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ORIGINAL ARTICLE

## Multidisciplinary intervention to identify and resolve drug-related problems in Norwegian nursing homes

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### Abstract

**Objective.** To describe an innovative team intervention to identify and resolve DRPs (drug-related problems) in Norwegian nursing homes. **Design.** Descriptive intervention study. **Setting.** Three nursing homes in Bergen, Norway. **Subjects.** A total of 142 long-term care patients (106 women, mean age 86.9 years). **Results.** Systematic medication reviews performed by pharmacists in 142 patients revealed altogether 719 DRPs, of which 504 were acknowledged by the patients' physician and nurses, and 476 interventions were completed. "Unnecessary drug" and "Monitoring required" were the most frequently identified DRPs. Drugs for treating the nervous system and the alimentary tract and metabolism were most commonly questioned. **Conclusions.** The multidisciplinary team intervention was suitable to identify and resolve drug-related problems in nursing home settings. Systematic medication reviews and involvement of pharmacists in clinical teams should therefore be implemented on a regular basis to achieve and maintain high-quality drug therapy.

**Key Words:** Drug-related problems, drug utilization review, nurses, nursing homes, physicians, patient care team, pharmacists

Nursing homes comprise about 40 000 beds and constitute the largest institutional level in Norway. The institutions provide medical treatment and care services mainly to old patients with complex health problems and severe mental and functional impairment. Drug therapy is an important treatment modality, and the majority of patients use multiple medications concurrently. However, age-related pharmacokinetic and pharmacodynamic changes, and co-morbidity pose great challenges to optimal drug therapy. Prevalence of DRPs (drug-related problems) is high in nursing home populations worldwide, e.g. extensive use of psychotropic medications and under-treatment of heart failure [1–7]. A DRP can be defined as "an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes" [8]. Studies from various countries and healthcare systems have shown that systematic medication reviews in nursing homes are effective in identifying DRPs [3,9,10], and pharmacists' involvement

has been shown to have a positive impact on the quality of medication use [11,12].

Medical care for Norwegian nursing home patients is most commonly provided by part-time employed general practitioners. Consulting pharmacists are not usually active members of the institutions' multidisciplinary teams. Collaboration with pharmacists may increase physicians' and nurses' knowledge and awareness of DRPs.

The aim of this study was to describe an innovative team intervention to identify and resolve DRPs in Norwegian nursing homes.

### Material and methods

#### Study population

At a nursing home conference in Bergen, Norway, directors and staff were informed about our study. Aiming at inclusion of 150 study patients, medium-sized

Nursing home patients are at great risk of experiencing drug-related problems. Appropriate methods to handle these problems should be developed and evaluated.

- Multidisciplinary case conferences between pharmacists, physicians, and nurses are a suitable method to identify and solve drug-related problems among nursing home patients.
- Drug-related problems were most often associated with unnecessary prescriptions and lack of therapeutic monitoring.
- The most commonly questioned drugs were those prescribed for treating the nervous system and the alimentary tract and metabolism.

nursing homes (60–75 beds) were invited to volunteer, and three randomly selected institutions were included. Eligible study subjects were long-term care patients  $\geq 65$  years, not terminally ill, who were using at least one regular medication. Nursing home staff was asked to include 50 patients per home at random, according to inclusion criteria during spring 2006.

#### *Baseline data collection*

All study procedures (systematic review and case conferences) were piloted on 15 patients at a nursing home not participating in the study.

Baseline data collection and medication reviews were conducted by three experienced pharmacists employed at the Department of Pharmaceutical Advisory Services at Haukeland Hospital Pharmacy, Norway. Two pharmacists performed systematic reviews at one nursing home each, while one of them shared the last institution with a third pharmacist. Prior to, and during data collection, meetings were held with the pharmacists involved and the study supervisors (authors SR and AGG) to ensure consistency of the review process and classification of DRPs, and to discuss and resolve ambiguities.

Baseline data comprised patients' age and gender, diagnoses, relevant blood tests, and complete medication lists (brand name, formulation, strength, dosage, regular or p.r.n. (when required) medication and date of medication initiation). Patients' body weight and blood pressure were provided by nurses. All drugs were classified according to the Anatomical Therapeutic Chemical system [13]. Based on creatinine values, glomerular filtration rates were estimated [14].

#### *Medication review*

Each patient's drug regimen was systematically reviewed by a pharmacist according to the criteria of a recently established Norwegian classification tool [15], taking into account the patient's individual clinical characteristics. The assessment included available national treatment recommendations [16,17] and a web-based tool for identifying drug–drug interactions, where severity is classified according to a four-point scale [18]. The pharmacists identified and classified potential DRPs in individual patients (Table I) [15].

#### *Multidisciplinary case conferences*

Nursing home physicians and nursing staff usually conduct weekly pre-round case conferences on the wards to discuss and resolve individual patients' health problems. For the purpose of this study, the pharmacists performing the medication reviews joined these meetings and presented identified DRPs for groups of 5–10 patients at a time to the patients' physician and primary nurse, inviting them to discuss and reconsider the problems. The identified DRPs could be accepted, re-classified (agreement that a problem is present, but classified in another DRP category), or rejected, respectively. Furthermore, relevant interventions were planned to resolve the acknowledged DRPs, e.g. drug cessation, additional drug, dosage adjustment, or therapeutic monitoring. In the case of disagreement between the health professionals concerning a DRP, the nursing home physician responsible for drug therapy held the final decision.

#### *Outcome measures*

Data were analysed with regard to DRPs (classification shown in Table I) identified by pharmacists and acknowledged at case conferences, medications involved, and interventions. Agreement between pharmacists and clinical teams was considered as full agreement (type of DRP and medication involved), partial agreement (type of DRP or medication involved), rejection, or additional DRP (identified during case conference). Three weeks after the case conferences the pharmacists examined whether the planned interventions had been completed, based on information in medical charts or provided by nursing home staff.

#### *Ethics and approvals*

The study was approved by the Regional Committee for Medical Research Ethics, the Norwegian Data Inspectorate, and the Norwegian Directorate for Health and Social Affairs. Information on the study was provided to each patient or adult offspring of mentally impaired patients.

Table I. Drug-related problems (DRPs) in 142 nursing home patients as identified by pharmacists and discussed at multidisciplinary case conferences.

DRP category <sup>15</sup>	Multidisciplinary case conference						
	Medication review Identified by pharmacists	Rejected	Full agreement	Re-classified		New	Acknowledged (Sum)
				from other categories	to other categories		
Drug choice problem	288	91	169	44	28	15	228
Need for additional drug	4	2	1	1	1	1	3
Unnecessary drug	235	71	144	38	20	12	194
Inappropriate drug choice	49	18	24	5	7	2	31
Dosing problem	127	46	60	13	21	7	80
Too high	85	25	47	9	13	2	58
Too low	22	10	7	2	5	4	13
Sub-optimal dosing scheme	17	9	6	2	2	1	9
Sub-optimal formulation	3	2	–	–	1	–	–
Adverse reactions	9	8	–	1	1	–	1
Interactions	42	28	4	–	10	–	4
Inappropriate drug use	43	6	31	7	6	–	38
Administered by health personnel	43	6	31	6	6	–	37
Administered by patient	–	–	–	1	–	–	1
Other	210	64	107	39	38	6	153
Monitoring required	80	25	45	21	10	2	68
Unclear documentation	113	36	52	8	25	–	60
Not classified/complex problem	17	3	11	10	3	4	25
Total	719	243	372	104	104	28	504

### Statistical analysis

Data were analysed as a before-and-after study. Student's t-test and Wilcoxon rank-sum tests were performed to compare groups. P-values < 0.05 were considered statistically significant. Software from SPSS version 14.0 was used.

### Results

Nursing home staff at the three institutions selected at random 147 out of 216 patients, 142 of whom met the inclusion criteria. Women accounted for 74.6% and were generally older than men (87.7 vs. 84.6 years,  $p < 0.05$ ). Dementia (65% of all patients), hypertension (35%), and depression (34%) were the three most common diagnoses. On average each patient used 11.5 drugs (8.1 regular medications and 3.4 drugs used p.r.n.). Lactulose, paracetamol, and acetylsalicylic acid were the most frequently used regular medications, while paracetamol, oxazepam, and paracetamol/codeine combinations were the most common p.r.n. medications. The average number of drugs did not differ significantly between the genders ( $p = 0.46$ ).

### Drug-related problems

The pharmacists identified 719 DRPs in 140 of the 142 patients (mean per patient = 5.1, SD = 3.0). At the case conferences 476 of the identified DRPs were

accepted (full agreement was achieved on 372 (52%) DRPs, while 104 (14%) DRPs were accepted but re-classified) and 243 (34%) DRPs were rejected. During the case conferences additionally 28 DRPs were identified. Finally, 504 (mean per patient = 3.5, SD = 2.2) DRPs were acknowledged (Figure 1).

DRPs were most commonly classified as "Unnecessary drug" (33% of identified, and 38% of acknowledged DRPs), and "Monitoring required" (11% of identified, and 13% of acknowledged DRPs). Agreement between pharmacists and clinical teams was most commonly achieved with regard to "Inappropriate drug use – administered by health personnel", while physicians and/or nurses often disagreed on "Adverse reactions" and "Interactions" (see Table I).

The drugs most commonly used were also those most frequently involved in DRPs: 219 (43%) of acknowledged DRPs were connected to 13 drugs, with paracetamol, lactulose, and zopiclone at the top (Table II). The most common rationale for, e.g., stating that there was no need for an analgesic, laxative, or anxiolytics/hypnotic in a particular patient was that these drugs were prescribed p.r.n. but had not been given within the preceding months. Drug dosing was considered to be too high in the case of, e.g., paracetamol > 4 grams/daily, zopiclone > 5 mg/daily, or lactulose > 30 ml/daily.

Altogether 39 drug–drug interactions were identified by the intervention tool [18]. Two combinations were classified as moderate severity and 37 combinations as low severity. Three additional drug–drug

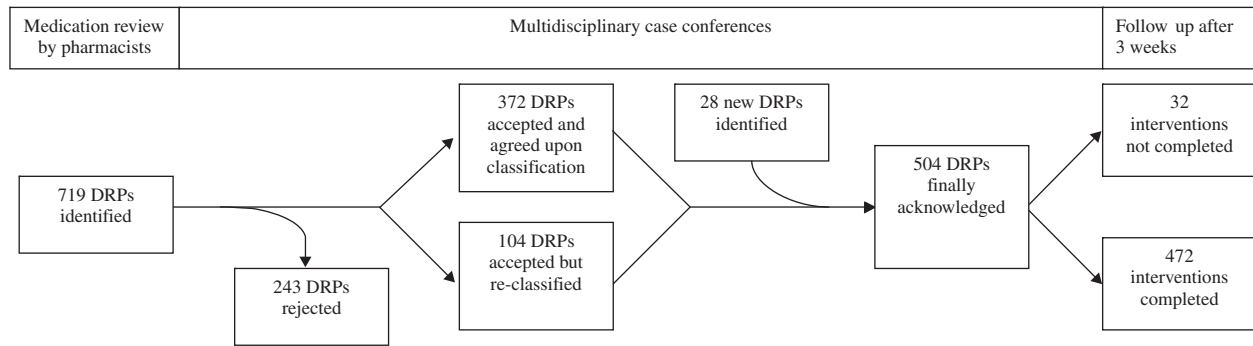


Figure 1. Drug-related problems (DRPs) in 142 nursing home patients as identified by pharmacists and assessed by multidisciplinary clinical teams.

interactions not detected by the tool were identified by the pharmacists.

*Interventions*

The pharmacists proposed 694 interventions to resolve the 719 DRPs identified. The physicians and nurses agreed to 504 interventions of which 472 (94%) were implemented during the follow-up period. The most common interventions were “Drug cessation” (e.g. p.r.n. analgesics, laxatives, and anxiolytics/hypnotics that were considered to be unnecessary), “Therapeutic monitoring” (e.g. serum levels of cobolamine and serum levels of potassium in digitoxin users) and “Dose adjustment” (e.g. dose reduction of paracetamol, zopiclone, and lactulose in

cases where prescribed doses were considered too high). Agreement levels between pharmacists and clinical teams varied with regard to type of intervention, “Therapeutic monitoring” and “Documentation” being the least likely to be initiated (Table III). Altogether 206 medications (63 regular) were discontinued, resulting in a mean reduction of 1.5 drugs per patient ( $p < 0.01$ ).

**Discussion**

The team intervention was suitable to identify and resolve drug-related problems in nursing homes. On average, the pharmacists identified 5.1 DRPs per study patient; 3.5 were acknowledged by physicians and nurses, of which 94% were followed up.

Table II. Drugs most commonly involved in drug-related problems in 142 nursing home patients.

Acknowledged Drug-related problem	Drug (group)							Total
	Analgesics <sup>a</sup>	Laxatives <sup>b</sup>	Anxiolytics/hypnotics <sup>c</sup>	Vitamin B <sup>d</sup>	Diuretics <sup>e</sup>	Anti-thrombotics <sup>f</sup>	Anti-emetics <sup>g</sup>	
<b>Drug choice problem</b>								
Need for additional drug	1	1	–	–	1	–	–	3
Unnecessary drug	29	22	25	9	2	1	11	99
Inappropriate drug choice	2	1	1	1	–	1	–	6
<b>Dosing problem</b>								
Too high	8	15	9	–	4	4	–	40
Too low	6	–	–	–	–	–	–	6
Sub-optimal dosing scheme	1	–	1	–	–	–	–	2
Sub-optimal formulation	–	–	–	–	–	–	–	–
<b>Adverse reactions</b>								
Interactions	1	–	–	–	–	1	–	1
<b>Drug use problem</b>								
Administered by health personnel	3	1	1	2	1	1	–	9
Administered by patient	–	–	–	1	–	–	–	1
<b>Others</b>								
Monitoring required	1	1	1	9	6	1	–	19
Unclear documentation	4	5	3	2	1	2	–	17
Not classified/complex problem	2	9	3	1	–	–	–	15
<b>Total</b>	<b>58</b>	<b>55</b>	<b>44</b>	<b>25</b>	<b>15</b>	<b>11</b>	<b>11</b>	<b>219</b>

Notes: <sup>a</sup>Paracetamol, paracetamol/codeine, tramadol, <sup>b</sup>lactulose, sodium picosulphate, bisacodyl, <sup>c</sup>zopiclone, oxazepam, <sup>d</sup>vitamin b-complex/folic acid, hydroxycobolamin, <sup>e</sup>furosemide, <sup>f</sup>acetylsalicylic acid, <sup>g</sup>metoclopramide.

Table III. Interventions to resolve drug-related problems in 142 nursing home patients, and most frequently involved drugs.

Intervention	Proposed by pharmacist n	Acknowledged at case conference n	Completed within 3 weeks		The three most commonly involved drugs					
			n	(%)	No. 1 drug(s)	n	No. 2 drug(s)	n	No. 3 drug(s)	n
Drug cessation	250	208	206	99	Zopiclone	12	Metoclopramide	11	Oxazepam, lactulose, Sodium picosulphate*	8
Dose adjustment	122	72	71	99	Paracetamol	12	Lactulose	10	Zopiclone	7
Therapeutic monitoring	104	73	61	84	Cobolamine	6	Digitoxin,	4	Furosemide, warfarin*	4
Documentation	87	51	41	80	Paracetamol	2	Acetylsalicylic acid	2	37 different drugs*	1
Drug change	54	36	33	92	Lactulose	5	Paracetamol	3	Paroxetine	2
Other	72	62	58	94	7 different drugs*, **	2	34 different drugs*	1		
Additional drug	5	2	2	100	Paracetamol	1	Lactulose	1		
Total	694	504	472	94						

Notes: \*Number applies for each of the drugs, \*\*donepezil, lactulose, lamotrigine, sodium picosulphate, laurylsulphate, budesonide/formoterol and zopiclone.

### Strengths and limitations

To our knowledge, this is the first Norwegian study evaluating the impact of physician–pharmacist–nurse cooperation to optimize medication use in nursing homes. Detailed baseline data enabled comprehensive medication reviews, and the criteria of the Norwegian DRP classification system [15] ensured equal structure and conduct of the assessments. One advantage of the implicit review process is that it takes into account the clinical characteristics of each patient. The strengths of the process are the involvement of prescribers and nurses in the decision-making on whether identified issues were to be actioned or not.

The main limitation is that the study is small and that a control group was not included. Although a part-selection of patients cannot be ruled out, two out of three eligible patients were included, and the results of the study are probably relevant for other Norwegian nursing homes. The clinical information retrieved from patients' medical record is assumed to be based on correct diagnostic work-up, but we were not able to assess the validity and completeness of diagnoses. The intervention revealed a significant reduction in number of medications. However, effects on clinical endpoints and drugs costs were not examined, as this was beyond the scope of this study.

### Drug-related problems

Comparisons with other studies are hampered by methodological differences. The 3.5 acknowledged DRPs per patient in this study compare well to the 3.5 DRPs per patient identified by cooperating physicians and pharmacists in Dutch polypharmacy patients [2]. Medication review studies conducted in

the UK [3] and Norway [5] revealed an average of 2.5 DRPs per patient. These differences may be explained by different study populations, fewer clinical data available, or lack of contribution of nursing home physicians and nurses. Our findings that drugs affecting the nervous system and alimentary tract and metabolism were often involved in DRPs are in line with previous studies [2,5].

### Multidisciplinary case conferences

The multidisciplinary meetings in this study represent an extension of established case conferences between physicians and nurses, turning to account for the complementary knowledge of pharmacists. Presenting their medication review findings and recommendations at face-to-face meetings, the pharmacists were able to facilitate discussions and decision-making with regard to DRPs. On the other hand, the physicians and nurses provided additional clinical information based on their profound patient knowledge that was essential to make final decisions on DRPs and appropriate interventions. Controlled studies by Schmidt et al. [19] and Crotty et al. [20] indicate that direct communication and teamwork by physicians, pharmacists, and nurses are effective for improving psychotropic prescribing and nursing home staff's drug therapy knowledge [19], and for improving overall prescribing quality [20].

The effectiveness of medication reviews by pharmacists can be evaluated by means of acceptance rates by physicians of the pharmacists' recommendations. Our study revealed 66% acceptance, and 94% implementation of accepted DRPs. Previous studies report acceptance rates between 39% and 92% [3,4,21]. This

is probably due to different communication models when addressing DRPs. Direct communication between healthcare providers in general reveals higher acceptance rates [3,21] than indirect contact, e.g. written reports [4]. The physician–pharmacist meetings conducted by Finkers et al. [2] as well as in the present study provided an opportunity to discuss, acknowledge, adjust, and reject DRPs raised by the pharmacists, and to add new problems to the list. This proactive approach may also have contributed to the high rate of problem-solving achieved in this study (see Table III), as interventions were planned and partly executed during the case conferences.

We found that agreement between pharmacists and clinical teams varied with regard to different DRP categories (see Table I). Only 10% of the identified drug–drug interactions were accepted by the clinical teams, while proposed DRPs regarding “Unnecessary drug” and “Unclear documentation” were highly accepted. This is possibly explained by the fact that most interactions were considered of minor clinical importance. Another explanation is that risk–benefit analyses have already been performed by physicians when prescribing the actual drugs and combinations. A third explanation may be that physicians consider inquiries concerning their drug therapy decisions to be a threat to their professional position.

Although 94% of all planned interventions were conducted, somewhat lower completion rates were found for “documentation” and “monitoring”. Three weeks may have been too short for the staff to initiate more time-consuming interventions. Follow-up periods in medication review studies vary from three weeks to 12 months; however, numbers of subjects lost to follow-up due to terminal illness and death may increase with the time window [2,3,19,21].

## Conclusions

In our experience, the multidisciplinary meetings in general contributed to increased knowledge and critical reflections on drug treatment and can potentially improve the long-term communication between team members, and hence the quality of the patients’ drug treatment. Policy-makers should consider implementing systematic medication reviews on a regular basis to achieve and maintain high-quality drug treatment in nursing home patients. Future research should include clinical end-points to substantiate beneficial patient-related outcomes, e.g. reductions in side-effects, and possible cost-savings. Furthermore, prescribing quality in larger geriatric populations should be surveyed, based on suitable indicators, e.g. NORGEF [22].

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## Conflicts of interests

None.

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