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EVALUATION OF POLYPHARMACY AND INAPPROPRIATE MEDICATION USE IN PATIENTS RECEIVING HOME HEALTH CARE SERVICES: A CROSS-SECTIONAL STUDY

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Abstract

Objectives: Polypharmacy is an important condition that causes adverse outcomes such as drug-drug interactions, falls, increased hospitalizations and mortality. In our study, we aimed to evaluate polypharmacy and inappropriate medication use according to two different criteria in home care patients.

Materials and Methods: Our observational and cross-sectional, single-center study included all patients who receive home health care service from our unit and agree to participate. A face-to-face information form was carried out to measure the patients' socio-demographic characteristics, drug use, and level of knowledge about the use of drugs. Inappropriate medication use was evaluated using Beers and STOPP criteria.

Results: 179 individuals, most of whom were female (n=124; 69.2%), participated in this study. The mean age was 83,54 ± 7.53. The mean number of chronic diseases was 2.14. The average number of drugs was 5.80 ± 3.18. There was a relationship between polypharmacy and high education level and being married (p=0.005; p=0.007). There was a statistically significant relationship between the number of chronic diseases and the number of drugs used (p>0.001). Inappropriate medication use was present in 66 (36.8%) patients and the most frequently used inappropriate drugs were antipsychotics (n=38; 21.2%) according to Beers criteria. According to the STOPP criteria, inappropriate medication use was present in 33 (18.4%) patients, and the most common inappropriate drug use was NSAIDs (n=5; 2.7%).

Conclusion: Rates of polypharmacy and inappropriate medication use according to both criteria were found to be high. Physicians should plan the drugs used in this group carefully.

Keywords: Polypharmacy, potentially inappropriate medication, home care service.

Introduction

Home health care (HHC) service is defined as offering health care and follow-up services to patients in a home setting where they live with their families to meet their medical needs including rehabilitation, physiotherapy, and psychological treatment, in line with the recommendations of physicians.[1]

HHC recipients, nursing home residents, and hospitalized individuals are more likely to be ill, have more chronic diseases, and are therefore more exposed to increased drug use.[2]

Although many studies have been carried out on polypharmacy, which is defined as "multiple drug use", there is no consensus on its scientific definition. However, the most commonly used definition of polypharmacy is the use of five or more drugs.[3]

When we look at the rates of polypharmacy; studies that resulted in 64.7% in Brazil and 52.3% in Japan were reported.[4-5]In a study covering seven European countries (Czech Republic, England, Finland, France, Germany, Italy, Netherlands) and Israel, the rate of polypharmacy was reported as 49.7%.[6]Polypharmacy causes adverse consequences such as mortality, falls, fractures, adverse drug reactions, drug-drug interactions, prolonged hospital stay and re-hospitalization immediately after discharge. Drug interactions are an important problem for elderly patients. Drugs that may cause problems for elderly patients are grouped under the heading of “potentially inappropriate medication (PIM)”. So scanning medicine about PIM is important for polypharmacy patients. Various scanning tools have been developed to help identify PIMs.[7] The most commonly used one is the Beers criteria, which was first developed by the American Geriatrics Society in 1991.[8] Despite its widespread use, the Beers criteria were found to be inadequate due to its limitations, such as including drug lists that are not available in countries other than the United States of America. To eliminate these deficiencies, STOPP criteria were developed and put into use in Ireland in 2008.[9] Both groups of criteria maintain their reliability by being updated for reasons such as new studies in the medical world, new developments, and the addition of newly licensed drugs.

In our study, we aimed to take a holistic approach to HHC patients by examining the frequency of polypharmacy, sociodemographic characteristics that may influence polypharmacy (such as marital status, dependents, etc.), and other external factors in detail, and to compare PIM use according to both criteria in this patient group.

Materials and Methods

Study universe and sample

This study was conducted between 15/09/2019 and 15/11/2019 in the Recep Tayyip Erdoğan University Faculty of Medicine, Department of Family Medicine, Home Health Care Unit. Our study is single-center, observational, and cross-sectional. Between these dates, the number of people affiliated to our unit was 352 and our sample size was 179. G power was calculated as 5.2 with 95% confidence.

Home health care (HHC) services in Türkiye are provided by HHC units. These units consist of at least one responsible physician (general practitioner or specialist physician) and two assistant health personnel. Patients who need HHC services apply to the HHC units by calling them directly. These units register the patients who will receive service and organize the visit program. Arranging the treatment plans and medications of the patients is the duty of the responsible physician of the HHC services unit. In addition, patients are also followed up by specialist doctors for various diseases.

The study was initiated by obtaining verbal consent from the patient/patient relatives who received service from our unit and agreed to participate in the study. Interviews were completed with the person responsible for the care of the patients who could not answer the questions for various reasons (dementia, hearing problems, etc.) during the study. In the study, an information inquiry form with 37 questions was used to measure the sociodemographic characteristics, drug use status, chronic diseases, knowledge level of the patients, and who their caregivers are. In the evaluation of the caregiver, groupings were made as family members (parent, children), non-family relatives, and paid private caregivers. Then, all drugs used by the patients were noted, and the presence of polypharmacy and PIM use were examined. Patients under the age of 65 were not included in our study.

The study was approved by the Recep Tayyip Erdoğan University Faculty of Medicine, Non-Invasive Clinical Research Ethics Committee, on 09/09/2019 with the decision number 2019/121.

Data collection tools

In this study, the use of five or more drugs was considered polypharmacy. Beers (2012) and STOPP criteria were used in the assessment of PIM.

Beers Criteria (2012):

It was created in 1991 by Dr. Mark Beers and colleagues based on the result of a nursing home study to identify criteria for inappropriate drug use in the elderly [8]. The expert committee established by the American Geriatrics Association (AGS) in 2012 defined the "2012 AGS Beers Criteria". The final update of the AGS expert committee involved 53 medications or medication classes, which are divided into three categories: "potentially inappropriate medications", "potentially inappropriate medications due to drug-disease or drug-syndrome interactions", and "potentially inappropriate medications to be used with caution".[10]

STOPP Criteria (Screening Tool of Older Persons' Potentially Inappropriate Prescriptions):

Due to the deficiencies in the Beers criteria and the incompatibility of these criteria with the nature of drug use in European countries, alternative criteria were needed. Therefore, a committee was established by Gallagher P. et al. in 2008, and STOPP criteria were constituted.[9]

STOPP and START (Screening Tool to Alert to Right Treatment) criteria were updated in 2015. The final list encompasses 81 STOPP criteria of potentially inappropriate medications in the elderly, and 34 START criteria of PIMs that should be used frequently in the elderly but may not be used.11 A descriptive analysis of the results for each criterion was performed by not only determining the number of subjects with PIM identified by each tool but also measuring the number of inappropriateness criteria identified in each patient.

Statistical analyses

All statistical analyses were carried out using SPSS statistical software version 22.0 [IBM Corp released 2012. IBM SPSS Statistics for Windows, IBM Corp, Armonk, NY]. Descriptive statistics of evaluation results are given as numbers and percentages for categorical variables, and mean, standard deviation, minimum, and maximum for numerical variables. If there was a normal distribution, the student-t test was performed to compare numerical variables between two independent groups, otherwise the Mann-Whitney U-test was used. If difference scores are normally distributed, comparisons of numerical variables between dependent groups were done using the Paired-T test, otherwise, the Wilcoxon test was used. Pearson Correlation Analysis was performed when the parametric test condition was met for relationships between numerical variables, and otherwise, Spearman Correlation Analysis was used. A statistical significance level of alpha was considered as $p < 0.05$.

Results

Evaluation of the relationship between polypharmacy and sociodemographic data of the participants

Of the 179 people included in the study 69.2% (n=124) were female. The mean age was 83.5 ± 7.5 years. The oldest age was 104 years. The mean value of the number of chronic diseases was 2.14 and the median value was 2. The most common chronic disease was hypertension (n=111; 62.0%). The distribution of the most common chronic diseases is shown in Figure 1.

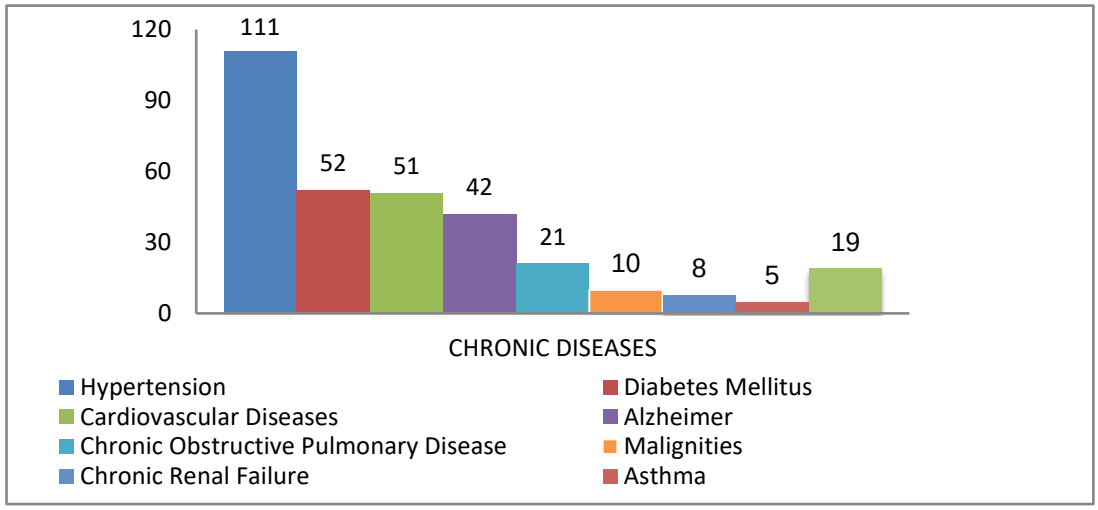

Figure 1. Distribution of common chronic diseases (n)

The relationship between sociodemographic characteristics and polypharmacy is given in detail in Table 1. There was no relationship between age and polypharmacy (p=0.110). We found a relationship between having a high education level and being married and polypharmacy (p=0.005; p=0.007). In addition, as the number of chronic diseases of the participants increased, the number of drugs they used increased, and this relationship was statistically significant (p<0.001). The rate of polypharmacy, which was 52.6% in patients with up to 2 chronic conditions, increased to 84.1% in those with at least 3 chronic conditions. When the diseases were examined separately, a significant relationship was found only with diabetes mellitus, hypertension, and ischemic heart disease (p=0.002; p=0.008; p=0.010).

Table 1. Evaluation of the relationship between polypharmacy and sociodemographic data of the participants

		Polypharmacy According to the Number of Drugs Used				
		No		Yes		
		n	%	n	%	p
Gender	Female	49	39,5%	75	60,4%	0,181
	Male	16	29,0%	39	71,0%	
Age	65-84	29	30,9%	65	69,1%	0,110
	≥85	36	42,4%	49	57,6%	
Education Status	Illiterate	27	52,9%	24	47,1%	0,005
	Up to High school	36	31,9%	77	68,1%	
	High School and above	2	13,3%	13	86,7%	
Marital status	Married	16	23,9%	51	76,1%	0,007
	Single	49	43,8%	63	56,3%	
Care Provider	Family	35	34,6%	66	65,4%	0,412
	Private Caregiver	17	33,3%	34	66,6%	
	Other (Non-family relatives)	13	48,1%	14	51,9%	
Number of Chronic Diseases	≤2	55	47,4%	61	52,6%	0,000
	≥3	10	15,9%	53	84,1%	

Evaluation of the relationship between polypharmacy and drug use of the participants

The average number of drugs used by the patients was 5.80 ± 3.18. Polypharmacy was observed in 114 (63.6%) patients. 52.5% (n=94) of the patients were using 5-9, 36.3% (n=65) 0-4, and 11.2% (n=20) 10 and more drugs. Medications of the patients were mostly prepared (59.2%; n=106) and given (69.3%; n=124) by the caregiver. The majority were taking their medication regularly (89.9%; n = 161). Most of the patients could recognize their medication (76.5%; n=137) and were aware of how much to take (73.2%; n=131), and side effects (64.2%; n=115). In 45.8% of the patients (n=82), it was observed that their medications weren't revised by any physician for 1 year or more. Most of the patients (69.3%; n=124) were taking their medication with the help of someone else. There were 18 patients (10.1%) who stated that they didn't take their medication regularly. 20 (11,1%) patients were using medication without the physician's recommendation. It was seen that individuals without polypharmacy tend to take their medication more regularly (p=0.021). The evaluation of the relationship between the drug use status of the participants and polypharmacy is given in Table 2.

22.9% (n=41) of the patients were taking additional vitamin/mineral supplements and most of them (85.3%; n=35) were recommended by the physician. Again, most of the vitamin users (82.9%; n=34) had polypharmacy and this was statistically significant (p=0.004). There were 52 (29.1%) people using herbal products. Most of these patients had polypharmacy (67.3%; n=35), but there was no statistically significant difference (p≥0.05).

Table 2. Evaluation of the relationship between polypharmacy and drug use of the participants

		Polypharmacy According to the Number of Drugs Used				p
		No		Yes		
		n	%	n	%	
Who Prepares the Medicines?	Patient	9	31,0%	20	69,0%	0,705
	Care Provider	41	38,7%	65	61,3%	
	Other (pharmacy etc.)	15	34,1%	29	65,9%	
How does the patient take the drugs?	Patient	17	30,9%	38	69,1%	0,317
	With the help of a care	48	38,7%	76	61,3%	
Do the patients take the drugs regularly?	Yes	54	33,5%	107	66,5%	0,021
	No	11	61,1%	7	38,9%	
Does the patient recognize the drugs used?	Yes	47	34,3%	90	65,7%	0,313
	No	18	42,9%	24	57,1%	
Does the patient know how much medicine to take?	Yes	45	34,4%	86	65,6%	0,367
	No	20	41,7%	28	58,3%	
Does the patient know the side effects of medications?	Yes	43	37,4%	72	62,6%	0,688
	No	22	34,4%	42	65,6%	
Time elapsed since the last date drugs were revised	3 months and below	24	29,6%	57	70,4%	0,151
	3 months - 1 year	5	31,3%	11	68,8%	
	1 year and above	36	43,9%	46	56,1%	
Warfarin Sodium Use	Yes	13	31,0%	29	69,0%	0,409
	No	52	38,0%	85	62,0%	
Use of Vitamins and Minerals	Yes	7	17,1%	34	82,9%	0,004
	No	58	42,0%	80	58,0%	
Herbal Product Use	Yes	17	32,7%	35	67,3%	0,519
	No	48	37,8%	79	62,2%	

Evaluation of Inappropriate Medication Use

We examined PIM use in our patients according to Beers and STOPP criteria. PIM use and the list of breached criteria are given in Figure 2. 66 (36.8%) patients had PIM use according to Beers criteria, and there were 93 instances of PIM in total (Figure 2). The most frequently used PIM according to Beers criteria were antipsychotics (n=38; 21.2%) (Table 3).

Table 3. Beers criteria-distribution by inappropriate drugs

A- Drug Groups	**Inappropriate Drug**	**Number of Patients (n)**	**Patient Percentage (%)**
Anticholinergic Drugs	First generation antihistamines	3	1,6
Cardiovascular Drugs	Alpha 1 Blockers	8	4,4
	Anti-arrhythmic Drugs	2	1,1
	Nifedipine	7	3,9
	Spironolactone	5	2,7
Central Nervous System Drugs	Tertiary tricyclic antidepressants	2	1,1
	Antipsychotics	38	21,2
Pain medications	Non-steroidal anti-inflammatory drugs (NSAID)	10	5,5
B- Disease or Syndrome	**Inappropriate Drug**	**Number of Patients (n)**	**Patient Percentage (%)**
Heart failure	Cilostazol	1	0,5
Dementia and cognitive impairment	Antipsychotics	17	9,4

The STOPP criteria identified 33 (18.4%) patients with PIM use, and 42 instances of PIM use were determined in total (Figure 2). The most common PIM use based on the STOPP criteria was the use of NSAID and antiplatelet therapy in combination without PPI prophylaxis (n=5; 2.7%). Instances of PIM use defined by STOPP criteria are detailed in Table 4.

In the use of PIM, violations were observed more frequently according to Beers criteria compared to STOPP criteria (Figure 2).

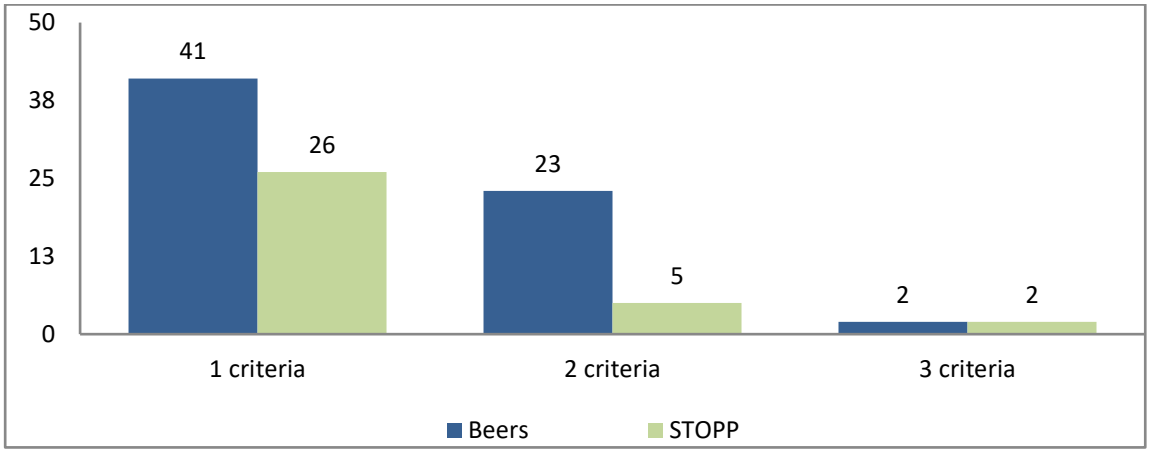

Figure 2. Instances of inappropriate medication use and breached criteria (n)

Table 4. List of Breached Criteria According to STOPP Criteria

Criterion	Medicine	Number of Patients (n)	Patient Percentage (%)
Cardiovascular System Criteria	Use of beta blockers and verapamil/ diltiazem	4	2,2
	Loop diuretic use as the first-line HT treatment	3	1,6
	Use of thiazide in those with a history of gout	2	1,1
	Use of diuretics for HT in those with urinary	1	0,5
Antiplatelet / Anticoagulant Drugs	Use of NSAID and vitamin K antagonists in combination	1	0,5
	NSAID with concurrent antiplatelet agent(s)	5	2,7
Central Nervous System and Psychotropic Drugs	TCA is used as a first-line antidepressant treatment	1	0,5
	Neuroleptic use in dementia patients	2	1,1
	Use of first-generation antihistamines	3	1,6
Renal System Criteria	NSAID use in patients with glomerular filtration rate <50 ml/min/1.73 m2	4	2,2
Gastrointestinal System Criteria	Use of verapamil in chronic constipation	2	1,1
Respiratory System Criteria	Theophylline alone in Chronic Obstructive Pulmonary Disease	2	1,1
	Non-selective beta-blocker use in patients with asthma	3	1,6
Musculoskeletal System Criteria	Use of NSAIDs in patients with severe Hypertension or Heart Failure	1	0,5
Endocrine System Criteria	Use of glimepiride in patients with Type-2 Diabetes Mellitus	4	2,2
Analgesic Drugs	Opiate use in the first-line treatment of mild pain	2	1,1
Antimuscarinic/Anticholinergic Drug Burden	Concurrent use of two or more anticholinergic/antimuscarinic drugs	2	1,1

Discussion

In our study, the rate of patients using 5 or more drugs was 63.6%. In the study of patient groups aged 65 years and older conducted by S. Giovanini et al., the rate of patients using 5 or more drugs was 62.1% and Hamano and Tokuda found the rate of patients using 6 or more drugs to be 60.7%.[12-13]

In the literature, we see that different results were obtained in different studies in terms of gender. While the rate of polypharmacy was higher in women in the study of Onder *et al.*[6], it was higher in men in the study by Komiya *et al.*.[5] In our study, the rates were close to each other and weren't statistically significant.

In their study, Ramos LR et al. found that polypharmacy was higher in the group with a higher education level.[14] In our study, the rate of polypharmacy was the highest in the group with a high education level, and this difference was statistically significant. When marital status was examined, in the study by Komiya et al., the rate of polypharmacy was higher in those who were married, similar to our study.[5] In our study, it was observed that being married and having a high education level had a negative effect in terms of polypharmacy, but it would be appropriate to support this outcome with studies with a larger sample size. As the education level increases, the health awareness, expectations, and demands of individuals increase. This may be the reason why this group benefits from health services more, and it may also lead to increased use of supplements by these individuals.[15] Indeed, in our study, similar to that of J. Peklar et al., the rate of polypharmacy was significantly higher in those who use vitamin supplements.[16]

The rate of polypharmacy was also higher in patients with a high number of chronic diseases in our study and in the literature[6, 12] As in our study, chronic diseases increase the risk of polypharmacy since chronic diseases are conditions that require regular, ongoing, and sometimes use of several medications in combination.

In the literature, the distribution of rates of PIM according to Beers and STOPP criteria varies. In a study conducted in Spain, PIM rates identified by Beers/STOPP were 22.9% and 38.5%, and in a Nigerian study, these values were 30.3% and 15.7%.[17-18] In an Indian-based study PIM rates by Beers/STOPP were 27.73% and 48.71%.[19] And in a Brazil study, these rates were 51.8% and 33.8%.[4] In our study, PIM rates identified by the Beers/STOPP were 36.8% and 18.4%. We think that clinical practices vary from country to country and differences between patient groups selected in studies affect PIM rates.

The Beers criteria cover a broader range of drugs that may lead to higher PIM rates than the STOPP criteria. Recent studies have highlighted that STOPP criteria may be more effective in identifying clinically significant adverse drug events compared to Beers criteria, particularly in European settings. This suggests that STOPP

criteria could offer a more tailored approach for assessing PIMs in Turkish populations, potentially leading to more accurate and relevant findings.[20,21]

While the most frequently used PIMs were antipsychotics according to Beers criteria (n = 38; 21.2%), STOPP criteria identified NSAIDs as the most common PIM (n: 5; 2.7%). In a study conducted in China, the most common PIM was benzodiazepines with 34.4% according to Beers, and calcium channel blockers used in chronic constipation with 18.5% according to STOPP.[22] In the study of Amelia Ubeda et al., the most frequently used PIM was long-acting benzodiazepine according to Beers (33.3%), while it was long-acting neuroleptic use according to STOPP.[23] The most common PIM was NSAIDs (diclofenac) by Beers (40.9%) and furosemide by STOPP (23.6%) in the study by Akande-Sholabi *et al.*.[24]Again, the differences in practices and patient groups between countries are also reflected in these results. The fact that the patient group we examined in our study consisted of patients who had difficulties in admission to the hospital, and received HHC services and that we didn't exclude them according to their cognitive functions influenced these results. The higher incidence of Alzheimer's disease (23.4%) in our study compared to the normal geriatric patient population (8%) is an indicator of this difference.[25] In addition to memory loss, behavioral changes, and psychiatric symptoms are observed in Alzheimer's patients and these should also be controlled.[26] Due to both old age and Alzheimer's as well as due to the dependence on living at home, our patients' need for psychiatric treatment increased, and therefore the rate of antipsychotic drug use may have been high. The data in Turkiye show that the rate of prescription NSAIDs is over 30% in patients over 65 years of age.[27] Apart from the side effects of NSAIDs, their interactions with other drugs are also important. Thus, as in all patients, patients who receive HHC services should be evaluated with a holistic approach and their treatment should be carefully planned.

The rate of polypharmacy has also been found to be high in HHC patients. The most frequently used PIM in our study were antipsychotics according to Beers criteria and NSAIDs according to STOPP criteria. The study shows that the two different PIM criteria yield different results in HHC patients aged 65 and over. Since the STOPP criteria cover a more specific group of medications and are more suitable for the European healthcare system, the use of STOPP criteria may be a more appropriate approach for our country. However, considering the advantages of both criteria, using both criteria together could be beneficial for patient safety and treatment quality. Future studies applying the STOPP criteria to larger patient groups in our country may provide more accurate data.

HHC patients are a vulnerable group of patients who are mostly elderly and need special care. PIM use should be considered while prescribing drugs in this patient group. It would be beneficial to develop warning systems and mobile applications that can be used in daily practice in the follow-up of HHC patients and outpatient clinics.

In addition, the majority of patients receiving HHC services take their medications with the help of their caregivers and a significant portion of them are not aware of drug side effects. Educating patients and caregivers about medications and their side effects will improve the quality of care and treatment for these patients. Online maintenance courses can be arranged for this.

Limitations of the study

Differences in social behavior and differences arising from the payment of the insurance system may have affected the results of our study.

Although our study is limited due to its single-center nature, we think that it'll shed light on future studies in terms of revealing the situation of HHC patients regarding polypharmacy, PIM use, and drug use practices.

Ethical Considerations: The study was approved by the Recep Tayyip Erdoğan University Faculty of Medicine, Non-Invasive Clinical Research Ethics Committee, on 09/09/2019 with the decision number 2019/121.

Conflict of Interest: The authors declare no conflict of interest.

References

1. Karakaş N, Bentli R, Firinci B, Zabci B. Investigation of the relationship between depression and nutritional status of elderly patients in homecare. J SurgMed. 2019;3(12):829-32
2. Fog, A., Mdala, I., Engedal, K., & Straand, J. Variation between nursing homes in drug use and in drug-related problems. *BMC Geriatrics*. 2020:20;336. https://doi.org/10.1186/s12877-020-01745-y.
3. Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. BMC Geriatr. 2017;17(1):230. doi:10.1186/s12877-017-0621-2
4. Oliveira MG, Amorim WW, de Jesus SR, et al. A comparison of the Beers and STOPP criteria for identifying the use of potentially inappropriate medications among elderly patients in primary care. J Eval Clin Pract. 2015;21(2):320-5. doi:10.1111/jep.12319
5. Komiya H, Umegaki H, Asai A, et al. Factors associated with polypharmacy in elderly home-care patients. Geriatr Gerontol Int. 2018;18(1):33-41. doi:10.1111/ggi.13132
6. Onder G, Liperoti R, Fialova D, et al. Polypharmacy in nursing home in Europe: results from the SHELTER study. J Gerontol A Biol Sci Med Sci. 2012;67(6):698-704. doi:10.1093/gerona/glr233
7. Demircan, C., Hasanzade, U., Tatar, M., & Büyükuysal, M. (2023). Evaluating Potentially Inappropriate Medications in the Elderly with Seven Different Screening Tools. *Turk J Geriatr*. 2023; 26(4):413−23. https://doi.org/10.29400/tjgeri.2023.369.
8. Beers MH, Ouslander JG, Rollingher I, Reuben DB, Brooks J, Beck JC. Explicit criteria for determining inappropriate medication use in nursing home residents. Arch Intern Med. 1991;151(9):1825-32. PMID:1888249
9. Gallagher P, O'Mahony D. STOPP (ScreeningTool of OlderPersons' potentially inappropriate Prescriptions): application to acutely ill elderly patients and comparison with Beers' criteria. Age Ageing. 2008;37(6):673-9. doi:10.1093/ageing/afn197
10. Campanelli CM. American Geriatrics Society updated beers criteria for potentially inappropriate medication use in older adults: the American Geriatrics Society 2012 Beers Criteria Update Expert Panel. J Am Geriatr Soc. 2012;60(4):616. doi:10.1111/j.1532-5415.2012.03923.x
11. O'Mahony D, O'Sullivan D, Byrne S, et al. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. Age Ageing. 2015;44(2):213-18. doi:10.1093/ageing/afu145
12. Giovannini S, van der Roest HG, Carfì A, et al. Polypharmacy in homecare in Europe: cross-sectional data from the IBenC study. Drugs Aging. 2018;35(2):145-52. doi:10.1007/s40266-018-0521-y
13. Hamano J, Tokuda Y. Inappropriate prescribing among elderly homecare patients in Japan: prevalence and risk factors. J Prim Care Community Health. 2014;5(2):90-6. doi:10.1177/2150131913518346
14. Ramos LR, Tavares NUL, Bertoldi AD, et al. Polypharmacy and Polymorbidity in Older Adults in Brazil: a public health challenge. Rev Saude Publica. 2016;50:9s. doi:10.1590/S1518-8787.2016050006145

15. Şayir ÇT, Toprak DE, Karaoğlu SA. Evaluation of polypharmacy and complementary therapy use in patients ≥ 65 years, attending to Family Medicine Outpatient Clinic of Şişli Etfal Training and Research Hospital. Turk J FamPract. 2014;18(1):35-41. doi:10.2399/tahd.14.35220
16. Peklar J, Henman MC, Kos M, Richardson K, Kenny RA. Concurrent use of drugs and supplements in a community-dwelling population aged 50 years or more: potential benefits and risks. Drugs Aging. 2014;31(7):527-40. doi:10.1007/s40266-014-0180-6
17. Hudhra K, García-Caballos M, Jucja B, et al. Frequency of potentially inappropriate prescriptions in older people at discharge according to Beers and STOPP criteria. Int J Clin Pharm. 2014;36(3):596-603. doi:10.1007/s11096-014-9943-8
18. Fadare JO, Desalu OO, Obimakinde AM, et al. Prevalence of inappropriate medication prescription in the elderly in Nigeria: A comparison of Beersand STOPP criteria. IntJ Risk Saf Med. 2015;27(4):177-89. doi:10.3233/JRS-150660
19. Keche, Y., Gaikwad, N., Wasnik, P., Siddiqui, S., Nagpure, K., & Dhaneria, S. Usefulness of STOPP/START criteria and Beers criteria for prescribing in geriatric patients in a tertiary health care center, Raipur, Central India. *J Fam Med Prim Care.* 2022:11;7064 -71. https://doi.org/10.4103/jfmpc.jfmpc_733_22.
20. Falemban A H. Medication-Related Problems and Their Intervention in the Geriatric Population: A Review of the Literature. Cureus. 2023:15(9): e44594. DOI 10.7759/cureus.44594
21. Perpétuo C, Plácido AI, Rodrigues D, Aperta J, Piñeiro-Lamas M, Figueiras A, Herdeiro MT and Roque F. Prescription of Potentially Inappropriate Medication in Older Inpatients of an Internal Medicine Ward: Concordance and Overlap Among the EU(7)-PIM List and Beers and STOPP Criteria. Front. Pharmacol. 2021:12;676020. doi: 10.3389/fphar.2021.676020
22. Li H, Pu S, Liu Q, et al. Potentially inappropriate medications in Chinese older adults: The Beers criteria compared with the screening tool of older persons' prescriptions criteria. Geriatr GerontolInt. 2017;17(11):1951-8. doi:10.1111/ggi.12999
23. Ubeda A, Ferrándiz L, Maicas N, et al. Potentially inappropriate prescribing in institutionalised older patients in Spain: the STOPP-START criteria compared with the Beers criteria. PharmPract (Granada). 2012;10(2):83. doi:10.4321/s1886-36552012000200004
24. Akande-Sholabi, W., Ajilore, O., Showande, S., & Adebusoye, L. Potential inappropriate prescribing among ambulatory elderly patients in a geriatric centre in southwestern Nigeria: Beers criteria versus STOPP/START criteria. *Trop J Pharm Res*. 2020:19;1105-11. https://doi.org/10.4314/tjpr.v19i5.29.
25. Turkish Neurological Society. Alzheimer's Disease. Available at: https://www.noroloji.org.tr/menu/94/alzheimer-hastaligi. Accessed July 12, 2024.
26. Teixeira, A., Rocha, N., & Gatchel, J. Behavioral or neuropsychiatric symptoms of Alzheimer's disease: from psychopathology to pharmacological management. *Arq Neuropsiquiatr*. 2023: 81:1152 – 62. https://doi.org/10.1055/s-0043-1777774.

27. Baspınar MM, Basat O. Evaluation of the rational analgesic use in elderly adults: A cross-sectional study. Pak J Med Sci. 2020;36(5):1063-8. doi:10.12669/pjms.36.5.2331