Impact of Educational Intervention on Prescribing Inappropriate Medication to Elderly Nursing Homes Residents

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SUMMARY
Introduction Problems with polypharmacy, adverse drug reactions and non-adherence are especially frequent among elderly nursing home residents.
Objective The aim of our study was to evaluate effectiveness of a specific form of staff education on appropriateness of prescribing in a cluster of nursing homes for the elderly.
Methods The study was designed as before-and-after trial of educational intervention on appropriateness of prescribing in nursing homes for the elderly. In total 20 nursing homes located in Belgrade, Serbia were included in the study with 104 elderly residents and 27 caring physicians. Appropriateness of prescribing was checked against Beers, START and STOPP criteria, before and 6 months after the intervention.
Results There were 349 inappropriately prescribed drugs according to Beers criteria before the intervention and 37 drugs six months after the intervention. According to STOPP criteria there were 70 drugs inappropriately prescribed before the intervention, and 20 drugs 6 months after. When both criteria are taken together, there is a significant difference between the average number of inappropriate drugs per patient before (3.4±0.5) and after (0.6±0.7) educational intervention (t=38.902; p<0.001). Finally, before the intervention 143 appropriate drugs were omitted according to START criteria, while 6 months after the intervention there were only 67 omissions.
Conclusion Simple, but well targeted educational interventions may improve polypharmacy and decrease inappropriate prescribing rate, contributing to a better care of elderly patients in nursing homes.
Keywords: elderly; nursing homes; inappropriate prescribing; education; polypharmacy

INTRODUCTION

Aging is actually the accumulation of progressive and irreversible molecular changes in cells and tissues of human organism [1]. Therefore, more specificity of elderly people exists in regard to pharmacokinetics and pharmacodynamics of drugs that are used for their numerous functional problems and disorders (1-5 on average). Majority of elderly people are chronically taking several drugs, and it is not rare that even 20 or more drugs are prescribed to one person [2, 3], or that drugs are prescribed without obvious reason or diagnosis [4]. Recent studies among elderly nursing home residents showed that even 48% of patients in Italy [5] and 21.9% of patients in Germany [6] were prescribed inappropriate medication, which led to the increased risk of their hospitalization (hazard ratio 1.73). At least some of inappropriate prescriptions were associated with doctors who did not know well the residents or did not have important information about their patients when prescribing [7].

Polypharmacy in the elderly is always associated with increased occurrence rate of adverse drug reactions and clinically significant interactions. If the elderly are left without appropriate guidance, they are prone to non-adherence and avoidance of drugs for which they believe that have caused their unpleasant symptoms. With such behaviour, the elderly are exposed to significant risks of under-treatment and/or complications caused by drugs with a narrow therapeutic window [8]. Besides, physicians in charge of elderly patients often cannot recognize whether a certain symptom or sign is caused by the disease itself, or by a certain drug taken by the patient [9].

Problems with polypharmacy, adverse drug reactions and non-adherence are especially frequent among elderly nursing home residents, and there are certain risk factors for their occurrence: age over 75, length of stay more than 2 years and feeding tube versus normal feeding [10]. Recent systematic review [11] analyzed interventions aimed at optimizing prescribing in nursing homes for the elderly, as staff education, multi-disciplinary team meetings, pharmacist medication reviews and computerized clinical decision support systems. Education has shown to be most promising, but its effectiveness and optimal forms are not yet established [12].

OBJECTIVE

The aim of our study was to evaluate the effectiveness of a specific form of staff education on

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the appropriateness of prescribing in a cluster of nursing homes for the elderly.

METHODS

The study was designed as before-and-after trial of educational intervention on the appropriateness of prescribing in nursing homes for the elderly. In total 20 nursing homes located in Belgrade, Serbia were included in the study, with 104 elderly residents that fulfilled inclusion and exclusion criteria, and 27 caring physicians. In the beginning, all 47 existing nursing homes in Belgrade were contacted with a request for the study, but managers of only 20 of them were willing to participate in the study. The inclusion criteria were age over 65 and at least two chronic health disorders; the exclusion criteria were major psychiatric diseases, dementia and refusal of the residents to participate in the study.

The study was conducted during 2012 and 2013 in three phases: in the first, three-month phase prescribing practices were recorded and analyzed; the second, one-month phase was education of both physicians and nursing homes residents, and the third, three-month phase was carried out 6 months after completion of the second phase consisting of repeated recording and analyzing of prescribing practices.

The data about the prescribed medication and diagnosis were recorded from the residents' medical files. Appropriateness of prescribing was judged according to Beers, START and STOPP criteria [13, 14]. The Beers criteria were developed by a geriatrician Mark Beers in 1991, and they listed drugs which should not be used in elderly persons due to their propensity to cause adverse effects thanks to pharmacological properties or to changes in physiological functions of elderly persons. The START criteria (Screening Tool to Alert doctors to the Right Treatment) consist of 22 indicators which may reveal omissions in prescribing drugs that are actually needed by elderly persons [15]. The STOPP criteria (Screening Tool of Older People's potentially inappropriate Prescriptions) consist of 65 frequent examples of potentially inappropriate prescribing in the elderly including drug–drug and drug–disease interactions, drugs which increased the risk of falls in the elderly and duplicate prescriptions of drugs from the same pharmacological group [16]. These criteria were chosen because they are most used and cited in studies on inappropriate drug prescribing in elderly patients [13-16]. Besides, the residents were interviewed about adverse drug reactions and over-the-counter drugs they use, including money they spent for such drugs.

The intervention was two-faceted: (1) one-hour lectures about specificities of pharmacokinetics and pharmacodynamics of drugs in the elderly, the Beers, START and STOPP criteria, screening tool to alert physicians to right treatment, together with the brochure with identical content; (2) one-hour lectures given to the nursing homes residents about adherence, adverse drug reactions and drug-drug interactions, together with the brochure with the same content. The lectures were structured, with the

following subheadings: introduction, changes of intestinal absorption of drugs with increasing age, distribution of drugs in elderly patients, excretory function of kidneys in the elderly, excretory function of liver in the elderly, changes in the responsiveness of the elderly to centrally acting drugs, compliance of elderly patients, rationale, composition and utilization of the Beers criteria for inappropriate prescribing, composition and utilization of the START criteria for inappropriate prescribing and composition and utilization of the STOPP criteria for inappropriate prescribing. The lectures were held by one of the investigators (medical doctor, Master of Science in pharmacology), using audio/visual aids (video beam presentation). The brochures were written by another investigator (medical doctor, clinical pharmacology specialist), with the same subheadings as in the video presentation. The brochure for the residents was written using layperson's language, with short sentences, and was pilot-tested for clarity prior to printing in a small sample of 5 residents.

The data were primarily statistically described, using central tendency measures (median or mean) and standard deviation as a measure of dispersion for continuous variables; the percentages were used for categorical variables. Correlation between continuous variables was tested by the Pearson correlation coefficient. Differences in the values of categorical variables before and after educational intervention were tested by the Chi-square test, and differences in the values of continuous variables were tested by the Wilcoxon's test. The differences were considered significant if probability of null hypothesis was less than 0.05.

RESULTS

A total of 104 nursing home residents participated in the study, with average age of 82.6±2.1 years. There were 62 (59.6%) females and 42 (40.4%) males. The average length of stay in a nursing home was 4.3±1.4 years. Eighty-three (79.9%) participants were suffering from chronic diseases for more than 10 years, and the average number of diagnosis per participant was 7.5±1.6 (median 8, range 5-16) (Table 1). The participants were taking on the average 14.1±2.5 drugs (median 14, range 8-21) chronically. Among the medication used, 10.2±2.3 drugs were prescribed (median 10, range 6-16), while 3.2±1.5 drugs were bought over-the-counter (median 3, range 1-6).

Eighty-five participants (81.7%) experienced at least two adverse drug reactions during the last year, and they spent on the average 2828.8±1128.6 RSD (Republic of Serbia Dinars) monthly for over-the-counter (OTC) drugs. Sixty-four (61.5%) nursing home residents spent more than 2000 RSD monthly for the OTC drugs. While there were no significant correlations between the duration of stay in a nursing home and the number of drugs taken by participants (r=-0.133; p=0.183) or money spent on the OTC drugs (r=-0.001; p=0.995), a weak correlation was detected between the total number of drugs raken by the residents and money they spent on the OTC drugs (r=0.230; p=0.019).

Table 1. Diagnoses recorded among the nursing homes residents

Diagnosis	N	%
Essential hypertension	49	13.8
Diabetes mellitus type II	43	12.1
Insomnia	41	11.5
Depression	37	10.4
Rheumatism (not specified)	30	8.4
Angina pectoris	29	8.1
Urinary incontinence	26	7.3
Anxiety	15	4.2
Cardiac arrhythmias	13	3.7
Breast cancer	12	3.4
Epilepsy	12	3.4
COPD	11	3.1
Cerebrovascular insufficiency	8	2.2
Supraventricular tachycardia	8	2.2
Parkinson's disease	7	2.0
Chronic heart failure	7	2.0
Edema	3	0.8
Stroke	2	0.6
Lumbar syndrome	1	0.3
Fracture of thoracic vertebral body	1	0.3
Ischemic cardiomyopathy	1	0.3
Total	356	100.0

N – number of patients; COPD – chronic obstructive pulmonary disease

Table 2. Inappropriately prescribed drugs to the nursing home residents according to the Beers criteria before and after intervention

Drug	Before intervention		After intervention	
	N	%	N	%
Glibenclamide	43	12.3	1	2.7
Nifedipine	32	9.2	1	2.7
Zolpidem	33	9.5	2	5.4
Amitriptyline	20	5.7	1	2.7
Nifedipine, slow-release	15	4.3	1	2.7
Verapamil	14	4.0	2	5.4
Alprazolam	14	4.0	1	2.7
Diltiazem, slow-release	13	3.7	1	2.7
Tolterodine	13	3.7	1	2.7
Megestrol	12	3.4	2	5.4
Naproxen	12	3.4	2	5.4
Carbamazepine	12	3.4	1	2.7
Lorazepam	11	3.2	1	2.7
Digoxine	11	3.2	2	5.4
Clomipramine	11	3.2	1	2.7
Theophylline	11	3.2	1	2.7
Diclofenac	10	2.9	1	2.7
Darifenacin	10	2.9	1	2.7
Ticlopidine	9	2.6	1	2.7
Ibuprofen	7	2.0	2	5.4
Amiodarone	7	2.0	2	5.4
Maprotiline	7	2.0	2	5.4
Trihexyphenidyl	6	1.7	1	2.7
Spironolactone	5	1.4	1	2.7
Trospium chloride	3	0.9	1	2.7
Propafenone	3	0.9	1	2.7
Methyldopa	2	0.6	1	2.7
Sotalol	2	0.6	1	2.7
Terazosine	1	0.3	1	2.7
Total	349	100.0	37	100.0

N – number of patients

Table 3. Inappropriately prescribed drugs to the nursing home residents according to STOPP criteria before and after intervention

Drug	Before intervention		After intervention	
	N	%	N	%
Acetylsalicylic acid	50	71.5	13	65.0
Diazepam	4	5.7	2	10.0
Bromazepam	4	5.7	2	10.0
Lorazepam	3	4.3	1	5.0
Loperamide	2	2.9	1	5.0
Thiotropium	3	4.3	1	5.0
Aminophylline	3	4.3	0	0.0
Glibenclamide	1	1.4	0	0.0
Total	70	100.0	20	100.0

Table 4. Inappropriately omitted drugs to nursing home residents according to START criteria before and after intervention

Drug	Before intervention		After intervention	
	N	%	N	%
Ranitidine	35	24.5	16	23.8
Famotidine	16	11.2	7	10.4
Ipratropium + fenoterol	16	11.2	7	10.4
Acenokumarol	13	9.1	6	9.0
Heparin	10	6.9	5	7.5
Salbutamol	10	6.9	5	7.5
Trihexyphenidyl	9	6.3	4	6.0
Hydrotalcitum	7	4.9	5	7.5
Antacide 1	7	4.9	4	6.0
Biperiden	6	4.2	3	4.5
Antacide 2	4	2.8	2	2.9
Bromocriptine	4	2.8	1	1.5
Progesterone depo	3	2.1	1	1.5
Progesterone + estradiol	3	2.1	1	1.5
Total	143	100.0	67	100.0

There were 349 inappropriately prescribed drugs according to the Beers criteria before the intervention and only 37 drugs six months after the intervention (Table 2). The median number of inappropriately prescribed drugs according to the Beers criteria before education was 11.0 (range 1.0–43.0), and the median number after education was 1.0 (range 1.0–2.0); the difference was significant (Z=4.629; p<0.001). According to the STOPP criteria there were 70 drugs inappropriately prescribed before the intervention, and 20 drugs after 6 months (Table 3). The median number of inappropriately prescribed drugs according to the STOPP criteria before education was 3.5 (range 1.0–20.0) and the median number after education was 1.5 (range 0.0–6.0); the difference was significant (Z=2.823; p<0.005). When both criteria were taken together, there was significant difference between the average number of inappropriate drugs per patient before (3.4±0.5) and after (0.6±0.7) the educative intervention (t=38.902; p<0.001). Finally, before the intervention 143 appropriate drugs were omitted according to the START criteria, while 6 months after the intervention there were only 67 omissions (Table 4). The median number of omitted drugs according to the START criteria before education was 9.0 (range 3.0–18.0), and the median number after education was 5.0 (range 1.0–8.0); the difference was significant (Z=3.423; p<0.001).

DISCUSSION

Polypharmacy and inappropriate prescribing have been already described in nursing homes worldwide, and the necessity for more careful prescribing for this vulnerable population has been stressed-out [12, 13]. The average number of prescribed drugs per elderly person is constantly growing [14]; at the same time, prescribing for the elderly becomes increasingly complex, since the prolongation of life is associated with increase in the number of co-morbidities, and more drugs means more drug-drug and drug-disease interactions and more possible adverse effects [15, 16].

Inappropriate prescribing to the elderly is a serious public health problem, since increased rates of interactions and adverse effects lead to increased morbidity and mortality [17]. Prescription drugs that may have especially harmful consequences for elderly persons if prescribed in high doses are antihypertensives and diuretics, due to the decreased perfusion to vital organs and electrolyte abnormalities, and cardiac glycosides due to a narrow therapeutic window and arrythmogenic potential [18].

According to a study of Linjakumpu et al. [19], even 64.6% of elderly persons regularly use two or more non-steroid anti-inflammatory analgesics (NSAIDs). In our study, 28% of the nursing homes residents were taking at least one drug from this group. In the elderly, NSAIDs decrease renal perfusion which leads to hypertension and initiate gastritis; patients are then prescribed antihypertensives and antisecretory drugs in the attempt to ameliorate adverse effects of NSAIDs. This can cause polypharmacy and further complicate the care of the elderly. On the other hand, appropriately chosen and carefully titrated antihypertensive therapy considerably reduces morbidity and mortality of the elderly [20].

We noted prescription of amitriptyline in 20 patients (19%), the drug which is considered inappropriate for the elderly due to its strong anticholinergic properties [21]. Besides, even 41% of all study participants were prescribed glibenclamide, an oral antidiabetic drug from the sulphonylurea group. This type of long-acting oral antidiabetics should be avoided in the elderly due to a very high risk of hypoglycemia, as explicitly stated in the Beers criteria.

Although there are drugs which have very positive influence on health of elderly patients, like statins, ACE inhibitors, beta-adrenergic receptor blockers [22] and especially aspirin, which successfully reduces cardiovascular events [23], therapeutic regimens of the elderly should be regularly reviewed and adjusted according to major organs function and co-morbidities of patients [24]. Physicians should be familiar with specificities of prescribing to the elderly, and this could be ensured with a targeted, high-quality education. On the other hand, elderly patients are mostly aware of polypharmacy, and almost 70% of them require from their care-givers to eliminate at least one of the prescribed drugs [25]. It has been already shown that co-medication with two drugs bears 6% chances of drug–drug interactions, while co-medication with 8 drugs increases the chance of interactions to almost 100% [10]. Besides, polypharmacy in nursing homes also increases pressure to their residents to buy the OTC drugs, creating them a considerable financial burden, as demonstrated in our study.

Although various kinds of educational interventions have been tested in the past for their ability to improve prescribing to elderly nursing homes residents, the results are inconsistent and the quality of published studies is moderate [26, 27, 28]. Interventions that were shown to be at least partially effective were on-site education as a solitary measure or as a segment of intervention package and medication review performed by hospital pharmacist [27]. However, the majority of studies implemented a multifaceted educational intervention, and some of them demonstrated improvement. Good example of such an intervention was shown in a study from Sweden, where the combination of small group educational sessions with nurses and physicians, feedback on prescribing, presentation of guidelines and written materials used in 46 nursing homes led to a decrease in the unnecessary utilization of antibiotics for 12.4% [29]. In spite of promising results from certain studies, the overall picture is still unclear, and specific recommendations cannot be offered [26, 27, 28]. Our study was designed to shed some more light on this problem by educating physician about specific criteria for appropriate prescribing to elderly nursing homes residents.

Educating caring physicians of elderly patients about the Beers and STOPP/START criteria of appropriate prescribing is a very important measure, since experienced doctors are sometimes skeptical towards guidelines in general and doubt their practical usefulness [30]. Duration of stay in a nursing home and the number of prescribed drugs are usually correlated with the number of inappropriately prescribed drugs [31, 32], although in our study we could not demonstrate this correlation (probably due to a relatively small number of study participants, which is the main limitation of our study). Regular educational sessions with physicians in charge of medical care of nursing homes' residents could change some obsolete prescribing habits and reduce risks associated with polypharmacy. Our undertaken educational intervention was simple, cheap and easy to perform, and it resulted in a significant improvement according to all three criteria.

CONCLUSION

Our study has confirmed that elderly patients in nursing homes are exposed to polypharmacy, which increases the risk of inappropriate prescribing, adverse drug reactions and higher treatment costs. Simple, but well-targeted educational interventions may improve such a situation, contributing to a better care of elderly patients in nursing homes.

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Утицај образовне интервенције на преписивање неодговарајућих лекова штићеницима установа за збрињавање старих лица

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КРАТАК САДРЖАЈ

Увод Проблеми с политерапијом, нежељене реакције на лекове и непридржавање режима лечења су нарочито чести код старијих штићеника старачких домова.

Циљ рада Циљ истраживања је био да се процени ефикасност специфичног облика образовања кадрова на целисходност преписивања лекова штићеницима домова за стара лица.

Методе рада Током студије испитана ја целисходност преписивања лекова у домовима за збрињавање старих лица пре извођења образовне интервенције и после ње. Из укупно 20 београдских старачких домова у студију су укључене 104 старе особе и 27 ординирајућих лекара. Адекватност преписивања лекова је проверена на основу критеријума *Beers*, *START* и *STOPP* пре едукације, као и шест месеци након интервенције.

Резултати Укупно је било 349 непримерено преписаних лекова према критеријумима *Beers* пре интервенције и 37 лекова шест месеци после интервенције. Према критеријумима *STOPP*, било је 70 лекова непримерено преписаних пре интервенције и 20 лекова шест месеци након ње. Када су оба критеријума узета заједно, утврђена је значајна разлика између просечних бројева неодговарајућих лекова по болеснику пре (3,4±0,5) и после (0,6±0,7) образовне интервенције (*t*=38,902; *p*<0,001). Коначно, пре интервенције 143 одговарајућа лека изостављена су према критеријумима *START*, док је шест месеци након интервенције било само 67 пропуста.

Закључак Једноставна, али добро циљана образовна интервенција може побољшати политерапију и смањити стопу неприкладног преписивања лекова, те допринети бољој бризи о старијим штићеницима у домовима.

Кључне речи: старе особе; домови за негу; неприкладно преписивање; образовање; политерапија