Study on the Current Status of Potentially Inappropriate Medication Use in Community Elderly Patients in Hubei Province (Postprint)

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Abstract

Background As the population aging situation in China becomes increasingly severe, polypharmacy among older adults is becoming more prevalent, and potentially inappropriate medication use is widespread in the elderly population. Objective To investigate potentially inappropriate medication (PIM) and potential prescribing omissions in community-dwelling elderly patients using three different evaluation criteria, providing a basis for standardizing medication therapy management in older adults. Methods From April 2021 to June 2021, this study employed a cluster sampling method to select Wuhan, Yichang, Qianjiang, and Zhijiang in Hubei Province as sample areas, randomly selecting 3 streets or townships from each for a total of 12 communities as research units. Community-dwelling elderly patients meeting predefined inclusion and exclusion criteria were selected as study subjects. The Beers Criteria (2023 edition), the Screening Tool of Older Persons' Prescriptions/Screening Tool to Alert to Right Treatment (STOPP/START) criteria (2014 edition), and the Chinese PIM criteria for older adults (2017 edition) were comprehensively applied to analyze PIM and potential prescribing omissions in community-dwelling elderly patients in Hubei Province. Results A total of 1,011 community-dwelling elderly patients were included, comprising 420 males (43.08%) and 591 females (57.92%). Statistically significant differences were observed in the number of medications taken among patients of different genders, ages, and types of chronic diseases ($P<0.05$). Using the Beers Criteria (2023 edition), 294 patients (29.08%) were identified with PIM; using the STOPP/START criteria (2014 edition), 189 patients (18.69%) were identified with PIM, with a total of 229 prescribing omissions; using the Chinese PIM criteria for older adults (2017 edition), 296 patients (29.28%) were identified with PIM. The drug with the highest frequency of PIM detected by the Beers Criteria (2023 edition) was immediate-release nifedipine; the drug with the highest frequency of PIM screened by the STOPP/START

criteria (2014 edition) was nonsteroidal anti-inflammatory drugs, and the item with the highest frequency of prescribing omissions was type 2 diabetes not receiving metformin therapy; the drug with the highest frequency of PIM detected by the Chinese PIM criteria for older adults (2017 edition) was nifedipine. Conclusion The issues of PIM and prescribing omissions in the treatment process of community-dwelling elderly patients warrant attention, and medication therapy management for community-dwelling elderly patients needs to be strengthened. The three criteria can complement each other to a certain extent and can more comprehensively screen for PIM and prescribing omission issues.

Full Text

Study on Potentially Inappropriate Medication Use Among Community-Dwelling Elderly Patients in Hubei Province

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Abstract

Background: As China' s population ages, there is growing concern about the prevalence of polypharmacy among the elderly and the widespread phenomenon of potentially inappropriate medication (PIM) use in this demographic. **Objective:** To investigate PIM and potential prescription omissions among community-dwelling elderly patients using three different evaluation criteria, and to provide evidence for standardizing medication management in older adults. **Methods:** From April to June 2021, this study employed cluster sampling to select Wuhan, Yichang, Qianjiang, and Zhijiang in Hubei Province as sample areas. From each area, three streets or towns were randomly selected, yielding 12 communities as research units. Elderly patients in these communities who met pre-established inclusion and exclusion criteria were enrolled. The Beers Criteria (2023 edition), the Screening Tool of Older Person' s Prescriptions/Screening Tool to Alert doctors to Right Treatment (STOPP/START) criteria (2014 edition), and the Chinese Criteria for Potentially Inappropriate Medication Use in Elderly People (2017 edition) were comprehensively applied to analyze PIM and potential prescription omissions among community-dwelling elderly patients in Hubei Province. **Results:** A total of 1,011 elderly patients

were included, comprising 420 males (43.08%) and 591 females (57.92%). Statistically significant differences were observed in the number of medications taken among patients of different genders, ages, and chronic disease categories ($P<0.05$). Using the Beers Criteria (2023 edition), PIM was detected in 294 patients (29.08%). Using the STOPP/START criteria (2014 edition), PIM was detected in 189 patients (18.69%), with 229 instances of prescription omission identified. Using the Chinese criteria (2017 edition), PIM was detected in 296 patients (29.28%). The drug with the highest PIM frequency according to the Beers Criteria (2023 edition) was immediate-release nifedipine. According to the STOPP/START criteria (2014 edition), the drug with the highest PIM frequency was non-steroidal anti-inflammatory drugs (NSAIDs), while the most frequent prescription omission was metformin non-use in type 2 diabetes. The Chinese criteria (2017 edition) identified nifedipine as the drug with the highest PIM frequency. **Conclusion:** The problems of PIM and prescription omission in community-dwelling elderly patients warrant serious attention, and strengthened medication therapy management is needed for this population. The three criteria complement each other to some extent, enabling more comprehensive screening of PIM and prescription omission issues.

Keywords: Precision medicine; Medication review; Community elderly patients; Potentially inappropriate medication; Beers criteria; STOPP/START criteria; Chinese Criteria for Potentially Inappropriate Medication Use in Elderly People; Hubei province

Introduction

As physiological functions decline with age, elderly patients experience reduced drug metabolism capacity, leading to an increased risk of adverse drug reactions due to drug accumulation [1]. Concurrently, older adults often suffer from multiple chronic conditions requiring polypharmacy, which increases the likelihood of drug-drug interactions and further medication-related risks. Consequently, potentially inappropriate medication (PIM) use is prevalent among the elderly population [2]. The American Geriatrics Society Beers Criteria and the Screening Tool of Older Person' s Prescriptions/Screening Tool to Alert doctors to Right Treatment (STOPP/START) criteria are currently the most widely used tools for evaluating inappropriate medication use in older adults. Additionally, Chinese scholars have published the Chinese Criteria for Potentially Inappropriate Medication Use in Elderly People (2017 edition) [3-5]. These criteria are developed based on pharmacological risks, clinical indications, patient comorbidities, and other factors, gradually transitioning from a drug-focused to a patient-centered approach [6]. Furthermore, studies have found that PIM is closely associated with falls, delirium, cognitive decline, and increased hospitalization rates in older adults [7]. Therefore, scholars advocate for pharmaceutical interventions, comprehensive assessments, and prescription optimization to reduce PIM occurrence [8]. Overall, although China has made progress in PIM

research and interventions, assessment tools remain imperfect compared with developed countries, and practical application requires further promotion, particularly regarding standardized medication management in community healthcare settings [9]. This study aims to evaluate PIM status among 1,011 community-dwelling elderly patients in Hubei Province using the Beers Criteria (2023 edition), STOPP/START criteria (2014 edition), and Chinese PIM criteria (2017 edition), providing a reference for medication therapy management and rational drug use in community-dwelling older adults.

Methods

1.1 Study Subjects From April to June 2021, this study employed cluster sampling to select Wuhan, Yichang, Qianjiang, and Zhijiang in Hubei Province as sample areas. From each area, three streets or towns were randomly selected, yielding a total of 12 communities as research units. Community-dwelling elderly patients who met pre-established inclusion and exclusion criteria were enrolled as study subjects. Inclusion criteria were: (1) diagnosed with at least one chronic condition (hypertension or diabetes) according to clinical diagnostic standards; (2) chronic disease medication use for $ $3 months; (3) long-term residence within the jurisdiction of community health service stations; (4) age $ $60 years; (5) clear consciousness and ability to express thoughts correctly; and (6) informed consent and willingness to participate. Exclusion criteria were: inability to communicate effectively; acute complications; severe illness preventing survey completion; and unwillingness to cooperate [10]. This study was approved by the Medical Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology, and all participants signed informed consent forms [Ethics approval number: 2020(S223)].

1.2 Research Tools **1.2.1 Instruments.** (1) General Information Questionnaire: 主要包括 age, gender, disease conditions, total number of medications, and medication information. (2) Community Elderly Patient PIM Evaluation Tools: The American Geriatrics Society Beers Criteria (2023 edition), which includes 8 major categories comprising 36 criteria for medications that older adults should avoid, and 38 medications or drug classes that should be used with caution or avoided in specific diseases or syndromes [4]. The STOPP/START criteria (2014 edition), consisting of two components: the Screening Tool of Older Person' s Prescriptions (STOPP), which includes 13 major categories with 81 criteria for inappropriate medication use, and the Screening Tool to Alert doctors to Right Treatment (START), which lists 34 medication regimens that are commonly omitted [3]. The Chinese Criteria for Potentially Inappropriate Medication Use in Elderly People (2017 edition), which includes 13 major categories covering 72 medications/classes that older adults should avoid, and 44 medications/classes in 7 disease states [5].

1.2.2 Survey Process and Quality Control. Before the formal survey, investigators received standardized training and provided uniform instructions and

guidance to all participants. Specifically, investigators explained the study' s purpose, significance, content, confidentiality principles, and voluntary participation. Participants decided whether to enroll after fully understanding the survey content and their rights, and signed informed consent forms. Given that study subjects were elderly patients with potential educational limitations, a question-and-answer interview method was used to avoid information distortion due to comprehension errors. Trained investigators asked questions based on the uniformly designed questionnaire and recorded responses on-site to ensure data accuracy and consistency. When participants had questions or confusion, investigators provided explanations according to standardized survey guidelines, ensuring that explanations did not influence responses or introduce information bias. All explanations were provided without altering the original meaning. Completed questionnaires were collected immediately and checked on-site for missing items, legibility, and logical errors. If issues were identified while participants were still present, investigators immediately asked for supplementation or correction to ensure data integrity and validity. Questionnaires were considered invalid if: (1) key items were missing (e.g., basic demographic or medication information); (2) multiple logical contradictions or skip-pattern errors could not be reasonably resolved; or (3) participants reported difficulty understanding the questionnaire or refused to answer. For subsequent quality control and traceability, all questionnaires were independently verified by two individuals before data entry and stored using a unified coding system.

1.3 Statistical Methods Microsoft Office Excel 2016 was used to extract relevant information and establish the database. SPSS 24.0 software was used for data processing and analysis. Normally distributed continuous data were expressed as ($\bar{x}\pm s$), and comparisons between groups were performed using independent samples t-tests and one-way analysis of variance. Categorical data were expressed as relative frequencies, with $P<0.05$ considered statistically significant.

Results

2.1 Basic Characteristics of Community-Dwelling Elderly Patients A total of 1,011 elderly patients were included, comprising 420 males (43.08%) and 591 females (57.92%). Age distribution was: 450 cases (44.51%) aged 60-69 years, 453 cases (44.81%) aged 70-79 years, 103 cases (10.19%) aged 80-89 years (very old), and 5 cases (0.49%) aged $ 90$years(extremelyold), withameanageof(68.56\pm8.62)years.Participantshadanaverageof(2.07\pm\$1.15)$ disease diagnoses. Specifically, 322 cases (31.85%) had one chronic disease, 394 cases (38.97%) had two comorbidities, and 295 cases (29.18%) had $ $3comorbidities.Thethreemostcommondiagnoseswerehypertension(906cases, 89.61\pm\$2.16)$. Specifically, 809 cases (80.02%) took 1-4 medications, 192 cases (18.99%) took 5-9 medications, and 10 cases (0.99%) took $ $10 medications (maximum: 18). Most patients primarily used Western medications, supplemented by traditional Chinese medicine (TCM) or Chinese patent medicines. TCM or Chinese patent

medicines were used by 281 cases (27.79%), and health supplements by 84 cases (8.30%). Statistically significant differences were observed in the number of medications taken among patients of different genders, ages, and chronic disease categories ($P<0.05$), as shown in Table 1 .

2.2 PIM Status in Community-Dwelling Elderly Patients Among the 1,011 community-dwelling elderly patients, the Beers Criteria (2023 edition) identified PIM in 294 cases (29.08%), with 390 total PIM instances. Specifically, 230 cases (78.23%) had one PIM, 35 cases (11.90%) had two PIMs, 26 cases (8.84%) had three PIMs simultaneously, and 3 cases had four PIMs simultaneously.

The STOPP/START criteria (2014 edition) identified PIM in 189 cases (18.69%), with 231 total PIM instances. The majority (162 cases, 85.71%) had one PIM, while only 2 cases had four PIMs simultaneously.

The Chinese PIM criteria (2017 edition) identified PIM in 296 cases (29.28%), with 318 total PIM instances. Specifically, 274 cases (92.57%) had only one PIM, and 22 cases had two PIMs. PIM screening results across the three criteria are shown in Table 2 .

2.2.1 PIM Assessment Using the Beers Criteria (2023 Edition). The Beers Criteria (2023 edition) identified 390 PIM instances related to inappropriate drugs. The drug with the highest PIM frequency was immediate-release nifedipine (192 cases, 49.23%), as shown in Table 3 . PIM related to drug-disease interactions totaled 60 cases, detailed in Table 4 , with the highest frequency being NSAIDs and COX-2 inhibitor use in heart failure (37 cases). PIM requiring cautious use in older adults totaled 76 cases, with diuretic use accounting for 74 cases (97.37%) (Table 5). Drug-drug interactions accounted for 7 cases, primarily involving anticholinergic drug interactions, peripheral $ $1-blocker and loop diuretic interactions, and corticosteroid-NSAID interactions (Table 6).

2.2.2 PIM Assessment Using the STOPP/START Criteria (2014 Edition). The STOPP component identified 231 instances of potentially inappropriate prescribing among community-dwelling elderly patients, involving 8 criteria. The top three most frequent criteria were: NSAID use in moderate-to-severe hypertension (159 cases, 68.83%), NSAID use in heart failure (37 cases, 16.02%), and NSAID use in patients with a history of peptic ulcer or gastrointestinal bleeding without concurrent H2-receptor antagonist, proton pump inhibitor, or misoprostol (14 cases, 6.06%), as shown in Table 7 .

The START component identified 229 instances of prescription omission, with the most frequent omission being metformin non-use in type 2 diabetes, as shown in Table 8 .

2.2.3 PIM Assessment Using the Chinese PIM Criteria (2017 Edition). The Chinese PIM criteria (2017 edition) identified 318 PIM instances among community-dwelling elderly patients. The top three most frequently in-

appropriate drugs were nifedipine (213 cases, 66.98%), clopidogrel (33 cases, 10.38%), and reserpine (25 cases, 7.86%), as shown in Table 9 . PIM in disease states totaled 104 cases, involving 9 criteria. The top three most frequent were: NSAID use in heart failure (45 cases, 43.27%), reserpine use in hypertension (23 cases, 22.12%), and NSAID use in patients with a history of peptic ulcer (14 cases, 13.46%), as shown in Table 10 .

Discussion

One-way ANOVA of the relationships among gender, age, chronic disease categories, and number of medications in 1,011 community-dwelling elderly patients in Hubei Province revealed that the number of medications increased with age, and patients with $ $2 chronic conditions took significantly more medications than those with only one chronic condition.

The results demonstrate a high prevalence of PIM among community-dwelling elderly patients in Hubei Province, requiring attention from community healthcare institutions. The PIM prevalence rates identified using the Beers Criteria (2023 edition), STOPP/START criteria (2014 edition), and Chinese PIM criteria (2017 edition) were 29.08%, 18.69%, and 29.28%, respectively.

Domestically, Yang et al. [11] used the Beers Criteria (2015 edition) to screen 216 community-dwelling elderly patients aged $ $65 years in Beijing, reporting a PIM prevalence of 26.4%, which is lower than our findings using this standard. This discrepancy may be due to differences in patient age and Beers Criteria versions. Additionally, Chen et al. [13] used the STOPP/START criteria (2014 edition) and Chinese PIM criteria (2017 edition) to screen 795 community-dwelling elderly patients in Beijing, reporting PIM prevalence rates of 18.5% and 28.9%, respectively, which are similar to our results.

Internationally, studies using Beers Criteria (2003-2012 editions) have reported PIM prevalence rates of 18.3%-87.3% in elderly patients [14-15], while STOPP/START criteria (2014 edition) studies have reported rates of 21.4%-41.2% [14,16]. These rates are generally higher than our findings and domestic studies, possibly due to differences in study populations, regions, and medication practices across countries.

Our study found that the Chinese PIM criteria (2017 edition) identified the highest PIM prevalence, followed by the Beers Criteria (2023 edition), with the STOPP/START criteria (2014 edition) identifying the lowest rate. This may be because the Chinese criteria are more tailored to medication practices among Chinese elderly, yielding higher sensitivity in PIM detection. Regarding the Beers Criteria and STOPP/START criteria (2014 edition), numerous studies have reported higher PIM prevalence with Beers than with STOPP/START [17-18], consistent with our findings. This may be because STOPP/START criteria (2014 edition) use a more detailed and practical physiological system-based organization, while our data collection did not capture all physiological conditions in detail, categorizing diseases into single conditions only. Therefore, detailed

matching of cases to STOPP/START criteria may have been limited. Additionally, the Beers Criteria are updated more frequently than STOPP/START (2014 edition), making them more aligned with current medication practices in older adults. Comparison of drug-disease interaction PIMs identified by Beers and STOPP/START criteria (2014 edition) revealed low content overlap, suggesting these criteria are often used jointly in PIM assessment studies to guide rational medication use in older adults [1,19-22].

Among PIMs identified by the three criteria, immediate-release nifedipine was the most frequent drug according to the Beers Criteria (2023 edition); NSAIDs were the most frequent drug class according to STOPP/START criteria (2014 edition); and metformin non-use in type 2 diabetes was the most frequent prescription omission. The Chinese PIM criteria (2017 edition) also identified nifedipine as the most frequent PIM drug. These medications are commonly used in older adults, and healthcare professionals should strengthen clinical observation and evaluation of their use.

All three criteria identified NSAID use in heart failure and in patients with a history of peptic ulcer as PIM issues. STOPP/START criteria (2014 edition) and Chinese PIM criteria (2017 edition) also identified NSAID use in hypertension as a PIM issue. NSAIDs should be used cautiously in older adults because decreased hepatic CYP2C9 metabolism increases the risk of gastrointestinal adverse events [23]. For patients at high cardiovascular risk who require NSAID therapy, celecoxib or naproxen may be used, though celecoxib, as a COX-2 inhibitor, has also been included in the Beers Criteria (2023 edition). Therefore, elderly patients with high cardiovascular risk, hypertension, and gastrointestinal risk require particularly careful consideration when using these drugs [24].

This study evaluated the PIM status of community-dwelling elderly patients in Hubei Province using three criteria, providing a reference for community healthcare workers in prescribing and prescription review. Community healthcare professionals should receive training on common PIM issues in older adults to promote rational drug use, reduce inappropriate medication risks, and prevent adverse drug reactions, thereby ensuring medication safety in elderly patients.

Limitations: This study used only three commonly employed PIM criteria and may not have captured all PIM scenarios. For example, 281 participants used TCM or Chinese patent medicines, yet none of the three criteria address TCM evaluation. TCM use is common among Chinese elderly, and reports of adverse reactions and drug interactions related to TCM have been increasing [25-27]. Therefore, the potential inappropriate risks of TCM use in older adults warrant further investigation.

Author Contributions

ZOU Jian was responsible for study conception and design, implementation, and manuscript writing. LI Wanping, GE Handa, and JIN Zhe contributed to data collection and organization, statistical analysis, and table preparation.

RUFEINA · Tuerxun, LI Juan, and WEI Anhua participated in manuscript revision. FENG Da was responsible for quality control and review of the article and assumes overall responsibility for the work.

Conflict of Interest: None declared.

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Note: Figure translations are in progress. See original paper for figures.