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ORIGINAL RESEARCH

Evaluating Inappropriate Medication Prescribing Among Elderly Patients in Palestine Using the STOPP/ START Criteria

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Background: Elderly patients suffer from chronic diseases and are prone to polypharmacy and potentially inappropriate prescribing (PIP). This study aimed to identify potentially inappropriate medications (PIMs) and potential prescribing omissions (PPOs) among elderly patients in a tertiary care hospital setting and to estimate the prevalence of polypharmacy.

Methods: This multicenter retrospective observational study reviewed patient data from two major Palestinian hospitals. The collected data included patient demographics, comorbidities, and medications administered during hospitalization and discharge. The study included 247 patients aged ≥ 65 years hospitalized between January 2019 and December 2019. The STOPP/START criteria version 2 was used to identify the prevalence of PIMs and PPOs. Clinical pharmacists verified the data, and SPSS was used for data analysis. Descriptive statistics, one-tailed bivariate correlations, and Pearson's test were applied to the variables of interest to examine their association with the STOPP/START criteria.

Results: A total of 247 patients were included in the study, and 50.2% were females. As a result, 165 (66.8%) participants were identified with PIPs, including 30 patients with PPOs, 91 with PIMs, and 44 with both. Furthermore, the prevalence of PIP during hospitalization and discharge was 56.29% and 64.39%, respectively. Polypharmacy (5–9 medications) was 44.5% and 52.1% during hospitalization and discharge, respectively, and excessive polypharmacy (ten medications or more) was 33.6% and 16.4% during hospitalization and discharge, respectively. Moreover, 47.3% of the patients had a comorbidity index of ≥ 5.

Conclusion: This study identified a high prevalence of PIPs among elderly patients during hospital admission and discharge. In addition, more than half of the geriatric patients in this study had PIP and a high prevalence of polypharmacy. Therefore, this study emphasizes the importance of adapting evidence-based tools, such as the STOPP/START criteria, to optimize patient medication therapy and guide prescribers in identifying and resolving PIMs and PPOs.

Keywords: STOPP/START criteria, potentially inappropriate prescribing, potentially inappropriate medications, potential prescribing omissions, polypharmacy

Introduction

The global population is aging rapidly, and associated aging diseases are widespread. Age-related diseases account for 51.3% of the global disease burden among older adults, including cardiovascular diseases, neoplasms, chronic respiratory disorders, and sensory organ malfunctions related to advanced age and multimorbidity.[1] Elderly patients suffer more from multiple chronic conditions and are prone to polypharmacy, defined as using multiple medications (five or more medications).[2] More than 36% of patients older than 65 take more than five medications, about 90% take at least one prescription, and about 80% take at least two. When over-The-counter and dietary supplements are included, these percentages are even higher.[3]

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Physiological changes associated with aging, such as decreased renal function, reduced muscle mass, and increased fat mass, affect medication pharmacokinetics and pharmacodynamics, causing an increased risk of adverse drug reactions and toxicity.[4] More than 60% of hospitalized elderly patients experience drug reactions during hospitalization. Therefore, optimizing and selecting medication therapy is crucial in treating acute illnesses, managing chronic diseases, preventing drug-drug interaction, drug-disease interaction, and preventing complications.[5]

Elderly patients with polypharmacy are at a higher risk for medication errors than other patients, and it has been reported in 28–42% of polymedicated and elderly patients in various healthcare settings.[1] Medication errors arise from a lack of awareness of appropriate prescribing among physicians or a lack of patient education. These errors might result in significant damage requiring a new pharmaceutical treatment, hospitalization, comorbidities, kidney damage, or even death in certain situations.[6]

Screening tools have been developed to improve prescribing in the elderly and to help identify inappropriate and high-risk medications with adverse outcomes and side effects. Beer's list and the STOPP/START criteria are the two most common criteria used to review potentially inappropriate medications among older patients.

The STOPP/START tool was developed in 2008 by a panel of Irish and UK experts and updated in 2015 by experts across Europe.[7] The STOPP/START criteria are composed of 114 criteria, 80 STOPP, and 34 START; these 114 criteria include intervention suggesting modification of the elderly pharmacotherapy to improve outcomes and prevent side effects.[8] The START helps identify medications that should be started to optimize elderly patient medication therapy management. In addition, the STOPP criteria determine potential inappropriate medications (PIMs) that might harm the elderly. Examples of the START criteria include the addition of ACE inhibitors, or ARB, after a heart attack or heart failure in patients with a cardiovascular disorder; starting an antidepressant for patients with at least three months of depressive symptoms, and considering starting a bisphosphonate in patients on chronic steroids in patients with endocrine disorders.

Examples of the STOPP criteria include prescribing long-acting sulfonylureas and caution in combining aspirin with warfarin in patients not receiving an acid-suppressing agent. For patients with central nervous system disorders, benzodiazepines increase the risk of falls in patients with a history of falls in the past three months. The STOPP/START criteria offer more benefits than the Beers criteria in improving patient outcomes and medication therapy since the beer criteria only identify high-risk medications to avoid or stop.[7]

Objective

No studies have been conducted in Palestine to assess the potentially inappropriate prescribing among the elderly. Therefore, this study aimed to determine the prevalence of polypharmacy and potentially inappropriate prescribing among patients aged ≥ 65 years in Palestine using the STOPP/START criteria tool.

Methods

Study Design

This multicenter retrospective observational study reviewed the electronic patient data from two major Palestinian hospitals. The study included hospitalized patients over 65 years old from January 2019 to December 2019. The study period was selected prior to the COVID-19 pandemic to reflect the usual medical practice under normal circumstances. The collected data included the patients' demographic information, diagnosis, comorbidities, and prescribed medications during hospitalization and discharge. Patients younger than 65 years of age, with incomplete medical records, multiple admissions during the study period, and those admitted to the emergency department were excluded from the study. According to the Raosoft sample size calculator website, a sample size of 247 was calculated, with an estimated confidence interval of 95% and a 5% error margin. A total of 247 participants out of 688 who met the study's inclusion criteria were included in the study.[9,10]

Data Collection, Assessment, and Analysis

Data were collected randomly by clinical pharmacy students at Birzeit University from an average of 20 patients per month from the hospital's medical records. The data collection sheet included patient demographics and characteristics such as patient ID, age, sex, reason for hospitalization, medications during hospitalization, and discharge and discharge

dates. The sheet also included patient comorbidities (eg, hypertension, diabetes, heart failure, renal failure, and atrial fibrillation). The data were double-checked, and the data collection sheet was reviewed by PharmD students and clinical pharmacists from the Faculty of Pharmacy at Birzeit University to ensure complete and accurate data management.

The collected data were added to Microsoft Excel 365 and assessed using the STOPP/START criteria version 2. The variables used for the analysis included (the number of medications, PIMs, and PPOs administered during hospitalization and discharge. The Charlson Comorbidity Index was calculated using Microsoft Excel 365.

The Charlson Comorbidity Index was developed to predict the risk of death for patients with specific comorbid conditions within one year of hospitalization. It includes 17 conditions that affect the patient score, which are age, myocardial infarction, CHF, peripheral vascular disease, cerebrovascular attack, dementia, COPD, connective tissue disease, peptic ulcer disease, liver disease, diabetes, hemiplegia, chronic kidney disease, solid tumor, leukemia, lymphoma, and AIDS. Each condition had a specific score from 1 to 6 based on its effect on the patient's survival rate; the sum of all points from the 17 conditions resulted in a single score. CCI starts from zero points, indicating no comorbidities; the higher the score, the higher the mortality rate for the patient.[11,12]

PIMs, according to the STOPP criteria, include drug indication, cardiovascular system antiplatelet/anticoagulant drugs, CNS and psychotropic drugs, renal, gastrointestinal, respiratory, musculoskeletal, urogenital, endocrine systems, drugs that have a high risk for falls, analgesic and antimuscarinic drugs. Furthermore, according to the START criteria, PPOs involve the cardiovascular, respiratory, central nervous, gastrointestinal, musculoskeletal, endocrine, and urogenital systems. Analgesic drugs and vaccines were also included in the start criteria. Each category had special codes and was used for PIMs. In addition, PPOs were categorized based on drug groups into codes for the hospitalization period, drugs group, discharge drugs group, and both groups.

The collected data and variables of interest, such as age, hospitalization period, number of medications prescribed, and Charlson comorbidity index (CCI), were transferred to SPSS statistical package version 25.0. Data recording was performed to re-categorize continuous data. Descriptive statistics, such as frequencies and percentages, were obtained for categorical data. The mean, median, range, and minimum and maximum values were obtained for continuous data. The Shapiro–Wilk normality test showed that age, CCI, and hospitalization were not normally distributed. Binary logistic regression, a stepwise method, was performed to determine which variables of interest would effectively predict PIPs occurrence according to the STOPP/START criteria and to control the effect of other variables.

Ethical Considerations

This study was approved by the ethical committee of Birzeit University (reference number: BZUPNH2106). Anonymous patient data were provided by Palestine Medical Complex and Salfit Hospital, and the requirement for written consent was waived. Patients' personal information or identities were not collected, and all information will be used for the research and will not be shared. This study complied with the principles of the Declaration of Helsinki.

Results

Demographics and Characteristics

In this study, more than half of the participants were female, 33.6% were aged 65–70 years, and 18.2% were > 80 years, with a median age of 73 years. The median comorbidity index was 4, ranging between 2 and 9, and 47.3% of the patients had a comorbidity index of 5. The median duration of hospital stay was 3.6 ± 2.32 days, with a maximum of 16 days. (Table 1)

Prevalence of Polypharmacy

As shown in Table 1, 44.5% and 52.1% of the participants had polypharmacy (5–9 medications) during hospitalization and discharge, respectively. Furthermore, 33.6% and 16.4% of the patients had excessive polypharmacy (>10 medications) during hospitalization and discharge, respectively.[13] The number of prescribed medications median (interquartile range) was 8.0 (5.0–11.0) and 6.0 (4.0–11.0) for drugs/patients during the hospitalization period and discharge, respectively. Intravenous fluids (eg, normal saline, dextrose 5%), oxygen therapy, blood transfusion, and plasma transfusion were not counted as part of hospitalization or discharge medication.

Table 1 Distribution of Patient Characteristics Among the Study Sample

Patient Characteristics	Number of Patients (%)
Gender	
Males	123 (49.8%)
Females	124 (50.2%)
Age groups	
Median (SD)	73 (67.808–80.432)
65–70	83 (33.6)
71–75	66 (26.7)
76–80	53 (21.5)
> 80	45 (18.2)
Comorbidity index	
Median (SD)	4 (3.095–6.256)
≤ 4	130 (52.6)
≥ 5	117 (47.4)
Hospitalization period (Days)	
Median (SD)	3 (1.277–5.923)
< 5	187 (75.7)
5–10	55 (22.3)
> 10	5 (2.0)
Number of medications per patient during hospitalization (n = 247)	
≤ 4	54 (21.9)
5–9	110 (44.5)
≥ 10	83 (33.6)
Number of medications per patient on discharge (n = 219)	
≤ 4	69 (31.5)
5–9	114 (52.1)
≥ 10	36 (16.4)

Prevalence of PIPs

Figure 1 shows the prevalence of PIPs among participants, 165 (66.8%) of participants had at least one (PIM) or (PPO); 30 patients had PPOs, 91 patients had PIMs, and 44 patients had both PIPs. Furthermore, the prevalence of PIPs among participants during hospitalization was 108 (56.29%) of hospitalized patients with at least one PIP out of 247 participants. On the other hand, 141 (64.39%) patients with at least one PIP on discharge out of 219 participants with complete discharge medication records. Twenty-eight patients were missing the information for the discharged medications.

Prevalence of PIMs

According to the STOPP criteria, 144 and 143 PIMs occurred during hospitalization and discharge, respectively. Figure 2 shows the distribution of PIPs among the patients.

As shown in Figure 3, inappropriate drug indication PIMs were the most frequent, with 49.3% of the total PIM instances, followed by inappropriate antiplatelet/anticoagulant medications (20.8%). Duplication of therapy was the most common PIM with a prevalence of 33.5%. Furthermore, the inappropriate use of a combination of aspirin and clopidogrel

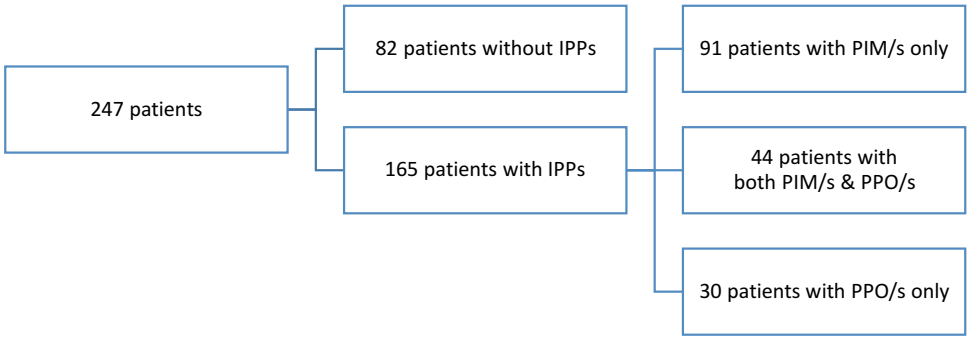

Figure 1 Patients distribution regarding PIPs occurrence.

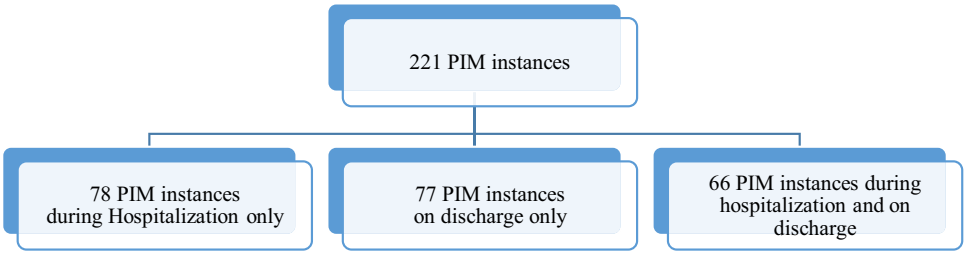

Figure 2 Distribution of PIMs.

had a prevalence of 13.6%. Aspirin plus clopidogrel should be used as secondary stroke prevention in patients with a coronary stent(s) inserted in the previous 12 months, concurrent acute coronary syndrome, or a high-grade symptomatic carotid arterial stenosis (Table 2).

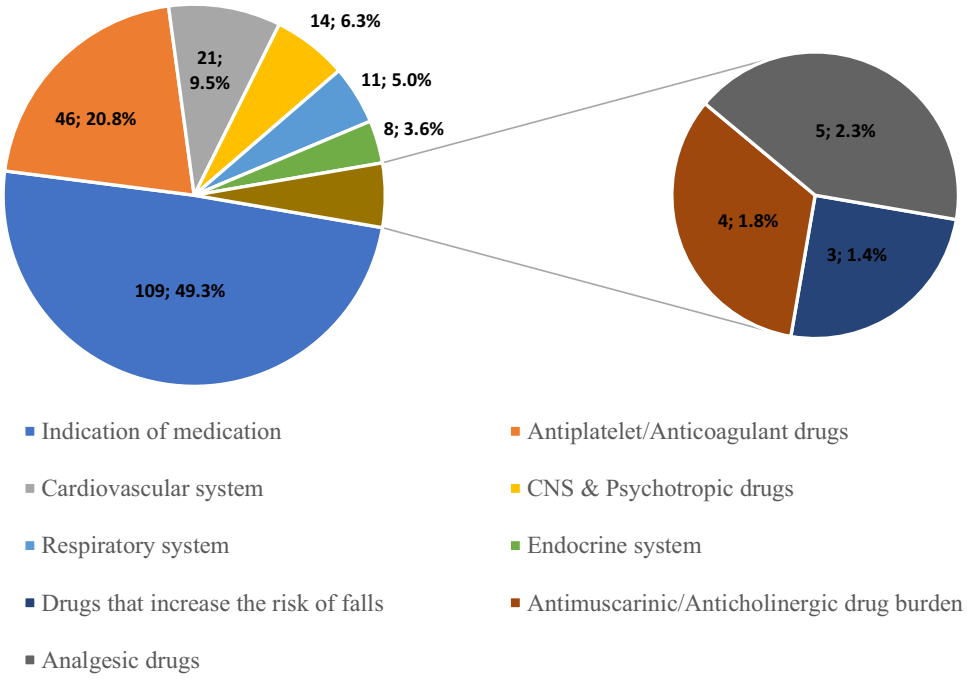

Figure 3 Prevalence of detected PIMs according to the STOPP criteria.

Table 2 Number of PIMs Identified According to the STOPP Criteria

STOPP Criteria*	Prevalence
Indication of medication	
A1. Any drug prescribed without an evidence-based clinical indication	35 (15%)
A3. Any duplicate drug class prescription	74 (33%)
Cardiovascular system	
B5. Amiodarone as first-line antiarrhythmic therapy in supraventricular tachyarrhythmias	1 (0.05%)
B6. Loop diuretic as first-line treatment for hypertension	8 (0.03%)
B9. Loop diuretic for treatment of hypertension with concurrent urinary incontinence	3 (0.01%
B12. Aldosterone antagonists with concurrent potassium-conserving without monitoring of serum potassium	9 (0.045)
Antiplatelet/Anticoagulant drugs	
C3. Aspirin, clopidogrel, dipyridamole, vitamin K antagonists, direct thrombin inhibitors or factor Xa inhibitors with concurrent significant bleeding risk	6 (0.03%)
C4. Aspirin plus clopidogrel as secondary stroke prevention unless the patient has a coronary stent(s) inserted in the previous 12 months or concurrent acute coronary syndrome or has a high-grade symptomatic carotid arterial stenosis	30 (13.6%)
C5. Aspirin in combination with vitamin K antagonist, direct thrombin inhibitor or factor Xa inhibitors in patients with chronic atrial fibrillation without a clear indication for aspirin	10 (0.045%)
CNS & Psychotropic drugs	
D2. Initiation of tricyclic antidepressants as first-line antidepressant treatment	1 (0.005%)
D7. Anticholinergics/antimuscarinics to treat extra-pyramidal side-effects of neuroleptic medications	1 (0.005%)
D16. First-generation antihistamines	12 (0.05%)
Respiratory system	
G2. Systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD	7 (0.03%)
G4. Non-selective beta-blocker with a history of asthma requiring treatment	4 (0.019%)
Endocrine system	
J1. Sulphonylureas with a long duration of action with type 2 diabetes mellitus	7 (0.03%)
J3. Beta-blockers in diabetes mellitus with frequent hypoglycemic episodes	1 (0.05%)
Drugs that predictably increase the risk of falls in older people	
K1. Benzodiazepines	3 (0.013%)
Analgesic drugs	
L2. Use of regular opioids without concomitant laxative	5 (0.022%)
Antimuscarinic/Anticholinergic drug burden	
N. Concomitant use of two or more drugs with antimuscarinic/anticholinergic properties	4 (0.018%)

Notes: *STOPP Criteria reproduced from: O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing*. 2015;44(2):213-218. doi:10.1093/ageing/afu145. Erratum in: *Age Ageing*. 2018;47(3):489.[7]

Prevalence of PPOs

According to the START criteria, there were 84 potentially prescribing omissions (PPOs). The most frequent PPOs were related to the cardiovascular system (51.2%), followed by the endocrine system (22.6%) (Figure 4). The most common PPOs were A5 which is shown in Table 3, which states, "statins therapy with a documented history of coronary, cerebral, or peripheral vascular disease unless the patient's status is the end of life or age is > 85 years" with a prevalence of 22.6%. The other one was F1 which is "ACE inhibitors or angiotensin receptor blockers in diabetes with evidence of renal disease, i.e., overt dipstick proteinuria or microalbuminuria (>30mg/24 hours) with or without serum biochemical renal impairment" with a prevalence of 22.6%.

Table 4 shows the relationships between the variables of interest and PIPs occurrence; three significant positive correlations with a P-value≤ 0.001, including hospitalization PIMs and the number of drugs during hospitalization (OR=1.234), discharge PIMs, and the number of medications at discharge (OR=1.401), and PPOs and Charlson comorbidity index (OR=1.224). No confounding effects were found for the other variables tested.

Discussion

This study examined PIPs in geriatric patients' medications admitted to the internal medicine unit according to the STOPP/START criteria tool, which helps detect PIPs that reduce potentially adverse drug events and improve geriatric healthcare outcomes.

The prevalence of PIP in the study was 66.8%, which is alarming and, unfortunately, indicates a lack of awareness about PIMs and PPOs by healthcare providers in Palestine, leading to adverse outcomes. This finding is higher than the prevalence reported in similar studies conducted in Malaysia, and England, which showed PIPs prevalence of 58.5%, and 40%, respectively;[14,15] In a similar study of inappropriate prescribing in the elderly in the internal ward in Portugal was at a much lower rate of (11.2–17.2%) though the prevalence of polypharmacy in that study was 75%.[16] On the other hand, higher prevalence has also been reported; a study conducted in Sudan showed a prevalence of 78%, and in a multicenter study in multihospital, a prospective cohort study including hospitalized elderly patients at the internal medicine of 5 hospitals in Spain revealed that 81.5% patients had at least one PIP during hospitalization.[17,18] A Brazilian study in hospitalized patients in a general hospital's medical and cardiology units revealed inadequate prescriptions affecting 99.3% of the participating patients.[19] The high prevalence of PIPs is due to the multiple comorbidities, polypharmacy, and lack of awareness and knowledge among healthcare providers of geriatric pharmacotherapy and

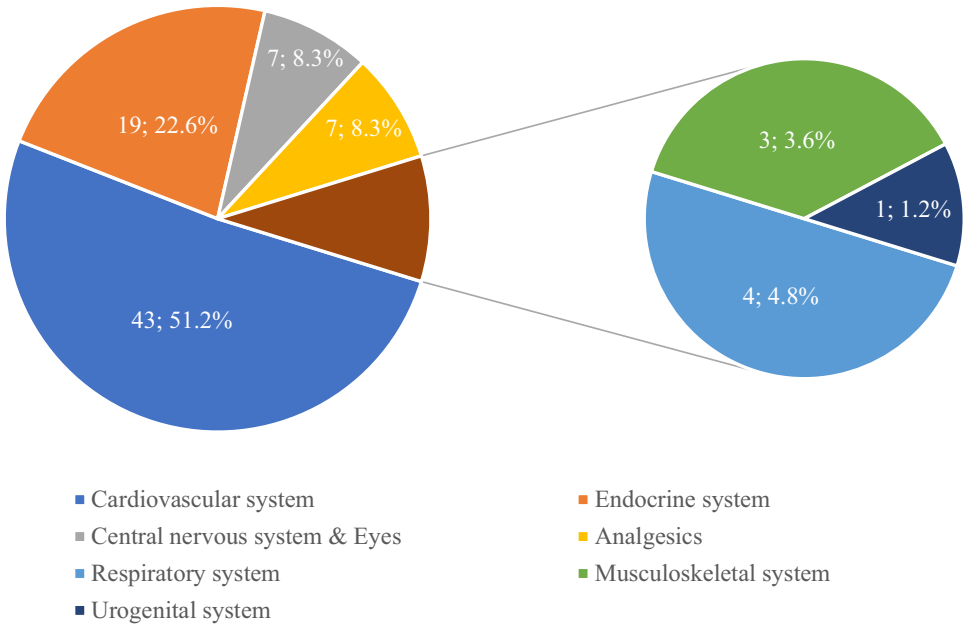

Figure 4 Prevalence of detected PPOs according to the START criteria.

Table 3 Number of PPOs Detected According to the START Criteria

START Criteria*	Prevalence
Cardiovascular system	
A1. Vitamin K antagonists or direct thrombin inhibitors or factor Xa inhibitors in the presence of chronic atrial fibrillation.	2 (0.024%)
A3. Antiplatelet therapy with a documented history of coronary, cerebral or peripheral vascular disease.	2 (0.0245)
A5. 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.	19 (22.6%)
A6. Angiotensin Converting Enzyme (ACE) inhibitor with systolic heart failure and/or documented coronary artery disease.	6 (0.07%)
A7. Beta-blocker with ischemic heart disease.	8 (0.1)
A8. Appropriate beta-blocker with stable systolic heart failure.	6 (0.07%)
Respiratory system	
B1. Regular inhaled beta 2 agonist or antimuscarinic bronchodilator (eg, ipratropium, tiotropium) for mild to moderate asthma or COPD.	4 (0.05%)
Central nervous system and Eyes	
C3. Acetylcholinesterase inhibitor (eg, donepezil, rivastigmine, galantamine) for mild- moderate Alzheimer's dementia or Lewy Body dementia.	7 (0.08%)
Musculoskeletal system	
E1. Disease-modifying anti-rheumatic drug (DMARD) with active, disabling rheumatoid disease.	1 (0.01%)
E6. Xanthine-oxidase inhibitors (eg, allopurinol, febuxostat) with a history of recurrent episodes of gout.	2 (0.02%)
Endocrine system	
F1. ACE inhibitor or Angiotensin Receptor Blocker (if intolerant of ACE inhibitor) in diabetes with evidence of renal disease ie, overt dipstick proteinuria or microalbuminuria (>30mg/24 hours) with or without serum biochemical renal impairment.	19 (22.6%)
Urogenital system	
G1. Alpha-1 receptor blocker with symptomatic prostatism, where prostatectomy is not considered necessary.	1 (0.01%)
Analgesics	
H2. Laxatives in patients receiving opioids regularly.	7 (0.08%)

Notes:*START Criteria reproduced from: O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing*. 2015;44(2):213-218. doi:10.1093/ageing/afu145. Erratum in: *Age Ageing*. 2018;47(3):489.[7]

tools to identify drug-related problems.[18] Therefore, educating and training geriatric health care providers and recruiting clinical pharmacists in hospitals will play a vital role in improving health care outcomes and reducing PIPs.[1]

The use of multiple medications to treat chronic diseases, severe illnesses, and other health problems, known as polypharmacy, is more common among elderly patients because they have experienced multiple comorbidities and chronic and acute diseases that need to be treated by a variety of drugs.[20] Moreover, multiple medications increase drug-drug and drug-disease interactions, which may cause serious adverse events, especially among geriatric patients. So it is necessary to establish the need to use multiple drugs and reduce or stop unnecessary medications.[21] The WHO has recommended taking appropriate steps in patient medication management and targeting polypharmacy to protect patients from harm while maximizing the benefit of medications.[22] Polypharmacy is associated with adverse drug events, hospitalization, and mortality.[23]

In this study, the prevalence of polypharmacy during hospitalization and discharge was 44.5% and 52.1%, respectively, with a median number of administered medications (interquartile range) during hospitalization of 8.0 (5.0–11.0)

Table 4 Correlation P-values for the Presence of PIMs (During Hospital Admission and Discharge) and PPOs with Patient Characteristics

	Hospitalization PIMs	Discharge PIMs	PPOs
Gender	0.153	0.469	0.847
Age	0.208	0.259	0.887
Comorbidity index	0.547	0.890	0.001
Hospitalization period	0.147	0.339	0.240
Number of medications during hospitalization	<0.001	/	0.374
Number of medications on discharge	/	<0.001	0.260

medications/patient and a mean (standard deviation) of 7.96 (4.10) medication/patient. On the other hand, the median number of discharged medications was 6.0 (4.0–8.0) medication/patient and a mean (standard deviation) of 6.13 (3.49) medication/patient. A similar finding was reported in other studies; for example, an Irish study showed a lower median of 5 medications per patient;[24] and a Japanese study showed the same median, which was 8.0 medications per patient when compared to the number of medications per patient during hospitalization in this study.[25] A higher prevalence of polypharmacy was reported in a regional study in Jordan among hospitalized patients, where elderly patients have polypharmacy more significantly than non-elderly patients, with a prevalence of 82.7%.[26] Furthermore, a Lebanese study reported a mean of 4.83 (2.77) medications per patient;[27] a study conducted in Kuwait showed a mean of 6.30 (3.0) medications per patient; however, the same study was conducted during hospitalization and a higher mean during discharge.[28]

Multiple comorbidities and polypharmacy are directly related to the prevalence of PIMs or PPOs. In a US study, PIMs were higher in patients with multimorbidity and polypharmacy. This study revealed a significant correlation between the Charlson comorbidity index (CCI) and PPO occurrence. A high comorbidity index indicates more comorbidities that require more medications to be prescribed and a high chance of being missed. However, other studies have reported a significant correlation between CCI and PIMs. This relationship could be explained as when the number of comorbidities increases, the number of medications increases, resulting in more PIMs.[24] Moreover, a significant correlation between the number of prescribed medications and the occurrence of PIMs increases the risk of drug-drug, drug-disease interactions, therapeutic duplication, and other drug-related problems; therefore, polypharmacy results in a higher risk of prescribing errors.

In this study, drug therapy duplication was the most common PIMs. Therapeutic duplication is defined as prescribing multiple medications for the same indication or purpose without a clear distinction of when one agent should be administered over another or prescribing at least two medications from the same drug class simultaneously to a patient.[29,30] Therapy duplication causes a higher risk of adverse events with no added therapeutic benefit. Therapy optimization with monotherapy is considered before adding another drug; one may try another medication monotherapy before duplication.[30] For example, in the study, patients were prescribed two H2 receptor antagonists such as famotidine and ranitidine serve no clinical benefit, or two corticosteroids dexamethasone and prednisone, or using multiple diuretics such as (spironolactone, hydrochlorothiazide, and furosemide), or multiple anticoagulants with no indications placing the patient at higher risk for adverse events and complications. Improving therapy outcomes and maintaining patient safety can be improved by implementing START/STOP criteria tools.[31] Furthermore, medication reconciliation during the patient transition of care by a clinical pharmacist has been shown to minimize medication discrepancy and duplication of therapy.[32,33]

Prescribing medication without indications supported by scientific evidence is another potential drug-related problem that might lead to worse outcomes and complications when medications used without scientific-based evidence. As stated in the criteria C4 PIM, for example, aspirin plus clopidogrel as secondary stroke prevention unless the patient has

a coronary stent(s) inserted in the previous 12 months or concurrent acute coronary syndrome or has a high-grade symptomatic carotid arterial stenosis is not recommended because there is no added benefit from the combination over clopidogrel monotherapy. In addition, it increases the risk of bleeding and mortality.[34]

Statins and ACE inhibitors, or ARBs, have been recommended by most guidelines for managing and preventing cardiovascular disorders because of their benefits in reducing morbidity and mortality.[35,36] Initiation of statin therapy with a documented history of coronary, cerebral, or peripheral vascular disease is one of the most common PPOs. Statin therapy minimizes cardiovascular and cerebrovascular events and has a role in reducing mortality and morbidity.[37] The other most common PPO was "ACE inhibitors or angiotensin receptor blocker in diabetes with evidence of renal disease" this therapy is needed since ACE inhibitors and ARBs are considered to reduce the progression of diabetic nephropathy in type 1 and 2 diabetes. Also, they have a role in enhancing insulin sensitivity, thus preventing type 2 diabetes complications.[38]

It has been reported in some studies that 1 in 3 elderly patients falls each year, and elderly patients should be assessed and evaluated for increased risk of falls, including medication assessment.[39] Medications linked with increased risk of falls include benzodiazepine, neuroleptics, hypnotics agents, tricyclic antidepressants, and antipsychotics.[40] In a multicenter study to assess factors associated with potentially inappropriate prescribing in older patients according to STOPP/START criteria, 48.1% of patients were prescribed benzodiazepine increasing their risk of falls.[18] Fortunately, In this study, prescribing medication that increases the risk of falls was minimal among the participants. Furthermore, inappropriate prescribing of proton pump inhibitors (PPIs) was not common in this study compared to other studies in the literature.[18] In this study, PPIs were prescribed for appropriate indications for gastrointestinal bleeding prophylaxis or gastrointestinal disorder treatment.[41]

Limitations and Strengths

This study is one of the few to investigate multiple drugs using the Palestine STOPP/START criteria. Moreover, the study did not exclude patients with multiple comorbidities, which are usually excluded from understanding more about STOPP/START in patients aged > 65 years.

However, the STOPP/START criteria do not cover all drug-drug interactions, such as antibiotics and supplements. In addition, the data collected did not include specific laboratory test values and treatment duration, which were needed for specific criteria such as renal system PIMs, which require GFR values. In addition, the hospital system does not include a complete patient medical record which is a problem in collecting data. This study only investigated patients admitted to the internal department, which may limit the generalizability of the results. Moreover, this was a retrospective study which is a limitation.

Conclusion

This study identified a high prevalence of PIPs among elderly patients during hospital admission and discharge. In addition, more than half of the geriatric patients in this study had PIP and a high prevalence of polypharmacy. Therefore, this study emphasizes the importance of adapting evidence-based tools such as the STOPP/START criteria to optimize patient medication therapy and guide prescribers in identifying and resolving drug-related problems.

Disclosure

The authors report no conflicts of interest in relation to this work.

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