean of 3.5 problems per patient). Sixty-two per cent of problems, in 87% of patients, were classified as 'unclear or not confirmed indication or need for review' of the prescribed drug. By the time of the follow-up, a mean of 1.7 ($n = 159$) problems per patient had been solved and the number of drugs per patient had decreased significantly from 13.5 to 12.7 ($P < 0.0001$).

Conclusions: The majority of patients had at least one drug prescribed for which the indication was unknown. The intervention was accompanied by a significant decrease in the number of drugs per patient, but half of the drug-related problems remained unsolved.


Keywords: polypharmacy, nursing home, drug-related problems, hospital pharmacist, medication review, medicines utilization review

INTRODUCTION

Nursing home patients are among the frailest of the elderly. They receive more medication than non-institutionalized elderly (1, 2). Drug-related problems are a great concern in this patient group (3–5). Ruths *et al.* (6) showed that three of four Norwegian nursing home residents had clinically relevant drug-related problems; most frequently related to adverse drug reactions, drug choice and probable undertreatment. Among the nursing home patients, the group receiving the highest number of drugs (termed polypharmacy) has the highest risk of experiencing adverse drug effects (7, 8). Polypharmacy has been defined in many different ways and the appropriate definition may differ according to patient population and study setting (9). According to Fulton and Allen (10), polypharmacy should be defined as: 'the use of medications that are not clinically indicated'. More commonly, polypharmacy is defined as using more than a certain number of drugs, irrespective of the appropriateness of drug use (8, 11, 12). A recent hospital-based study from Norway showed that

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1 the risk of experiencing a drug-related problem
 2 increased linearly with the number of drugs on
 3 admission (13). This would suggest that there is no
 4 clear cut-off point that can be used to identify
 5 at-risk polypharmacy patients. A study carried out
 6 in the USA found that nursing home patients
 7 receiving nine or more drugs were more than twice
 8 as likely as patients receiving a lower number of
 9 drugs, of experiencing an adverse effect (8). Poly-
 10 pharmacy in Dutch nursing homes has been
 11 defined as the use of more than nine different
 12 drugs (14).

13 Structured medication reviews by clinical phar-
 14 macists are seen as successful interventions to
 15 improve medication safety in the inpatient setting
 16 (14). Evaluations of similar interventions carried
 17 out in the community setting showed more con-
 18 flicting results (15). So far, only few randomized
 19 controlled studies of medication reviews involving
 20 clinical pharmacists have been performed in the
 21 nursing home setting (16–19). The nature of the
 22 medication reviews varied across the studies. One
 23 study assessed the effects of multidisciplinary case
 24 conferences (18). In three other studies, the phar-
 25 macists carried out the medication reviews and
 26 sent the findings to the physician without directly
 27 discussing them with the physician (16, 17, 19).
 28 Overall, there were few improvements in patient
 29 outcomes. These rather disappointing results may
 30 be partly due to a lack of direct cooperation with
 31 the patient's physician. Such cooperation is viewed
 32 as an essential part of successful interventions in
 33 primary care (15).

34 Little is known about the extent of drug-related
 35 problems of polypharmacy patients in Dutch
 36 nursing homes, and we are unaware of any Dutch
 37 studies about interventions to optimize prescribing
 38 in this patient group. That is why we investigated
 39 the feasibility of teams of hospital pharmacists and
 40 nursing home physicians carrying out medication
 41 reviews. We aimed to identify the number and
 42 nature of drug-related problems of nursing home
 43 patients and the extent to which it was feasible to
 44 optimize their medication. The intervention was
 45 targeted at the population most at risk of drug-
 46 related problems: polypharmacy patients receiving
 47 more than nine drugs. Our study is an essential
 48 step in the development and assessment of new
 49 healthcare interventions to optimize pharmaco-
 50 therapy in nursing home patients (20).

METHODS

Polypharmacy definition

We defined polypharmacy as the use of more than nine drugs. This definition is based on the Dutch official framework for evaluating the quality of nursing home care (14). We excluded the following substances: dermatologicals, bladder-irrigation solutions (without active drug), antiseptic throat preparations, throat, nose, ear and eye preparations without active drug, cough and cold preparations, phytopharmaceuticals and food supplements. These substances were unlikely to cause relevant drug-related problems, based on consensus between the nursing home physicians, hospital pharmacists and researchers participating in this study. The exclusion of the listed substances resulted in a reduction of about 5% in the number of polypharmacy patients.

Study setting

The study was carried out in five nursing homes in the Northern part of the Netherlands (total capacity 742 patients). The nursing homes provided specialized medical, paramedical and nursing care for somatic and psychogeriatric patients on separate wards. In the Netherlands, the medical staffs of nursing homes comprises physicians with a 2-year specialist training. They are responsible for providing medical care for the patients during their stay in the nursing home. The medication for our nursing home patients was supplied by a single hospital pharmacy department. The standard pharmacy service included monitoring of medication profiles, including identifying drug–drug interactions, using an electronic system (Zamicom[®], HI-systems, Oosterhout, The Netherlands).

Description of the intervention process

All nursing home patients meeting the polypharmacy criterion were eligible for the intervention. The intervention consisted of a medication review carried out by one hospital pharmacist and the patient's nursing home physician. The hospital pharmacist identified all polypharmacy patients of one ward from the computer system about 1 week (3–8 days) before the meeting and sent the list of

patients to the nursing home physician. The pharmacist and the physician prepared for the meeting separately. During the meeting (referred to as 'initial meeting'), each patient's medication profile was reviewed. The appropriateness of each prescribed drug was discussed addressing indication, effectiveness and safety of the therapy as well as possible undertreatment. Standards for drug therapy included any available current clinical guidelines. Any issue that was identified, and recognized as a problem, by the pharmacist and the physician was documented. The pharmacist and physician prioritized the problems and then jointly prepared a plan for optimizing the medication profile. A form was used for documentation (patient data, medication profile, problems, plan etc.). The review took about half an hour per patient. Every patient of one ward was reviewed during one meeting. Six weeks later, the same pharmacist and physician met again and discussed for each patient, the problems identified and any alteration in the medication profile. The findings of this meeting (referred to as 'follow-up meeting') were also documented on a second report form (both forms are available from the authors). In total, three hospital pharmacists and 12 nursing home physicians participated in the intervention. Reviews were undertaken between October 2005 and May 2006.

The interventions were performed as part of good clinical practice with the aim of quality improvement rather than research. Furthermore, our investigations were based on secondary use of data. Therefore, a review procedure by a medical ethics committee was not needed. However, for both ethical and quality reasons, the study was conducted according to the Code of Conduct for Medical Research of the Council of the Dutch Federation of Medical Scientific Societies (21).

Data analyses

All data for the analysis were extracted from the electronic medication monitoring system and from the medication review report forms. Medication was classified according to the WHO Anatomical Therapeutic Chemical Classification System (ATC). The drug-related problems were categorized according to the BEDNURS study (6): indication, effectiveness and safety.

The change in the number of drugs per patient was statistically analysed by the non-parametric Wilcoxon-signed ranked test. Change was defined as the difference in the number of drugs between the initial meeting and the follow-up meeting. Data were analysed using SPSS 13.

Patients who died between inclusion and initial meeting were not analysed. The latest data available was used for patients who were lost from follow-up after the initial meeting because of death or transfer.

RESULTS

General characteristics of the polypharmacy intervention population

A total of 105 polypharmacy patients were included (about 14% of the total nursing home population, $n = 742$ patients). Of those, 91 polypharmacy patients were discussed at the initial meeting. Fourteen patients were excluded, because they died or were transferred between inclusion and intervention or because of alterations in their medication profile, so they no longer met the polypharmacy definition. During the follow-up meeting, 80 polypharmacy patients were assessed. There was no follow-up meeting for 11 patients, because of death or transferral. The latest data, available for these patients, were included in the analysis.

Table 1 shows the characteristics of the 91 evaluated polypharmacy patients: average age was 80 years; 68% were female; 51% were admitted for <1½ years. At least 17% of the polypharmacy patients had elevated liver enzymes and at least 40% had decreased renal function (creatinine clearance <40 mL/min).

Drug-related problems identified at the initial meeting

The 91 polypharmacy patients used 1226 prescriptions. We registered 323 drug-related problems (Table 2); an average of 3.5 per patient. While 96% of the polypharmacy patients had one or more drug-related problems, four patients were problem free. Of 323 drug-related problems, 304 (24.8%) were directly coupled to a prescribed drug and 19 problems were classified as 'need for additional

Table 1. Characteristics of evaluated polypharmacy patients

Variables	Number of polypharmacy patients (n = 91) (%)
Gender	
Male	29 (32%)
Female	62 (68%)
Age (years)	
50–59	4 (4%)
60–69	8 (9%)
70–79	25 (27%)
80–89	42 (47%)
90–99	12 (13%)
Admission year	
Before 7 January 2002	13 (14%)
2002	8 (9%)
2003	9 (10%)
2004	15 (16%)
2005	37 (41%)
2006	9 (10%)
Admission category	
Somatic (longstay)	48 (53%)
Psychogeriatric (longstay)	21 (23%)
Rehabilitation (shortstay)	14 (15%)
Somatic and psychogeriatric (longstay)	6 (7%)
Unknown	2 (2%)
Condition	
Bedridden	12 (13%)
Wheelchair dependent	57 (63%)
Mobile	19 (21%)
Unknown	3 (3%)
Kidney function*	
Normal (GFR \geq 40 mL/min)	45 (49%)
Decreased (GFR < 40 mL/min)	36 (40%)
Unknown	10 (11%)
Liver enzyme tests	
Normal ($\leq 2.5 \times$ ULN)	46 (51%)
Elevated ($> 2.5 \times$ ULN)	17 (19%)
Unknown	28 (30%)

GFR, glomerular filtration rate; P, psychogeriatric; S, somatic; ULN, upper limit of normal.

*Calculations based on formula by Cockcroft *et al.* (27).

drug' or 'need for review'. 62% ($n = 199$) of all drug-related problems were categorized as 'unclear or not confirmed indication or need for review'. These problems were observed in 87% of the polypharmacy patients. An example was the

continuation of a proton-pump inhibitor for prevention of gastric bleeding after the NSAID had been stopped.

Table 3 shows the initial numbers and related follow-up actions of drugs connected to drug-related problems classified by ATC-code. Most frequently these were related to medication of the nervous system, cardiovascular system and, alimentary tract and metabolism.

Findings at the follow-up meeting

Out of 323 drug-related problems (Fig. 1), 80 drugs were stopped, 79 were altered (e.g. change of dosages) and 164 drug-related problems remained unchanged because of patient's discharge from the nursing home or death ($n = 37$), or 'other reasons' like unstable clinical conditions and patient unwillingness ($n = 57$). The reason not to change was unknown for 70 problems.

Table 3 shows that medication for the nervous system was altered (or stopped) most frequently during the intervention. However, this group also included most drugs, which were not altered during the intervention despite a drug-related problem. Medication of the cardiovascular system and, alimentary tract and metabolism were also often altered during the interventions. Apart from changes in the medication profile because of drug-related problems, additional changes on 39 drugs were found during follow-up as a result of changes in the clinical condition after the initial meeting (e.g. start of an antibiotic).

Between initial meetings and follow-ups, 27 new drugs were started, while 103 drugs were stopped (including the additional changes mentioned above). Patients used a mean of 13.5 (median 12.6) drugs before the intervention. This decreased to 12.7 (median 11.9) after the intervention. This was a statistically significant decrease of 0.7 drugs per patient ($P < 0.0001$).

DISCUSSION

About a sixth of all nursing home residents received more than nine drugs (polypharmacy). Patients had an average of 3.5 drug-related problems (indication unknown was the most frequent problem), but changes were found on only 1.7 drug-related problems at follow-up. Partly, this

Table 2. Drug-related problems and patients with drug-related problems identified during the initial meeting, categorized according to BEDNURS (7)

Categories	Drug-related problems	Number of drug-related problems (n = 323) (%)	Number of patients (n = 91) (%)
Indications	Need for additional drug: undertreatment for diagnosis	10 (3%)	9 (10%)
	Unclear or not confirmed indication, need for review	199 (62%)	79 (87%)
	Unnecessary treatment: no appropriate medical indication, therapeutic or pharmacological duplication, drugs used for the treatment of avoidable adverse drug reactions	66 (20%)	39 (43%)
Effectiveness	Choice of drug: drug not indicated for condition, more effective drug available, contraindication present	19 (6%)	17 (19%)
	Dosage too low	2 (<1%)	2 (2%)
Safety	Risk for adverse drug reactions: unfavourable safety profile	10 (3%)	9 (10%)
	Drug-drug interactions	8 (2%)	6 (7%)
	Dosage too high	9 (3%)	8 (9%)
NA	No drug related problems	NA	4 (4%)

NA, not applicable.

*It is possible to have more drug-related problems per patient .

Table 3. Drugs connected to drug-related problems (DRP) and related follow-up actions classified by Anatomical Therapeutic Chemical Classification System (ATC) code

ATC-code	Initial meeting: number of drugs with DRP (%)	Follow-up: number of drugs stopped (%)	Follow-up: number of drugs altered (%)	Follow-up: number of drugs with DRP, no change (%)
A	54 (17.8%)	12 (3.9%)	15 (4.9%)	27 (8.9%)
B	18 (5.9%)	5 (1.6%)	4 (1.3%)	9 (3.0%)
C	59 (19.4%)	11 (3.6%)	20 (6.6%)	28 (9.2%)
D	23 (7.6%)	14 (4.6%)	1 (0.3%)	8 (2.6%)
G	6 (2.0%)	1 (0.3%)	0 (0.0%)	5 (1.6%)
H	12 (3.9%)	3 (1.0%)	4 (1.3%)	5 (1.6%)
J	7 (2.3%)	3 (1.0%)	2 (0.7%)	2 (0.7%)
L	1 (0.3%)	0 (0.0%)	1 (0.3%)	0 (0.0%)
M	6 (2.0%)	1 (0.3%)	0 (0.0%)	5 (1.6%)
N	82 (27.0%)	17 (5.6%)	26 (8.6%)	39 (12.8%)
P	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
R	22 (7.2%)	11 (3.6%)	3 (1.0%)	8 (2.6%)
S	14 (4.6%)	2 (0.7%)	0 (0.0%)	12 (3.9%)
Total	304 (100.0%)	80 (26.3%)	76 (25.0%)	148 (48.7%)

A, alimentary tract and metabolism; B, blood and blood forming organs; C, cardiovascular system; D, dermatologicals; G, genito-urinary system and sex hormones; H, systemic hormonal preparations, excluding sex hormones and insulins; J, anti-infectives for systemic use; L, antineoplastic and immunomodulating agents; M, musculo-skeletal system; N, nervous system; P, antiparasitic products, insecticides and repellents; R, respiratory system; S, sensory organs.

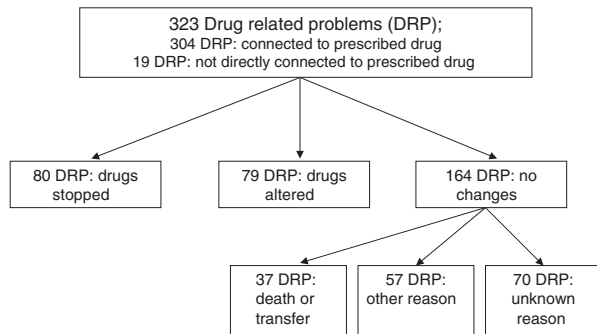


Fig. 1. The findings of the 323 drug-related problems during the follow-up meetings.

may be because the drug-related problems of polypharmacy patients who died or were discharged before the follow-up meeting could not be resolved, but were still included in the analysis. Polypharmacy decreased slightly but this was probably not clinically significant. Moreover, we did not expect a large reduction as polypharmacy is often associated with undertreatment.

In comparison with the BEDNURS study (6), we found that polypharmacy patients had more and different drug-related problems than the Norwegian nursing home residents. The BEDNURS investigators reported drug-related problems in 75% of all patients, while we found drug-related problems in 96% of our polypharmacy population. While in the BEDNURS study, adverse drug reactions, drug choice and probable undertreatment were the most frequent drug-related problems, we found unknown indications as the most frequent problem. Differences between the two studies limit direct comparison. For example, we used one physician and one pharmacist to identify the drug-related problems whereas the Norwegian study used a panel of four (6). Moreover, the nursing homes are not comparable being under different medical-care systems.

This study has two main limitations. First, it remains unknown whether changes in the medication led to improvement in the health or well-being of the patients. However, such outcome data is methodologically difficult to obtain, especially in the unstable nursing home population. Secondly, the quality of the interventions was not validated by other experts. For example, the hospital pharmacists and the nursing home physicians may have missed drug-related problems. However, decisions about pharmacotherapy in this area are difficult as current

guidelines rarely address the complexity of multiple chronic conditions of polypharmacy patients (22, 23). Future efforts should be particularly directed towards developing guidelines for prioritizing various therapies. Nevertheless, healthcare decisions need to be individualized to obtain a balance between life expectancy, goals of care and treatment targets as has been suggested recently (24).

Refinements in methodology are possible. First, we selected our patients based on their use of more than nine drugs as operated by the Dutch evaluation framework for responsible care (14). This is an arbitrary cut-off point (13). We may have missed patients with a similar number of problems using fewer drugs, especially undertreated patients. Therefore, further research should be undertaken to develop validated instruments to identify patients at risk. Relevant factors may include the number of drugs used as well as renal function, presence of multiple morbidities, use of drugs with a narrow therapeutic index etc. Secondly, it is of high importance to know and document the indications for the drugs prescribed. The strikingly high percentage of unknown indications is likely due to incomplete transmural transfer of data on the patients' medical histories, including drug therapies. For example, medications initially prescribed for a short-term treatment may unintentionally be used chronically (25, 26). A medication review carried out on admission to the nursing home might be more effective. Indications should be reported in medical referral and discharge letters. Thirdly, a large number of the polypharmacy patients had decreased renal function and some of them had contraindicated drugs or inappropriate dosages prescribed. To improve prescribing of renally cleared drugs for all nursing home patients, the electronic medication monitoring system should be linked to laboratory data to trigger appropriate warning signals. Fourthly, a relatively large number of drug-related problems remained unresolved, because more time was needed for implementing changes. Therefore, we suggest additional follow-ups for such patients. We also recommend repetition of the intervention. The monthly medication review by the nursing home physicians, recommended in the Dutch standard for pharmaceutical care in nursing homes, is currently not implemented in daily practice (14). This is to our knowledge the first study investigating the

feasibility of medication reviews in the Dutch nursing home setting. The effectiveness of our revised intervention should be tested in a randomized controlled trial.

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COMPETING INTERESTS

None.

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None.

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