ORIGINAL ARTICLE

Assessment of the Appropriateness of Prescriptions in a Geriatric Outpatient Clinic

Geriatri Polikliniğinde Reçete Uygunluğunun Değerlendirilmesi

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ABSTRACT

Objectives: Appropriateness of the geriatric outpatients' medications needs special attention due to risks of falls, fractures, depression, hospital admissions and mortality. This study aimed to identify current practice on medication usage by using the 2nd version of "Screening Tool of Older People's Potentially Inappropriate Prescriptions" and "Screening Tool to Alert Doctors to Right Treatment" criteria and affecting factors for the Turkish population.

Materials and Methods: This cross-sectional study was conducted between September 2015 and May 2016 at a university research and training hospital's geriatric outpatient clinic. Patients aged ≥65 years and had ≥5 different prescribed medications (considered as polypharmacy) were recruited. The main outcome measure was the frequency of inappropriate medications identified by clinical pharmacist in the outpatient clinic according to the 2nd version of the criterion sets.

Results: A total of 700 patients (440 female) were included in this study. According to the results, 316 patients (45.1%) with at least one potentially inappropriate medication and 668 patients (98.3%) with at least one potential prescription omission were detected. Potentially inappropriate medications were associated with the number of medications used per patient [odds ratio (OR): 1.20 $p<0.001$], living alone (OR: 4.12 $p=0.02$), and having congestive heart failure (OR: 2.41 $p<0.001$). Twenty-two (27.5%) out of 80 criteria and 4 (11.8%) out of 34 criteria did not apply to the study population.

Conclusion: Detecting inappropriate medications to maintain treatment effectiveness is necessary to provide the optimum therapy. Despite the awareness of polypharmacy in outpatient clinics it is still one of the important causes of inappropriate prescription followed by vaccination rate. Therefore, with the contribution of clinical pharmacist using these available criteria is important, moreover modification of these criteria according to the local needs to be considered to achieve better outcomes.

Key words: Clinical pharmacist, older adults, outpatients, polypharmacy, STOPP/START criteria

ÖZ

Amaç: Geriatri polikliniğinde reçete uygunluğu düşme, kırık, depresyon, hastaneye yatış ve mortalite riskini artırdığı için dikkat edilmesi gereken önemli bir konudur. Bu çalışmanın amacı STOPP/START kriterlerinin 2. versiyonu kullanılarak geriatri polikliniğindeki reçete uygunsuzluklarının ve uygunsuzluğu etkileyen faktörlerin belirlenmesidir.

Gereç ve Yöntemler: Bu çalışma kesitsel olarak Eylül 2015 ve Mayıs 2016 tarihleri arasında bir eğitim ve araştırma hastanesinin geriatri polikliniğinde yürütülmüştür. Çalışmaya ≥65 yaşında ve ≥5 ilaç (polifarmasi) kullanımı olan hastalar dahil edilmiştir. Bir klinik eczacı tarafından uygulanan STOPP/START kriterlerinin 2. versiyonuna göre uygunsuz ilaçların tespit edilmesi birincil çıktı olarak belirlenmiştir.

Bulgular: Toplamda 700 hasta (440 kadın) çalışmaya dahil edilmiştir. Dahil edilen hastaların 316'sının (%45,1) durdurulması gereken ve 668'inin (%98,3) ihmal edilmiş en az bir uygunsuz ilacı bulunduğu tespit edilmiştir. Uygunsuz ilaçların bulunması durumu; kullanılan ilaç sayısı [odds oranı (OR): 1,20 $p<0,001$), hastaların yalnız yaşaması (OR: 4,12 $p=0,02$) ve konjestif kalp yetmezliği tanısı (OR: 2,41 $p<0,001$) ile ilişkili bulunmuştur. STOPP kriterinden 80 kriterin 22'si (%27,5) ve START kriterinden 34 kriterin 4'ü (%11,8) çalışma süresince herhangi bir hastaya uygulanamamıştır.

Sonuç: Hastalar için en uygun ve etkili ilaç tedavisinin sağlanabilmesi amacıyla ilaç uygunsuzluklarının tespit edilmesi önem taşımaktadır. Poliklinikte polifarmasi hakkında farkındalık yüksek olmasına rağmen uygunsuz reçetelemenin başlıca nedenlerinden biri olmaya devam etmektedir, bunu aşılanma oranı takip etmektedir. Klinik eczacının katkısı ile mevcut kriterlerin kullanımı, ek olarak mevcut kriterlerin popülasyona uygun hale getirilmesi ya da yerel kriterlerin geliştirilmesi önem taşımaktadır.

Anahtar kelimeler: Klinik eczacılık, yaşlı hastalar, poliklinik, polifarmasi, STOPP/START kriterleri

INTRODUCTION

During the aging process, pharmacokinetic and pharmacodynamic parameters (such as muscle and liver mass, cardiac blood circulation, total body fluid) also change concomitantly with physical, cognitive and psychomotor characteristics and can alter therapeutic response to medications in older adults.[1,2] It is well-known that the incidence of geriatric syndromes increases gradually[3] along with the presence of chronic diseases leading to polypharmacy.

According to the Turkish Statistics Institute, older adult population in Turkey expanded 21.9% during the last five years and reached 9.1% in 2019, having the 66th rank among 167 countries in the list of countries with older adult population.[4] An increase in the older adult population brings up several concerns such as special care needs and increased medication use. It was determined that 30% of prescribed drugs in Turkey was issued for older adult patients.[5]

Increased medication use leads to polypharmacy, which defined as the use of multiple medications for multiple indications. Different cut-offs for polypharmacy was mentioned such as using ≥3 medications, ≥5 medications or 7-10 medications, however 3 concurrent use of medications might increase adverse effects and deteriorate physical health.[6]

Polypharmacy, due to an increased amount of indications or presence of potentially inappropriate medications (PIM) and potential prescription omissions (PPO), generates risks of falls, fractures, depression, mortality and hospital admissions.[7] There have been some explicit and implicit criteria developed to determine PIMs and PPOs such as Beers criteria[8] or Turkish inappropriate medication use in elderly (TIME) criterion set.[9] Due to TIME criterion set has an ongoing validation process, its usage is limited.[9] Among the available explicit criteria, Screening Tool of Older People's Potentially Inappropriate Prescriptions (STOPP) and Screening Tool to Alert Doctors to Right Treatment (START) are prominent due to their ease of use, wide coverage (includes most of drug related conditions) and clinicians' preferences in Europe. According to the new studies and emerging evidence, updated criteria were released in 2015.[10,11] Along with these criteria, comprehensive geriatric assessment should be considered to assess general health status in older adults and appropriateness of prescriptions.[12]

It has been reported that pharmacists play affective role in reducing number of falls, the number of medications, medication costs, number of hospital admission and PIMs by determining and making intervention about inappropriate prescription.[13] In one study conducted in geriatric outpatient clinic indicating that polypharmacy was seen 47.6% among the patients[14] which is the leading cause of PIMs. This ratio is consistent with the literature conducted in European populations.[14]

The quality of prescriptions and provided care can be eased by ensuring a more effective treatment with appropriate and accurate medications and to achieve a multidisciplinary team including a clinical pharmacist must take part in the treatment.[15,16]

In this study, appropriateness of the geriatric outpatients' medications was assessed according to the 2nd version of STOPP/START criteria and the influencing factors such as group of prescribed drugs, chronic diseases, immunization status, living arrangements, comprehensive geriatric screening test results on prescriptions were evaluated.

MATERIALS and METHODS

Patient characteristics

Patients who were aged 65 years or older and had at least 5 different prescribed drugs (excluding topical medicines other than glaucoma medications) were recruited from the university research and training hospital's geriatric outpatient clinic prospectively between September 2015 and May 2016. All patients who met inclusion criteria during the study period were recruited. Therefore, the sample size calculation was not performed. Patients diagnosed with advanced dementia or Alzheimer's disease or receiving anti-cancer treatment were excluded. To minimize bias; standardized forms were used for data collection, the study population was clearly defined and collected data were analyzed by a statistician independently.

The main outcome measures were the frequency of inappropriate medications among Turkish older adult outpatients and determination of factors affecting inappropriate medication usage according to the 2nd version of the STOPP/START criteria assessed by a clinical pharmacist.

Data collection

Data on demographics (such as age, gender, educational status), comorbidities, medication usage (strength, dose, duration, dosage form), laboratory findings related to the prescribed medications were obtained from the patients, healthcare team and hospital information management system. The prescribed medications were classified according to the first four characters of Anatomical Therapeutic Chemical Classification System (ATC) codes recommended by the World Health Organization. A time required to apply STOPP/START criteria was also recorded for each patient. Informed consent to participate in this study taken from all participants when they arrived in the outpatient clinic. The appropriateness of the patients' medications was determined according to the 2nd version of the STOPP/START criteria by the clinical pharmacist with the collaboration of clinicians upon their outpatient clinic visits. Polypharmacy was defined as using five or more medications. The study was approved by the University, Non-Interventional Clinical Research Ethics Board (26.08.2015/ GO 15/555) and the procedures used in this study adhere to the tenets of the Declaration of Helsinki. Informed consent to participate and publishing recorded data in this study taken from all participants when they arrived in the outpatient clinic.

In the literature female gender, older age, polypharmacy, having multiple prescribers, and having poor health status are more likely to be associated with PIMs.[17] The patient's characteristics has been given in comparison between genders since all of the study population, has older age and polypharmacy. The patient's characteristics also compared according to PIM presence to determine variables for logistic regression analyze.

Comprehensive geriatric assessment

A comprehensive geriatric assessment, which included the evaluation of functional status [by activities of daily living (ADL) and instrumental ADL (IADL) scales], nutritional status [by mini nutritional assessment-short form (MNA-SF)], cognitive status [by mini-mental state exam (MMSE) screening tests] and depressive symptoms [by geriatric depression scale (GDS) scores] was performed by physicians at outpatient clinics and data were recorded.

Statistical analysis

As descriptive statistics, mean and standard deviation (SD) or count and percentages are given for continuous variables and frequency and percentage are given for categorical variables. The normality of continuous variables was tested using the Shapiro-Wilk test. The difference between groups was analyzed with independent *t*-test or Mann-Whitney *U* test depends on parametric test assumptions. Chi-square tests are used to investigate whether a significant relationship between categorical variables exists or not. Univariate logistic regression analysis was used to determine which variable(s) are significant by using $p < 0.20$. Then, the variable(s) found significant is (are) included in the logistic regression analysis. Analysis was performed using valid data only, patients with missing data were excluded from analysis. All the data analyzed using SPSS version 23®.

RESULTS

During the study period, 700 (52.63%) out of 1,330 patients who admitted to the outpatient clinic were included. The patients with the usage of less than 5 medications, diagnosed with advanced dementia or Alzheimer's disease or receiving anti-cancer treatment were excluded. Of those, 440 (62.8%) were female and the mean ± SD age was 75.75±6.56 years in the total study group.

The mean ± SD number of comorbidities was 4.46±1.58 and medications per patient was 7.46±2.38. Characteristics of the study population are given in Table 1. STOPP/START criteria were applied to each patient with the mean duration ± SD of 6.42±2.51 min.

A total of 5226 prescribed medications were evaluated and the most common medications according to the ATC codes were listed as A10B-blood glucose lowering drugs-excluding insulins (n=403, 7.7%), N02B-other analgesics and antipyretics (n=351, 6.7%), C07A-beta blocking agents (n=332, 6.3%), C10A-lipid modifying agents-plain (n=310, 5.9%) and A02B-drugs for peptic ulcer and gastroesophageal reflux disease (n=285, 5.4%).

Among the study participants, 384 patients (54.9%) without any PIM and 12 patients (1.7%) without any PPO were detected (Figure 1). The inapplicable STOPP/START criteria given in Table 2. A total of 441 PIM was identified in 316 patients (45.1%) and 1660 PPO were identified in 688 patients (98.3%). The most common PIM was "any drug prescribed without an evidence-based clinical indication" with 64 (9.1%) and PPO was "pneumococcal vaccine at least once after age 65 according to national guidelines" with 681 (97.3%) (Table 3).

When all variables were analyzed according to the presence of PIM (existence and non-existence), statistically significant variables were detected as age (p=0.05), comorbidities (p=0.005), number of medications ($p < 0.001$), dyslipidemia (p=0.03), chronic obstructive pulmonary disease (p=0.02), gastritis (p=0.03), constipation (p=0.03), GDS score (p=0.03), congestive heart failure ($p < 0.001$), MNA-SF scores (p=0.05), but not in others (cigarette smoking, gender, fall history, hypertension, diabetes mellitus, hypothyroidism, hyperthyroidism, incontinence, Parkinson disease).

The variable(s) influenced PIM presence were determined with $p < 0.20$ by using univariate logistic regression analysis. After the variable(s) were chosen (such as age, gender, place of residence, geriatric syndromes per patient, comorbid diseases per patient), they were included in the multiple logistic regression analysis to evaluate their effects. The significant variables are given Table 4.

Additionally, when all variables were analyzed according to the presence of PPO (existence and non-existence), statistically significant relations were detected in variables such as number of medication (p=0.03), asthma (p=0.005) and rheumatoid arthritis (p=0.01). However, further analysis with multiple logistic regression analysis could not be performed as the results were unreliable due to imbalanced sample size in each group (688 *versus* 12).

DISCUSSION

Polypharmacy becomes an important issue with the aging in terms of increased risk of negative outcomes due to drug related problems. The implementation of STOPP/START criteria may play important role to determine inappropriate medication use and to modify the prescriptions for protecting older adult patients from negative outcomes of polypharmacy.

It is shown that with the collaboration of clinical pharmacist, appropriateness of prescription is improving in older adults.[13,16] Clinical pharmacist plays an important role in monitoring, dispensing and reviewing of the medications decided and initiated by the physicians.[13] Collaboration with physicians, detailed medication review and pharmaceutical care are resulting with less medication usage and costs.[16,18] Therefore, clinical pharmacists are encouraged to participate in wards and outpatients' clinics as a member of multidisciplinary team.[16] In this study by the clinical pharmacist assessments, 54.9% of the patients had no PIM and 1.7% had no PPO. However, 22 out of 80 (27.5%) STOPP criteria and 4 out of 34 (11.8%) START criteria were not applicable to any medication during the study period. At least one PIM was detected in 45.1% of the patients according to the STOPP criteria in our study that is similar to the other studies previously reported between 14.8%-49.1%.[5,19-21]

Concerns about special care needs and increased medication use is strongly related to each other. For older adult population; living arrangements as a part of special care needs (living alone or living with someone) can be decisive in situations such as medication use. Patients who are routinely monitored in outpatient clinics often need analgesics, diuretics, cardiovascular

Table 1. Characteristics of the study population				
Variables (n=700)	Total n (%)	Female (440, 62.8%) n (%)	Male (260, 37.2%) n (%)	*p* value
Smokers	171 (24.4)	48 (28.1)	123 (71.9)	‹0.001
Fall history	49 (7.0)	36 (73.5)	13 (26.5)	0.1
Level of education				
No education	229 (32.7)	211 (92.1)	18 (7.9)	
Primary school	257 (36.7)	159 (61.9)	98 (38.1)	
Middle school	56 (8.0)	23 (41.1)	33 (58.9)	‹0.001
High school	81 (11.6)	18 (22.2)	63 (77.8)	
University	69 (9.9)	28 (40.6)	41 (59.4)	
Higher education	8 (1.1)	1 (12.5)	7 (87.5)	
Living arrangements				
Alone	121 (17.3)	90 (80.4)	22 (19.6)	‹0.001
With partner/relative/caregiver	579 (82.7)	344 (59.4)	235 (40.5)	
Number of medications				
Medications *per* patient (mean ± SD)	7.46±2.38	7.47±2.44	7.46±2.30	0.95*
Total prescribed medication (n)	5226	3287	1941	
Person with polypharmacy (5-10 medication) (n, %)	570 (81.4)	365 (64)	205 (36)	0.17
Person with excessive polypharmacy (›10 medication) (n, %)	130 (18.6)	75 (57.7)	55 (42.3)	
Comprehensive geriatric tests results				
Katz score of ADL categoric (score ≤2/6)	85 (12.1)	61 (71.8)	24 (28.2)	0.06
MNA-SF categoric Malnutrition risk (score ≤11/14) Malnutrition (score ≤7/14)	103 (14.7) 18 (2.6)	70 (68) 11 (61.1)	33 (32) 7 (38.9)	0.53
MMSE (score ≥18, ≤23)	138 (19.7)	102 (73.9)	36 (26.1)	0.01
GDS categoric (score ≥5/15)	187 (26.7)	138 (73.8)	49 (26.2)	0.001
Most common and significant comorbidities				
Hypertension	608 (86.9)	392 (64.5)	216 (35.5)	0.03
Diabetes mellitus	366 (52.3)	237 (64.8)	129 (35.2)	0.31
Dyslipidemia	251 (35.9)	160 (63.7)	91 (36.3)	0.71
Coronary artery disease	207 (29.6)	106 (51.2)	101 (48.8)	‹0.001
Osteoporosis	181 (25.9)	151 (83.4)	30 (16.6)	‹0.001

Data other than n (%) are given as mean ± SD. Pearson chi-square test used as statistical evaluation, Mann-Whitney *U* test had been used for parameters with * sign. ADL: Activities of daily living, MNA-SF: Mini nutritional assessment-short form, MMSE: The mini-mental state exam, GDS: Geriatric depression scale, SD: Standard deviation

medications. Furthermore, generally use acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), anti-histamines and gastrointestinal system drugs for some minor symptoms that are contributing the inappropriate prescriptions.[22]

Like other studies, "inappropriate use of NSAID's",[5,19,20,22] "usage of medication that cause duplication"[5,20] and "inappropriate dosage of aspirin"[5] are some of the most common PIMs that were also identified in our patients. In this study, the most common PIM (presence of any medication prescribed without evidence-based indication) was associated mainly with proton pump inhibitors (PPI) usage. PPI treatment was continued for gastritis even though the disease was cured. "Drugs for peptic ulcer and gastroesophageal reflux disease" were also detected among most commonly used medications when listed according to their ATC codes. It has been reported that continuation of PPI at the maximum dose after relieved gastrointestinal
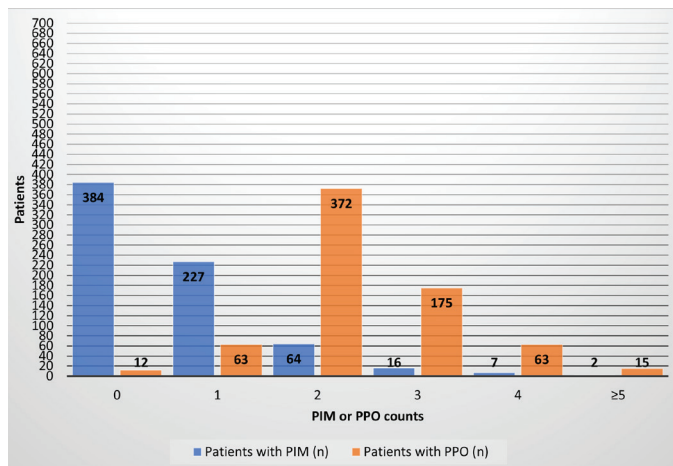
Figure 1. Number of PIM and PPO according to Screening Tool of Older Person's Prescriptions/Screening Tool to Alert Doctors to Right Treatment criteria

PIM: Potentially inappropriate medications, PPO: Potential prescribing omission

symptoms may lead to various problems such as increased risks of vitamin B12 deficiency, calcium and iron deficiency, osteoporosis, infection by bacteria such as *Clostridium difficile* and certain types of cancer.[12] Therefore, the necessity of PPI usage in patients should be assessed periodically.

One of the main findings of this study was that 98.3% of the patients had at least one PPO according to the START criteria, which is higher than the rates reported previously (28.1%-73.3%).[16,21,23] However consistent with the results of a study conducted in patients with falls and syncope.[24] "Calcium/vitamin D supplementation in patients with osteoporosis" is one of the most common PPO revealed in other studies[19,23-25] as in our study. Unlike other studies, the most frequent identified PPOs in this study were "pneumococcal vaccination at least once after 65 years of age according to national guidelines" (97.3%) and "annual influenza vaccination" (78.7%). Even though the vaccination is covered by the governmental health insurance the vaccinated older adult numbers were very low in this study.

The total time of the application of a criterion set might be an effective factor on its active usage in clinical practice. In this study, STOPP/START criteria were fully applied quickly with the mean duration ± SD of 6.42±2.51 min. Application time was found 3 min for STOPP criteria and 1 min for START criteria in a study by Ryan et al.[26] In another study, it was stated that the application time of START criteria did not exceed 5 min per patient and to apply STOPP criteria quickly, the results of the geriatric screening test of the patient and the detailed treatment history should be known previously.[27]

As expected in older adult patients, the number of comorbidities (median: 4, range: 1-10) and polypharmacy (median: 7, range: 5-20) was high in our study patients. Hypertension, diabetes mellitus and coronary artery diseases were the most common comorbidities in our study that is very similar to the results of Frankenthal et al.[23] (a study evaluated medications of 359 older adults according to the STOPP/START criteria) as well as the co-medications for these comorbidities. Those comorbid

conditions interfere each other in most cases and it is well known in clinical practice that clinicians should pay more attention to those group of patients in terms of appropriate and safe prescribing.

Unlike the study of Frankenthal et al.[23] most of the patients in this study were independent in their daily life activities according to the Katz score (87.9% vs. 25%). This might be explained by both exclusion of the advanced stage dementia patients and inclusion of small number of dementia patients (seen only in 13.1% of the patients).

Previous studies reported that age, female gender, number of medications, falls, and hospitalization are the most common factors associated with PIM.[17,19,20,23,28,29] Besides the number of medications (OR: 1.20) was associated with PIM in our study. It was also found that detection of PIM is probably increased by having congestive heart failure (2.41-fold) and living alone (4.12-fold). The gender had relation with smoking status, level of education, some of the comprehensive geriatric screening test scores and some comorbidities but it didn't produce statistically significant result on PIM occurrence. Even though comprehensive geriatric screening test scores in this study were similar with that of Kara et al.[19] Such as Katz score of ADL (6 *vs.* 6), IADL (16 *vs.* 17), MMSE (28 *vs.* 27), MNA-SF (13 *vs.* 13) and GDS (1 *vs.* 0), these similarities did not produce the same outcomes when multivariate logistic regression analysis was performed. Kara et al.[19] Found that gender, osteoporosis, number of medications and Katz scores of ADL were independently associated with STOPP criteria, however only similar outcome of this study is the number of medications.

The association between PPOs and age, female gender, number of medications and comorbidities has been shown in previous studies.[19,25,30,31] However, due to the uneven distribution of the number of patients with and without PPOs (688 and 12), multivariate logistic regression analysis was not performed in our study.

The removal of 2 criteria and modification of 2 criteria in START criteria and the modification of 5 criteria in STOPP criteria were recommended by Castillo-Páramo et al.[32] While they used the 1st version of STOPP/START in Spain. In another study conducted in Sri-Lanka due to unavailability of some medicines or clinical information the necessity of modified version of the STOPP/START criteria has been indicated.[33] In the 2nd version of criterion set 8% reduction has been made with the two Delphi rounds.[33] In our study, with the 2nd version of STOPP/START, it was found that 22 of 80 STOPP criteria and 4 out of 34 START criteria have not been applicable for any medication at the study period. Since, medications and procedures are not universal, local modification of STOPP/START criteria or development of local criteria to evaluate the medication of geriatric patients is necessary. Therefore, local "TIME" criteria have been developed which originated from the STOPP/START and the CRIME criteria.[9]

Table 2. Inapplicable STOPP and START criteria

Inapplicable STOPP criteria

Cardiovascular system criteria
1. Centrally-acting antihypertensives (*e.g.* methyldopa, clonidine, moxonidine, rilmenidine, guanfacine), unless clear intolerance of, or lack of efficacy with, other classes of antihypertensives
2. Aldosterone antagonists (*e.g.* spironolactone, eplerenone) with concurrent potassium-conserving drugs (*e.g.* ACEI's, ARB's, amiloride, triamterene) without monitoring of serum potassium
3. Phosphodiesterase type-5 inhibitors (*e.g.* sildenafil, tadalafil, vardenafil) in severe heart failure characterised by hypotension *i.e.* systolic BP <90 mmHg, or concurrent daily nitrate therapy for angina

Coagulation system criteria
1. Ticlopidine in any circumstances

Central nervous system criteria
1. Tricyclic antidepressants with dementia, narrow angle glaucoma, cardiac conduction abnormalities, prostatism, or prior history of urinary retention
2. Neuroleptics as hypnotics, unless sleep disorder is due to psychosis or dementia
3. Phenothiazines as first-line treatment, since safer and more efficacious alternatives exist
4. First-generation antihistamines

Renal system criteria
1. Digoxin at a long-term dose greater than 125 µg/day if eGFR <30 mL/min/1.73 m^2
2. Factor Xa inhibitors (*e.g.* rivaroxaban, apixaban) if eGFR <15 mL/min/1.73 m^2
3. Colchicine if eGFR <10 mL/min/1.73 m^2

Respiratory system criteria
1. Systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD
2. Benzodiazepines with acute or chronic respiratory failure *i.e.* pO_2 <8.0 kPa ± pCO_2 >6.5 kPa

Musculoskeletal system criteria
1. Corticosteroids (other than periodic intra-articular injections for mono-articular pain) for osteoarthritis
2. COX-2 selective NSAIDs with concurrent cardiovascular disease
3. NSAID with concurrent corticosteroids without PPI prophylaxis

Endocrine system criteria
1. Oestrogens with a history of breast cancer or venous thromboembolism.
2. Oestrogens without progestogen in patients with intact uterus
3. Androgens in the absence of primary or secondary hypogonadism

Drugs that predictably increase the risk of falls in older people
1. Hypnotic Z-drugs (*e.g.* zopiclone, zolpidem, zaleplon)

Analgesic drugs
1. Use of oral or transdermal strong opioids (morphine, oxycodone, fentanyl, buprenorphine, diamorphine, methadone, tramadol, pethidine, pentazocine) as first line therapy for mild pain.
2. Long-acting opioids without short-acting opioids for break-through pain

Total: 22 out of 80 (27.5%) criteria

Inapplicable START criteria

Cardiovascular system criteria.
Aspirin (75 mg - 160 mg once daily) in the presence of chronic atrial fibrillation, where vitamin K antagonists or direct thrombin inhibitors or factor Xa inhibitors are contraindicated

Central nervous system & ophthalmic criteria
Dopamine agonist (ropinirole or pramipexole or rotigotine) for restless legs syndrome, once iron deficiency and severe renal failure have been excluded

Musculoskeletal system criteria
Folic acid supplement in patients taking methotrexate.

Urogenital System criteria.
Topical vaginal oestrogen or vaginal oestrogen pessary for symptomatic atrophic vaginitis

Total: 4 out of 34 (11.8) criteria

STOPP: Screening Tool of Older Person's Prescriptions, ACE: Angiotensin converting enzyme, ARB: Angiotensin II receptor blockers, BP: Blood pressure, eGFR: Estimated glomerular filtration rate, COPD: Chronic obstructive pulmonary disease, COX-2: Cyclooxigenase 2, NSAIDs: Non-steroidal anti-inflammatory drugs, START: Screening Tool to Alert doctors to Right Treatment

Table 3. Most common PIMs according to STOPP criteria and PPOs according to START criteria

STOPP screening criteria	n (%)
Any drug prescribed without an evidence-based clinical indication	88 (10.9)
Any duplicate drug class prescription *e.g.* two concurrent NSAIDs, SSRIs, loop diuretics, ACE inhibitors, anticoagulants	73 (9)
NSAID with established hypertension (risk of exacerbation of hypertension) or heart failure	33 (4.1)
ACE inhibitors or angiotensin receptor blockers in patients with hyperkalemia	27 (3.3)
Long-term aspirin at doses greater than 160 mg *per* day	26 (3.2)
START screening criteria	
Pneumococcal vaccine at least once after age 65, according to national guidelines	789 (97.5)
Seasonal trivalent influenza vaccine annually	553 (68.4)
Vitamin D supplement in patients with known osteoporosis and previous fragility fracture(s) and/or (bone mineral density T-scores more than -2.0 in multiple sites)	77 (9.5)
Bone anti-resorptive or anabolic therapy (*e.g.* bisphosphonate, strontium ranelate, teriparatide, denosumab) in patients with documented osteoporosis, where no pharmacological or clinical status contraindication exists (bone mineral density T-scores ->2.5 in multiple sites) and/or previous history of fragility fracture(s)	73 (9)
Statin therapy with a documented history of coronary, cerebral or peripheral vascular disease, unless the patient's status is end-of-life or age is >85 years	66 (8.2)

PIM: Potentially inappropriate medications, STOPP: Screening Tool of Older Person's Prescriptions, NSAID: Non-steroidal anti-inflammatory drug, ACE: Angiotensin converting enzyme, SSRI: Selective serotonin reuptake inhibitor, PPO: Potentially prescribing omissions, START: Screening Tool to Alert Doctors to Right Treatment

Table 4. Factors independently associated with STOPP criteria

Variables	No PIM n (%)	PIM	OR	95% CI	*p* value
Living arrangements (living alone)	57 (47.1)	64 (52.9)	4.12	2.03-12.08	0.02
Congestive heart failure (exist)	21 (28.4)	53 (71.6)	2.41	1.37-4.22	0.001
Medication *per* patient	6.98±1.96	8.05±2.71	1.20	1.11-1.29	<0.001

Data other than n (%) are given as mean ± SD.
Multivariate logistic regression analysis was performed to find the independent associates of STOPP criteria. All variables with *p*<0.20 in the univariate logistic regression analysis were included in multivariate regression analysis (age, gender, place of residence, geriatric syndromes *per* patient, comorbid diseases *per* patient, falls in the last months, hypertension, ischemic heart disease, diabetes mellitus, hyperlipidemia, chronic obstructive pulmonary disease, osteoporosis, constipation, number of medication, comprehensive geriatric screening tests). The parameters that were significantly associated are given in the table *p*<0.005 is statistically significant. STOPP: Screening Tool of Older Person's Prescriptions, PIM: Potentially inappropriate medication, OR: Odds ratio, CI: Confidence interval

Study limitations

This study also has some limitations. Even though many patients were involved in this study compared to other published studies,[11,26,29] a randomized controlled study design could not be implemented due to a restrictive period of master of science thesis. About non-applicable criteria; this can't generalize to the Turkish population but considering our sample size this still gives an idea about necessity of the unused criteria. Moreover, the physicians in the department that this study was conducted were familiar with the 1st version of the STOPP/START criteria therefore this might have influenced on the practice of prescribing.

CONCLUSION

Detecting inappropriate medications to maintain treatment effectiveness is necessary to provide the optimum therapy. Despite the awareness of many risk factors related to inappropriate prescription; living arrangements, having a congestive heart failure and increasing number of medications are seen as risk factors of inappropriate prescription. The vaccination section presents only in 2nd version of STOPP/START criteria has shown a valuable insight of older adult Turkish patients' vaccination status. STOPP/START criteria are still playing a pivotal role in the appropriateness of prescription in line with this valuable tool a local tool may be more beneficial to covering population characteristics.

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