Indonesian Journal of Pharmacy and Natural Product
http://jurnal.unw.ac.id/index.php/ijpnp
Volume 08 Nomor 02 , September 2025
p-ISSN : 2656-3215
e-ISSN : 2615-6903

Mapping the Prevalence and Most Common Types of Potentially Inappropriate Medications (PIMs) in Older Adults with Polypharmacy: A Decade-Long Scoping Review in Nursing Home Settings

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ABSTRACT

Polypharmacy among older adults significantly influences the prevalence of potentially inappropriate medication (PIMs). Most existing studies have focused on community-dwelling older adults and primary health care settings. However, a comprehensive overview of the use of PIMs among older adults in nursing homes is still lacking. This study aimed to map the scientific evidence regarding the prevalence and most commonly reported PIMs in nursing homes. This scoping review was conducted based on a literature search of four electronic databases on July 29, 2025. We included observational studies published in English that reported the prevalence and types of PIMs in older adults residing in nursing homes. A total of 1,030 records were identified, and 13 studies fulfilled the inclusion criteria. The prevalence of PIM among older adults in nursing homes varied widely, ranging from 27.2% to 96.3%. Benzodiazepines and proton pump inhibitors were the most frequently reported PIMs. All the included studies were conducted in middle- and high-income countries. Future research should address the geographical evidence gap by conducting studies in underrepresented regions, particularly in low- and middle-income countries, to improve the generalizability of the findings.

Keywords: *Nursing Homes; Older Adults; PIM; Potentially Inappropriate Medication; Polypharmacy*

INTRODUCTION

The older adult population has grown significantly over the years, reaching 494.4 million people worldwide (Chen et al., 2025). Older adults are often considered a vulnerable population (Preston & Biddell, 2021), with vulnerability often attributed to social risks such as poverty, childlessness, frailty, and social isolation. Recent perspectives have emphasized their susceptibility within the healthcare context, particularly regarding medication management and safety, and have suggested approaches to address all necessary (Grimes et al., 2023; Langmann, 2023)

Considering the complexity of the healthcare needs of vulnerable older adults, particularly in relation to medication management, the role of healthcare settings emerges as a critical component of therapy effectiveness and patient safety. In addition to primary healthcare facilities, older adults also receive healthcare services at nursing homes. In addition to providing personal care facilities for the daily needs of older adults, nursing homes also play a role in providing long-term health care. Nursing homes provide routine wound care, psychosocial interventions, health monitoring, and medication management (Heiks & Sabine, 2022).

Submitted: 2025-01-15 Revised : 2025-08-28 Accepted : 2025-08-04

Health services in nursing homes face considerable challenges. Studies have shown that older adults in nursing homes are at a higher risk of experiencing polypharmacy and drug-related problems than community-dwelling older adults. A study in Italy found that the prevalence of polypharmacy reached 80.3% among nursing home residents compared to 16.1% among community-dwelling older adults, with 53.7% of cases involving drug-drug interactions compared to 26.4% (Burato et al., 2021). A study in South Korea also showed a higher prevalence of potentially inappropriate medication (PIM) in nursing homes (86.8%) than in the community (75.4%). Nursing home residents have 1.84 times the risk of experiencing PIM compared to community-dwelling older adults (Lee et al., 2022).

Based on a systematic review, the most common drug-related problem experienced by older adults is drug selection or potentially inappropriate medication (PIM) (Plácido et al., 2020). The prevalence of inappropriate medication use in older adults is high (27.4%), and Polypharmacy is a major contributing factor (AOR: 2.01, 95% CI: 1.51, 2.69) (Abdu et al., 2025). Older adults tend to suffer from multiple chronic diseases (multimorbidity), such as hypertension, diabetes, heart disease, and chronic pain. Each of these conditions requires its own pharmacological therapy. The accumulation of medications for various diagnoses is the primary cause of polypharmacy (Junius-Walker et al., 2021).

Considering these findings, older adults living in nursing homes face more health challenges, particularly in terms of complex medication use or polypharmacy and a high risk of potentially inappropriate medication. Although several studies have addressed the issue of polypharmacy and potentially inappropriate medications, most have focused on older adults living in the community or primary health care settings. Evidence specifically examining the older adult population in nursing homes remains limited and scattered.

A comprehensive mapping of the existing literature is needed to understand the prevalence and characteristics of potentially inappropriate medication have been studied in older adults in nursing homes. This study was conducted using a scoping review approach, with the aim of mapping the available scientific evidence regarding the prevalence and most common potentially inappropriate medication among the older adults in nursing homes, as well as identifying existing research gaps in this area.

METHODS

Inclusion Criteria

This scoping review followed the Joanna Briggs Institute (JBI) methodological guidelines (Peters M et al., 2020). This review focused on identifying the prevalence and most common potentially inappropriate medications (PIMs) among older adults with polypharmacy in nursing homes. We included only observational studies published between 2014 and 2024. Eligible studies were peer-reviewed, written in English, and based on evidence-based scientific methods. Gray literature was excluded from the study. The review protocol was developed in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Review) guidelines (Tricco et al., 2018).

Search Strategy

A literature search was conducted using the following Boolean terms: (“Polypharmacy”) AND (“nursing home” OR “nursing house”) AND (“potentially inappropriate medication” OR “PIM”). The search was performed on July 29, 2025, across four electronic databases: PubMed, Scopus, ProQuest, and Cochrane Library. The details of the search strategy and study selection process are illustrated in Figure 1.

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e-ISSN : 2615-6903

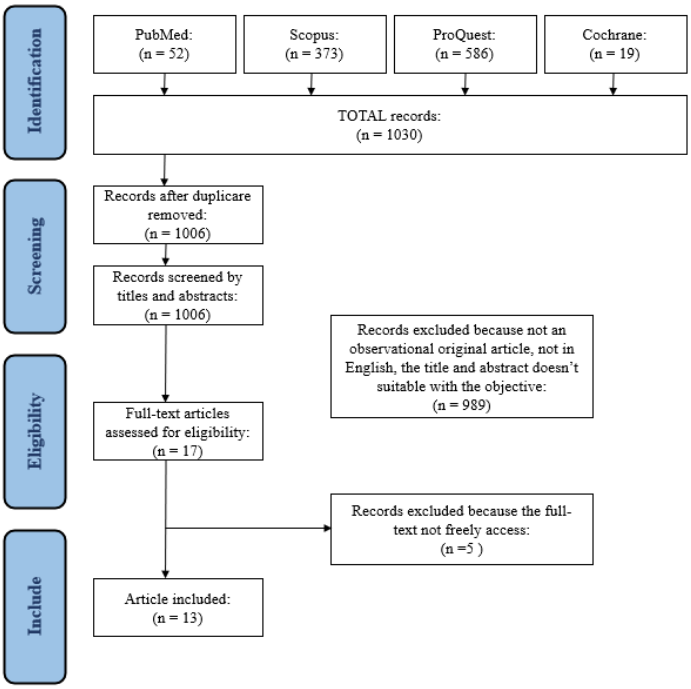

Figure 1. Flowchart of Selection Process for Including Studies in the Scoping Review

Eligibility Criteria and Data Selection

After conducting the database search, all records were imported into reference management tools, Mendeley Reference Manager. The initial screening of titles and abstracts was conducted by the first author, and subsequently cross-checked by another author to ensure accuracy and consistency. Duplicate records were identified and removed from the study. The articles were then screened by title and abstract, followed by a full-text assessment. Studies were eligible if they reported the prevalence and types of PIMs among older adults in nursing home settings. The exclusion criteria were as follows: 1) non-original observational research (e.g., reviews, case reports, conference abstracts, proceedings, or editorials); 2) studies not conducted in nursing home settings; 3) articles not available in English; and 4) full texts that could not be accessed.

Data Extraction and Synthesis

Data extraction was conducted based on the JBI methodological framework (Peters M et al., 2020). The extraction process variables included author(s), year of publication, country, study setting, instrument used to identify PIMs, reported PIM prevalence, and the most common PIMs identified. The key characteristics of the included studies are listed in Table 1.

Table 1 Key Features of Studies Included in the Final Review

Article	Setting	Instrument for Detecting PIM	PIM Prevalence	Most Common PIM Found
(Alves-Conceição et al., 2017)	125 residents at three long-term care facilities in northeastern Brazil	Beers Criteria 2012	31.7%	Acetylsalicylic acid used

Article	Setting	Instrument for Detecting PIM	PIM Prevalence	Most Common PIM Found
(Allegri et al., 2017)	860 residents at a nursing home in Lombardy, Italy	Beers Criteria 2012	44,4%	Benzodiazepines and antipsychotics
(Anrys et al., 2018)	1410 residents at 54 nursing homes in Belgium	Combination of STOPP Criteria Ver.2 and Beers Criteria 2015	88.3%	Benzodiazepines used
(Caçador et al., 2022)	193 residents at nursing homes in Viseu district, Portugal	Beers Criteria 2019	79,3%	Short-acting benzodiazepines
(Chae et al., 2023)	20,306 NH residents recorded from national senior cohort database in South Korea	1. Korean Medication Review Tool 2. Beers Criteria 2019	1. 89.3% 2. 67.9%	1. Proton pump inhibitor (PPI) 2. Ketorolac
(Díez et al., 2022)	218 residents at nursing homes located in Leon Region, Spain	1. STOPP Criteria Ver. 2 2. Beers Criteria 2019 3. PRISCUS List	1. 96.3% 2. 90.8% 3. 35.3%	1. Benzodiazepines ≥4 weeks 2. Combination of three or more CNS-drug 3. Sedative and hypnotic agents
(Drusch et al., 2023)	274,971 residents at seven nursing homes in France	Beers Criteria 2019	54.3%	Hypnotic drugs
(Hanlon et al., 2015)	1303 veteran living on Veteran Affairs Community Living Center, USA	Beers Criteria 2012	27.2%	Antipsychotics
(Herr et al., 2017)	30,702 residents at 451 nursing homes in France	The French List Laroche	47.4%	Benzodiazepines used
(Jankyova et al., 2020)	459 residents at nusing homes in Slovak Republic	EU (7)-PIM List	90.6%	Proton pump inhibitor (PPI)
(Koçak et al., 2022)	225 residents at a nursing home in Turkey	STOPP Criteria Ver. 2	47.6%	Proton pump inhibitor (PPI)
(Maclagan et al., 2017)	41,351 residents at nursing homes located in Ontario, Canada	Beers Criteria 2015	44%	Benzodiazepines used

Submitted: 2025-01-15 Revised : 2025-08-28 Accepted : 2025-08-04

Article	Setting	Instrument for Detecting PIM	PIM Prevalence	Most Common PIM Found
(Plácido et al., 2022)	210 residents from four nursing homes at Central Region of Portugal	EU (7)-PIM List	86.4%	Proton pump inhibitor (PPI)

RESULTS

Study Selection

A total of 1,030 studies were initially identified through database searches: 52 from PubMed, 373 from Scopus, 586 from ProQuest, and 19 from Cochrane databases. After removing duplicates, 1,006 studies remained for further screening. Following title, abstract screening, and full-text assessment for eligibility, 13 articles met the inclusion criteria and were included in this scoping review, as illustrated in the PRISMA flowchart in Figure 1.

Study Characteristic

The included studies were published between 2014 and 2023 and primarily involved older adults residing in nursing homes. Most studies were conducted in Europe (n=9), including two each from France and Portugal, and one each from Italy, the Slovak Republic, Belgium, Spain, and Turkey. From the Americas, three studies were identified, one each from the United States, Canada and Brazil. Only one study was conducted in Asia, specifically in South Korea. The sample sizes varied considerably across the studies, ranging from 193 to 274,971 nursing home residents. The characteristics of each study included in this scoping review are summarized in Table 1.

Potentially Inappropriate Medication Review

Each study used different tools to assess potentially inappropriate medications (PIMs). The most commonly used tools were the Beers Criteria (2012, 2015, or 2019 versions) and the STOPP Criteria Version 2. The prevalence of PIM among older adults with polypharmacy in nursing homes varied widely, ranging from 27.2% to 96.3%. The highest prevalence was reported in a study from Spain (96.3%) (Díez et al., 2022), followed by the Slovak Republic (90.6%) (Jankyova et al., 2020) and South Korea (89.3%) (Chae et al., 2023). The lowest prevalence was found in the United States (27.2%) (Hanlon et al., 2015).

Benzodiazepines and proton pump inhibitors (PPIs) were the most frequently reported potentially inappropriate medications (PIMs). Benzodiazepines were commonly cited in studies from Europe and North America (including Italy, Belgium, Portugal, France, the United States, and Canada). PPIs were more frequently reported in studies from South Korea, the Slovak Republic and Portugal.

DISCUSSION

This scoping review aimed to map the prevalence and most common types of potentially inappropriate medications (PIMs) among older adults with polypharmacy in nursing home settings. This study reviewed articles from the last decade. We chose studies published between 2014 and 2024 for the following reasons: 1) Many PIM screening tools, such as the Beers and START criteria, are regularly updated (O'Mahony et al., 2014; Resnick & Pacala, 2012). The cutoff likely aligns with a major update of these criteria, ensuring studies used contemporary guidelines for PIM identification and comparison; 2) The prevalence of PIM

drastically increased from 2013 (Riester et al., 2023). 3) 3) The use of electronic medical administration records like MCSS the Medical and Care Support System (MCSS), has drastically increased over the past decade (Malin & Graf, 2016). All of these reasons provide a current snapshot of PIM prevalence and types, making recent studies more relevant to their research objectives.

Given the objective of this scoping review to map the prevalence and patterns of potentially inappropriate medication use among older adults in nursing homes, randomized controlled trials (RCTs) and any other experimental studies were excluded. RCTs typically assess the efficacy of interventions in highly controlled settings that may not reflect real-world prescribing patterns or population characteristics. In contrast, observational studies offer more representative data on actual medication use in clinical practice and are more appropriate for capturing the scope and variability of the issue within this specific care setting.

Thirteen observational studies met the inclusion criteria, with the majority conducted in European countries. No studies were identified from Africa, the Middle East, Southeast Asia, or low-to-middle-income countries, indicating a significant geographical evidence gap. The prevalence of PIMs among the included studies varied widely, ranging from 27.2% to 96.3% in the included studies. The lowest prevalence was reported in the USA, while the highest was reported in Spain. Several factors may explain this variation. First, differences in the tools or instruments used to detect PIMs (Beers Criteria, STOPP Criteria, EU (7)-PIM List, PRISCUS List, and national tools such as the Korean Medication Review Tool). The Beers criteria identified a greater number of PIMs (Zhu et al., 2025). Detection with the STOPP Criteria Version shown 96,3% PIM among the respondents, Beers Criteria 2019 (90,8%), and PRISCUS List (35,3%) (Díez et al., 2022). Beers and START criteria showed different numbers of PIM. The Beers Criteria effectively identifies a wide spectrum of medication-related risks in older adults. Meanwhile STOPP Criteria identify clinically contextualized concerns (Zhu et al., 2025). Second, healthcare system characteristics, prescribing culture, and facilities could have contributed to the differences.

Differences in the healthcare system and prescribing culture may have affected the most common PIM. Certain drug classes were consistently identified as the most common PIMs in older adults. Benzodiazepines have been frequently reported in Europe and North America. Proton pump inhibitors (PPIs) also emerged as a frequent PIM in studies from South Korea, the Slovak Republic, and Portugal. These findings show that benzodiazepines and PPIs used in older adults should be a concern.

Benzodiazepines should be avoided. The use of benzodiazepines exposes users to the risks of abuse, misuse, and addiction. Concomitant use of opioids may result in profound sedation, respiratory depression, coma and death. Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting drugs. All benzodiazepines increase the risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes in older adults (American Geriatrics Society, 2023). Proton pump inhibitors should also be avoided. PPIs used for more than 8 weeks in older adults can increase the risk of dementia, hypomagnesemia, vitamin B12 deficiency, Clostridium difficile infection, pneumonia, GI malignancies, renal function impairment, osteoporosis, and fractures (Condur et al., 2025).

PIMs in older adults are strongly associated with an increased risk of hospitalization, prolonged length of stay, and higher medical costs (Henschel et al., 2015; Jenghua et al., 2025). Polypharmacy is the primary contributor to PIMs in older adults (Samara et al., 2023). Polypharmacy is defined as the concurrent use of five or more medications (Krustev et al., 2022). This often occurs because of the presence of multiple chronic conditions in older adults, each requiring its own pharmacological treatment. However, the accumulation of medications

can increase the number of drugs that are no longer necessary or appropriate (Junius-Walker et al., 2021).

Effective Polypharmacy management can be achieved through deprescribing, a systematic process of tapering, discontinuing, or substituting medications that are potentially harmful or no longer beneficial (Onder et al., 2019). This approach should be guided by a combination of PIMs detection tools (such as STOPP and Beers criteria), trigger tools, and the competency of healthcare professionals (Atmaja et al., 2024). Therefore, routine PIM detection in nursing home residents must be performed regularly to improve the safety of older adults. The geographical distribution of the studies reveals a disproportionate focus on high-income Western countries. These countries have established healthcare infrastructure and systems. Low-middle income countries nursing homes may differ in terms of medication availability, access to clinical pharmacists, and prescribing patterns (Tiraphat et al., 2021). The absence of studies from other regions, such as Southeast Asia, is concerning, given the region's rapidly aging population. Another possible factor that may contribute to the differences observed between high-income countries and low- and middle-income countries is the knowledge level of healthcare professionals. Variations in knowledge and training could influence prescribing patterns, medication management, and the implementation of interventions in nursing homes. Unfortunately, most of the included studies did not report data on the educational background or knowledge level of staff. Future research should aim to close the geographical evidence gap by conducting studies in underrepresented regions, such as Southeast Asia, Africa, Oceania, and low-to-middle income countries and explore the association between staff knowledge levels and the occurrence of potentially inappropriate medication use in nursing homes. Qualitative studies exploring prescriber behavior, barriers to deprescribing, and nursing home policies may also provide deeper insights into the causes of inappropriate medication use.

CONCLUSION

This scoping review highlights the significant prevalence of potentially inappropriate medications (PIMs) among older adults with polypharmacy residing in nursing homes, with rates varying widely from 27.2% to 96.3%. Benzodiazepines and proton pump inhibitors (PPIs) were the most frequently reported PIMs, raising concerns about their use among older adults, particularly those in nursing homes. Differences in screening tools, healthcare systems, and prescribing practices likely contribute to the variability in PIM prevalence across studies. The evidence base is geographically skewed, with most studies conducted in high-income Western countries and a lack of data from low- and middle-income countries or regions, including Africa and Southeast Asia. Future research should aim to address this gap through regionally diverse studies and deeper investigations into prescribing behavior and medication safety in nursing home settings.

ACKNOWLEDMENTS

We would like to thank the PUI-PT Center of Excellence for Patient Safety and Quality Universitas Airlangga for the research funding.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

Please write the contribution of each author here or mark in the following column.

☑ The authors made substantial contributions to the conception and design of the study

☑ The authors took responsibility for data analysis, interpretation and discussion of results

☑ The authors read and approved the final manuscript

Funding
PUI-PT Center of Excellence for Patient Safety and Quality Universitas Airlangga

Availability of data and materials
☑ All data are available from the authors

Competing interests
☑ The authors declare no competing interest

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Submitted: 2025-01-15 Revised : 2025-08-28 Accepted : 2025-08-04

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