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ORIGINAL RESEARCH ARTICLE

Appropriateness of Medication Prescribing in Hospitalized Older Adults in a Tertiary Teaching Hospital in the Philippines: A Cross-Sectional Study

Maria Stella T. Giron[1] · **Nelia P. Cortes-Maramba**[2]

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Abstract

Background The prescribing of potentially inappropriate medication (PIM) is a major health problem among older adults because of the high risk of adverse drug events. The number of older adults in the Philippines is increasing, and little is known about medication prescribing in this population.

Objectives Our objective was to determine the prevalence of and factors associated with PIM in older patients admitted to a tertiary teaching hospital.

Methods This was a cross-sectional study of patients aged ≥60 years admitted to a tertiary teaching hospital over a 3-month period. We used version 2 of the STOPP (Screening Tool of Older Persons' Prescriptions) criteria to identify PIM prescribing.

Results Included in this study were 328 older patients prescribed at least one medication; the median age was 65.5 years (interquartile range [IQR] 62–71), and 53.7% were women. The median number of medications prescribed was five (IQR 2–8). In total, 128 (39%) patients had at least one PIM, and the most common criterion was antimuscarinic/anticholinergic drug burden. PIM was significantly associated with polypharmacy (odds ratio 5.44; 95% confidence interval 1.54–19.20).

Conclusion The prevalence of PIM using STOPP version 2 was 39% in this sample of hospitalized older adults and was significantly associated with polypharmacy. There is a need to raise awareness about medication prescribing in the care and management of older patients.

Key Points

Potentially inappropriate medications (PIM) were identified in 39% of this sample of hospitalized older adults using the STOPP (Screening Tool of Older Persons' Prescriptions) criteria, and medications with anticholinergic properties accounted for the majority of PIM.

Increased education and awareness in the healthcare professions are needed to ensure safe and improved prescribing practices for older adults in the Philippines.

✉ Maria Stella T. Giron
mtgiron@up.edu.ph

Nelia P. Cortes-Maramba
pharmafaculty@gmail.com

[1] Institute on Aging, National Institutes of Health, University of the Philippines Manila, 623 Pedro Gil St., Ermita, 1000 Manila, Philippines

[2] Department of Pharmacology and Toxicology, College of Medicine, University of the Philippines, Manila, Philippines

1 Background

Older adults often present with chronic diseases and multiple comorbid conditions that require the prescription of a number of medications. Physiological changes brought about by aging may influence the pharmacokinetics and pharmacodynamics of medications and result in adverse drug reactions [1]. In addition, because older adults are often excluded from clinical trials, evidence is insufficient to guide prescribers on proper therapeutic decisions [2]. Prescribing for older adults therefore becomes a challenge and some prescriptions may not be appropriate.

Potentially inappropriate medication (PIM) has been defined as the prescription of medications for which the risks of potential adverse drug events (ADEs) outweigh the expected benefits in a patient [3]. PIM is an important public health problem because of the high prevalence and serious consequences in older adults [3]. Depending on the patient setting, PIM prevalence is reported to range from 18.5 to 82.6% in residential long-term care facilities [4], up to 98.2% in hospitals [5], and up to 86.2% [6] in primary care settings.

PIMs are associated with serious adverse events, such as falls [7], decreased quality of life [8] and ability to carry out activities of daily living [9], more frequent emergency visits and hospitalization [10, 11], and death [10]. Substantial medical expenditure has been reported with PIM [10].

To educate and aid clinicians in their choice of medications, explicit criteria for prescribing medications were developed [13, 14]. The STOPP (Screening Tool for Older Persons' Prescriptions) criteria, published in 2008 and updated in 2014, were formulated through a Delphi consensus method by a multidisciplinary team of 18 experts in geriatric pharmacotherapy from Ireland and the UK [15]. The STOPP criteria have been extensively used in several countries from different continents in both research and varied clinical settings [16]. Intervention studies showed STOPP to be effective in improving the quality of medication prescribing, decreasing adverse drug reactions [17] and recognizing patients requiring hospitalization following PIM-related ADEs [14].

As in the rest of the world, the proportion of older adults in the Philippines is increasing. Currently, adults aged ≥60 years account for 7.3% of the population, and this is projected to increase to 14.2% by 2050 [18]. The country has a mixed health system made up predominantly of the private sector. Patient out-of-pocket expenditure was 53.7% for total health and 85% for medications in 2014 [19, 20]. Under Philippine law, only physicians are allowed to prescribe, and there is no gatekeeping mechanism; patients are free to choose their own physicians, even specialists [19]. Visits to multiple physicians can therefore lead to prescription of multiple medications and to PIM.

PIM has become a global healthcare problem, particularly among older adults. This is evidenced by the number of tools developed to detect PIMs and numerous studies examining the prevalence of PIMs and related consequences. However, information regarding PIM in the Philippines is lacking. Recognizing medication-related problems is an important step in providing safer health outcomes for older Filipino adults. This study aims to determine the prevalence of and factors associated with PIM in older adults hospitalized in a tertiary teaching hospital.

2 Methods

2.1 Study Design, Setting, and Participants

This was a cross-sectional retrospective study conducted at a metropolitan tertiary teaching hospital in the Philippines. This study was approved by the Ethics Committee of the University of the Philippines Review and Ethics Board (2016-520-01).

The study population comprised patients aged ≥60 years who presented to the emergency department between 1 January and 31 March 2015 and were subsequently admitted to the hospital. A cut-off age of ≥60 years was chosen based on the World Health Organization (WHO) definition of older adults [21]. We excluded patients who were severely ill, were admitted to the intensive or coronary care units, had stage 4 cancer, or had a "do not resuscitate" order because the special type of management required in these areas meant that inappropriate medications may have been given by necessity.

Data were gathered from medical charts based on a list obtained from the medical records section. Two registered pharmacists independently reviewed and collected information on age, sex, medical diagnoses, and medications prescribed from the admission notes of the medical records. The data were reviewed and verified by the authors.

Medical diagnoses were categorized according to the *International Classification of Diseases and Related Health Problems, Tenth Revision* [22], and disease severity was assessed using the Charlson Comorbidity Index (CCI) [23]. Medications were classified according to the Anatomical Chemical Therapeutic classification system recommended by the WHO [24]. Polypharmacy was defined as the prescription of five or more medications [25].

We used version 2 of the STOPP criteria to determine exposure to PIM. These criteria are based on 80 PIMs categorized by physiological systems that predispose older adults to ADEs, including drug–drug interactions and drug duplications [18]. All medications listed in the STOPP criteria were reviewed and are marketed in the Philippines.

2.2 Analysis

Statistical analyses were performed using SAS university edition, version 5.2.6 (SAS Institute Inc., Cary, NC, USA). Descriptive statistics was used to summarize the population. Continuous variables were expressed as mean ± standard deviation or as median (interquartile range [IQR]) for nonparametric variables. Categorical variables were expressed as numbers or percentages. Pearson's Chi-squared tests or Fischer's exact tests were used to test for associations between categorical variables, and Student's *t* test or Mann–Whitney *U* tests were used to compare mean or median variables, respectively. Univariate analyses were used to identify the determinants (age, sex, number of medications, and severity of diseases) of PIMs. Multivariate regression analysis was conducted to identify the risk factors for PIM. The results are presented as odds ratios (ORs) with 95% confidence intervals (CIs). A 2-sided probability value of 0.05 was assumed.

3 Results

3.1 Subject Characteristics

The characteristics of the study population are shown in Table 1. The median age was 65.5 years (IQR 62–71), and 53.7% were female (Table 1). The number of medical diagnoses ranged from 1 to 12 (median 3; IQR 1–5), with the most common being hypertension (41.2%), heart failure (24.4%), atherosclerosis (21.6%), diabetes mellitus (20.4%), and cancer (17.1%). The median CCI score was one (IQR 0–2), and 22% had a score ≥2.

The number of prescribed medications ranged from 1 to 16 (median 5; IQR 2–8), with 198 (60.4%) patients prescribed five or more. The most commonly prescribed classes of medications were as follows: alimentary tract and metabolism (64.6%), cardiovascular system (56.7%), blood and blood-forming organs (49.1%), anti-infectives for systemic use (37.2%), and the nervous system (26.5%). Patients with PIM were significantly more likely to be prescribed medications for the cardiovascular system (atorvastatin, amlodipine, organic nitrates, captopril, and carvedilol), antithrombotics (acetylsalicylic acid, enoxaparin, and clopidogrel), and for constipation (lactulose) (Table 2).

3.2 Potentially Inappropriate Medication

Using STOPP version 2, we identified 146 PIMs in 128 (39.0%) patients: 87 (26.5%) patients had one PIM, 35 had two PIMs, five had three PIMs, and one had four PIMs. The most common criterion was antimuscarinic/anticholinergic drug burden (58.2%), followed by drugs affecting the central nervous system (11.6%), drugs that predictably increase the risk of falls (11.0%), and drugs affecting the cardiovascular system (10.3%) (Table 3). Diphenhydramine was the most commonly prescribed PIM (23.3%), followed by long-acting benzodiazepines and ranitidine (11% each), organic nitrates (10.3%), ipratropium bromide (9.6%), and neuroleptics (6.2%).

Age (OR 0.98; 95% CI 0.98–1.0) and sex (OR 0.82; 95% CI 0.53–1.53) were not associated with PIM, whereas polypharmacy (OR 11.1; 95% CI, 6.03–20.34) and increasing CCI (OR 1.83; 95% CI 1.49–2.23) were significantly associated with PIM (Table 4). Multivariate logistic regression analysis showed that the association between PIM and polypharmacy (OR 5.44; 95% CI 1.54–19.20) remained significant.

Table 1 Characteristics of the study population

Characteristic	*N* (%)
Age, mean (IQR)	65.5 (62–72)
Sex	
Female	176 (53.7)
Male	152 (46.3)
Diagnoses	
Hypertension	135 (41.2)
Congestive heart failure	80 (24.4)
Atherosclerosis	71 (21.6)
Diabetes mellitus	67 (20.4)
Cancer	56 (17.1)
Hypertensive heart disease	50 (15.2)
Coronary heart disease	46 (14.0)
Chronic kidney disease	40 (12.2)
Acute coronary syndrome	35 (10.7)
Cerebrovascular disease	31 (9.5)
Sepsis	16 (4.9)
Benign prostatic hyperplasia	15 (4.6)
CCI, median (IQR)	1 (0–2)
0	108 (32.9)
1	115 (35.1)
2	47 (14.3)
3	38 (11.0)
4	19 (5.8)
5	3 (0.9)
Medications, median (IQR)	5 (2–8)
1–4	130 (39.6)
5–9	138 (42.1)
≥10	60 (18.3)
Therapeutic class (ATC)	
Alimentary and metabolism	212 (64.6)
Blood and blood-forming organs	161 (49.1)
Cardiovascular system	186 (56.7)
Dermatologicals	4 (1.2)
Genitourinary system	30 (9.1)
Systemic hormonal preparations, excluding sex hormones	47 (14.3)
Anti-infectives for systemic use	122 (37.2)
Antineoplastic and immunomodulating agents	29 (8.8)
Musculo-skeletal system	14 (4.3)
Nervous system	87 (26.5)
Antiparasitic products, pesticides and repellents	0
Respiratory system	59 (18.0)
Sensory organs	15 (4.6)
Various	13 (4.0)

Data are presented as N (%), unless otherwise indicated

ATC Anatomic Therapeutic Chemical classification system, *CCI* Charlson Comorbidity Index, *IQR* interquartile range

Table 2 The most frequently prescribed medications among patients with and without potentially inappropriate medication

Medication	With PIM *N* (%)	Without PIM *N* (%)	*p* value
Atorvastatin	73 (55.3)	43 (21.9)	< 0.001
Lactulose	54 (40.9)	30 (15.3)	< 0.001
Acetylsalicylic acid	50 (37.9)	32 (16.3)	< 0.001
Clopidogrel	49 (37.1)	24 (12.2)	< 0.001
Omeprazole	44 (33.3)	53 (27.0)	0.22
Enoxaparin	44 (33.3)	22 (11.2)	< 0.001
Amlodipine	44 (33.3)	0	< 0.001
Organic nitrates	44 (33.3)	11 (5.6)	< 0.001
Captopril	32 (24.2)	5 (2.8)	< 0.001
Carvedilol	28 (21.2)	12 (6.1)	< 0.001

PIM potentially inappropriate medication

Table 3 Potentially inappropriate medication prescribing identified by the STOPP criteria

Criterion	*N* (%)
Any duplicate drug class prescription	5 (3.4)
Calcium channel blockers	5 (3.4)
Cardiovascular system	15 (10.3)
Loop diuretic as first-line treatment	11 (7.5)
Centrally acting antihypertensives	4 (2.7)
Central nervous system	17 (11.6)
Phenothiazines	1 (0.7)
First-generation antihistamines	16 (11.0)
Respiratory system	3 (2.0)
Antimuscarinic bronchodilators with a history of bladder outflow obstruction	3 (2.0)
Genitourinary system	2 (1.4)
Antimuscarinic drugs for chronic prostatism	2 (1.4)
Endocrine system	3 (2.0)
Sulphonylureas with a long duration of action	3 (2.0)
Drugs that predictably increase the risk of falls in older people	16 (11.0)
Benzodiazepines	12 (8.2)
Neuroleptic drugs	4 (2.7)
Antimuscarinic/anticholinergic drug burden	85 (58.2)

STOPP Screening Tool of Older Persons' Prescriptions

4 Discussion

This study showed that PIM, as identified by STOPP version 2, was prevalent in this sample of hospitalized older patients. Polypharmacy was significantly associated with PIM, and antimuscarinic/anticholinergic burden was the most common PIM.

Table 4 Factors associated with potentially inappropriate medication prescribing

	Unadjusted OR (95% CI)	*p* value	Adjusted OR[a] (95% CI)	*p* value
Age	0.98 (0.98–1.0)	0.361	0.98 (0.94–1.02)	0.247
Sex (female)	0.82 (0.53–1.53)	0.387	0.83 (49–1.38)	0.467
CCI	1.83 (1.49–2.23	< 0.001	1.14 (0.89–1.4)	0.287
Polypharmacy	11.1 (6.03–20.34)	< 0.001	5.44 (1.54–19.20)	< 0.001

CCI Charlson Comorbidity Index, *CI* confidence interval, OR odds ratio

[a]Adjusted for age and sex

The prevalence of PIM in this study was comparable to that reported in previous studies using STOPP version 2 in hospitalized older patients. PIM rates of 41.5% and 42.1% were reported in patients admitted to the medical department of a hospital in Spain [12] and to the Medical and Surgical Departments of a university hospital in Japan [26], respectively. The reported prevalences of PIMs in hospitalized older adults using the same version were higher in patients admitted to specialty wards of a tertiary hospital in Brazil (50%) [27], patients discharged from a geriatric teaching hospital in Belgium (56%) [28], patients discharged from a medical unit in the UK (59.1%) [29], cardiovascular patients admitted to a teaching hospital in Ethiopia (61.5%) [30], patients discharged from the cardiology and medicine departments of a university hospital in Albania (63%) [31], and patients requiring palliative care in a geriatric acute care hospital in Spain (88.5%) [32]. The timing of data collection (at admission or discharge), the units to which patients were admitted, and patient characteristics may have accounted for the discrepancies in PIM prevalence.

Polypharmacy was significantly associated with PIM, a finding similar to that in most PIM studies [24, 26, 27, 29]. Older patients are the largest consumers of medications because of multiple chronic conditions, multiple prescribers, and evidence-based guidelines recommending the use of more than one medication for the treatment of chronic conditions such as hypertension [33]. Multiple medications may be important in the management of multimorbid older patients, but it increases the risk of PIM and consequently the risk of ADE [17].

Most PIM studies in hospitalized older adults report that the most commonly prescribed PIMs are drugs affecting the central nervous system [11, 14, 26, 28]. In this study, the most common PIM criterion was antimuscarinic/anticholinergic drug burden. Diphenhydramine, a first-generation antihistamine, under the central nervous system criterion, was the second most common PIM. These two criteria have in common medications that possess anticholinergic properties. Our results present challenges concerning the risk of

prescribing anticholinergic medications and their adverse consequences. Older adults with concurrent multiple chronic diseases are prescribed medications for their anticholinergic activity and medications with unintended anticholinergic effects [34]. Because older adults have altered pharmacokinetics and pharmacodynamics, increased permeability of the blood–brain barrier, and multiple medications, they are very susceptible to the central and peripheral adverse effects of anticholinergic medications. A systematic review on the cumulative effects of anticholinergic medications reported an association with delirium, falls, physical and cognitive decline, and risk of dementia [35]. These consequences can lead to substantial burden of disease in older adults and a need for assistance with performing activities of daily living. Falls, cognitive decline, and dementia impose a substantial demand on health services and incur high healthcare costs. Physicians should be cognizant not only of the intended benefits but also, and more importantly, the adverse consequences of prescribing medications with anticholinergic properties in older adults.

This study examined the appropriateness of prescribing in older adults admitted to a tertiary teaching hospital in the Philippines. To the best of our knowledge, this is the first study on the appropriateness of medication prescribing using STOPP version 2 in hospitalized older patients in the Philippines. A previous study in another teaching hospital used the Beers 2012 criteria in older patients aged ≥65 years admitted to medical departments or to intensive care units and reported a higher PIM (49%) [36].

Our findings must be considered in light of some limitations. This study was conducted in a single tertiary teaching hospital, which precludes generalizability. A large prospective multicenter study is required to validate our findings. Data were collected retrospectively, no communication with physicians as to the rationale for prescribing a PIM was possible, and we may have underestimated the rate of PIMs not documented in medical records. Since the study was cross-sectional, causality of an association between the risk factors and PIM could not be established.

The results of this study convey the need to raise awareness about PIMs and educate healthcare professionals in the care and management of older patients. Lack of knowledge is reported to be the most common cause of prescribing error [37]. In the Philippines, only a handful of medical schools offer a course in geriatrics and geriatric medicine, as the specialty remains in its infancy. It was only in 2016 that the Commission on Higher Education, which is responsible for recommending policies and programs on higher education in the Philippines, included geriatric medicine in the medical curriculum [38]. Only a very few private hospitals in the country employ clinical pharmacists; in most hospitals, the pharmacist's role is limited to medication dispensing. Therefore, clinical pharmacists need to be included in the patient's healthcare team to collaborate with physicians in medication decision making and monitoring of patients for adverse drug reactions. Furthermore, adoption of electronic medical records in hospitals would enhance patient safety. Finally, the applicability of the STOPP criteria as a tool for education and prevention of ADRs should be investigated.

5 Conclusion

This study showed that PIM, using STOPP version 2, was prevalent in this sample of hospitalized older patients. The most common criterion was antimuscarinic/anticholinergic drug burden, and PIM was significantly associated with polypharmacy. We recommend that healthcare professionals are made aware of the problem of PIM and its consequences by providing the necessary education and in-depth training in prescribing for multimorbid older patients.

Author Contributions Conceptualization, writing—original draft preparation, funding acquisition, resources, and supervision: MSTG. Methodology, formal analysis, investigation, and writing—review and editing: MSTG and NPC-M.

Compliance with Ethical Standards

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Conflicts of Interest Maria Stella T. Giron and Nelia P. Cortes-Maramba have no conflicts of interest that might be relevant to the contents of this manuscript.

Ethics Approval This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Approval was granted by the Ethics Committee of University of the Philippines Review and Ethics Board (2016-520-01).

Data Availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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