Geriatric Medication Management Using STOPP/START Criteria on Polypharmacy in a Multicentre Hospital: A Systematic Review

Sneha Gowthaman[1*]; Dr. C. Dhandapani[1]

Department of Pharmacy Practice, KMCH College of Pharmacy, Coimbatore, Tamil Nadu, India

Corresponding Author:
Sneha Gowthaman

Abstract:

➤ *Background:*

   Patients 65 years of age and above are known as a special risk group for drug prescribing. They face high challenges like multi-comorbidities, polypharmacy, Potentially Inappropriate Prescribing, and the increasing risk of adverse drug reactions. The Screening Tool to Alert Doctors to the Right Treatment (START) and the Screening Tool for Older Persons's Prescriptions (STOPP) criteria are widely used to detect Potentially Inappropriate Prescribing (PIM) and prescribing omissions despite their effectiveness this tool is not widely explored. This systematic review aims to assess the prevalence of PIP, prescribing errors, and the impact of START/STOPP criteria interventions on clinical outcomes in older adults.

➤ *Methods:*

   From January 2015 to January 2025, a systematic search was conducted in PubMed, Google Scholar, Cochrane Library, and Scopus. Cross-sectional, Observational, Cohort, and Randomized controlled trials studies involving patients aged 65 and above were included. The data extraction followed PRISMA guidelines. The outcomes included PIP prevalence, types of prescribing errors, and hospitalizations.

➤ *Results:*

   A total of 36 articles were assessed, and the total number sample size of 4,449 patients' data was evaluated through the analysis of 9 studies of the latest years. The potentially inappropriate medication prevalence ranged from 19% to 85.1% of both the national and international reports. The potential prescribing omissions were observed in 4.2% to 81.4% of cases, mostly in hospital settings.

➤ *Conclusion:*

   This systematic review highlights the high prevalence of PIP among older adults and the effectiveness of interventions guided by STAT/STOPP criteria. A multidisciplinary approach among healthcare providers is necessary to obtain medication optimization. To achieve future goals the integration of STOPP/START criteria with the integration of electronic prescription systems can automate medication reviews and reduce errors.

Keywords: *STOPP, START, Geriatrics, Potentially Inappropriate Medications, Potentially Prescribing Omissions.*

I. INTRODUCTION

As the global population ages, managing medications in older adults has become more important than ever. According to the World Health Organization, by 2050, people over 60 will make up 22% of the world's population—double the percentage from 2015[2]. With aging comes unique healthcare challenges, including physical frailty, changes in how the body processes medications, and the presence of multiple chronic conditions [4]. This makes older adults the largest group of prescription medication users, but it also puts them at higher risk for inappropriate prescriptions and missed treatments, which can lead to adverse drug reactions and harmful interactions.

A medication is considered potentially inappropriate when the risks of taking it outweigh the benefits, especially when safer and more effective options are available. Inappropriate prescribing can negatively impact older adults in various ways [4]. Several tools exist to assess the safety and appropriateness of medications for the elderly, including Beers' criteria, Phadke's criteria, and the Screening Tool of Older People's Potentially Inappropriate Prescriptions (STOPP) and Screening Tool to Alert doctors to the Right Treatment (START) criteria. Among these, STOPP/START criteria stand out as the most up-to-date and widely used framework for evaluating geriatric prescriptions. They are straightforward to apply, making them valuable for researchers, students, and healthcare professionals. The STOPP list includes 80 indicators of potentially inappropriate prescriptions, while the START list contains 34 criteria for identifying necessary but missing prescriptions.

First introduced by Gallagher et al. in 2008, STOPP/START criteria are more effective than Beers' criteria in identifying inappropriate prescriptions among older adults [5]. As the first European-based guidelines, they are now the most validated and widely used criteria for elderly patients in Europe. In addition to their use in routine medication reviews, STOPP criteria have been successfully incorporated into intervention programs to reduce inappropriate prescriptions, improve medication adherence, and enhance quality of life. Research has also shown that using these criteria can help lower the risk of adverse drug reactions.

STOPP/START criteria have been applied in various healthcare settings, including hospitals, nursing homes, community-based care, primary care, post-acute care (PAC), and long-term care (LTC). With a growing elderly population, the need for timely and effective medical care is increasing, especially among individuals over 80 who often face complex health conditions requiring specialized treatment [6].

This systematic review will explore the prevalence of potentially inappropriate prescriptions, evaluate the impact of interventions based on STOPP/START criteria, and examine their influence on clinical outcomes in older adults. By analyzing data from different healthcare settings, this study aims to shed light on the benefits, challenges, and practical implications of using STOPP/START criteria in geriatric medication management. The findings could help improve prescribing practices and enhance medication safety for older patients worldwide.

II. MATERIALS AND METHOD

In this study, a systematic review was conducted to analyze geriatric prescribing patterns to identify inappropriate prescribing and prescribing omissions in geriatric healthcare management by using a STOPP/START criterion. Preceding this review, the search engines were employed to retrieve related research publications that fit the study scope and context. The main database used was PubMed, Google Scholar, and other works relevant to the context. For this study, the articles that met the inclusion and exclusion criteria were only included as per the PRISMA guidelines.

The search terms used were "Geriatric," "STOPP criteria," "START criteria," and "Hospital." Included the studies published between 2015 to 2025.

III. INCLUSION AND EXCLUSION CRITERIA:

➤ *Inclusion:*
- Utilization of START/STOPP criteria in geriatric patients.
- Research conducted in a multicentre hospital.
- Articles published between 2015 to 2025.

➤ *Exclusion:*
- Studies focusing on non-geriatric populations
- Research not utilizing STOPP/START criteria
- Case reports and opinion reports were excluded

➤ *Data Extraction:*
All the data were extracted regarding study design and population characteristics, based on the clinical intervention, measured outcomes, and key findings.

IV. RESULTS

The results from this systematic review identify a marked Prevalence of Potentially Inappropriate Prescribing and Potentially Prescribing Omissions in geriatric medication management through STOPP/START criteria. A total of 36 papers were reviewed and the aggregate sample size of 4,449 patients' data were considered through the examination of 9 studies of recent years (Table 2). The PIM varied between 19% and 85.1% with the PPO rates ranging from 4.2% to 81.4%.

This research depicts that polypharmacy is one of the greatest risk factors for managing elderly patients with multiple co-morbid conditions. Murthy et al. (2017) add that a majority of inappropriate prescriptions were located in the cardiovascular, antimicrobials, and gastrointestinal drugs. In a further study, it is mentioned Benzodiazepines for longer than 28 days (20.8%-25.9% prevalence) were predominantly classified as inappropriate, accounting for all fall hazards. Female gender was linked with a greater receipt of PIM (Table 1)

Szoszkiewicz et al. (2024) found that the STOPP/START version 3 now includes SGLT2-2 inhibitors for heart failure, anticoagulants and a greater focus on benzodiazepines and NSAIDs deprescribing. All these results demonstrate that systematic medication review needs, increased digitalization, and multidisciplinary action are required to make prescribing safe and effective for older adults.

V. CONCLUSION

The review highlights high PIM and PPO rates in geriatric patients, primarily due to polypharmacy, multiple prescribers, and guideline non-adherence. STOPP/START version 3 improves detection but requires digital integration and structured medication reviews to ensure safe prescribing practices. So, implementing this criterion into digital prescribing can enhance the healthcare provider to achieve better medication adherence and safer prescribing practices to ensure the quality of geriatric health.

ACKNOWLEDGEMENTS

DECLARATIONS

ABBREVIATIONS:

PIPs - Potentially Inappropriate Prescriptions
PPO - Potential Prescribing Omissions
STOPP- Screening Tool of Older Person's Prescriptions
START-Screening Tool to Alert to Right Treatment
PRISMA- Preferred reporting items for systematic reviews and meta-analysis
NSAIDs- non-steroidal anti-inflammatory drugs

REFERENCES

[1]. O'Mahony D, Cherubini A, Guiteras AR, Denkinger M, Beuscart JB, Onder G, Gudmundsson A, Cruz-Jentoft AJ, Knol W, Bahat G, van der Velde N, Petrovic M, Curtin D. STOPP/START criteria for potentially inappropriate prescribing in older people: version 3. *Eur Geriatr Med.* 2023 Aug;14(4):625-632. doi: 10.1007/s41999-023-00777-y. Epub 2023 May 31. Erratum in: *Eur Geriatr Med.* 2023 Aug;14(4):633. doi: 10.1007/s41999-023-00812-y. PMID: 37256475; PMCID: PMC10447584.

[2]. Sharma M, Loh KP, Nightingale G, Mohile SG, Holmes HM. Polypharmacy and potentially inappropriate medication use in geriatric oncology. *J Geriatr Oncol.* 2016 Sep;7(5):346-53. doi: 10.1016/j.jgo.2016.07.010. Epub 2016 Aug 3. PMID: 27498305; PMCID: PMC5037024.

[3]. By the 2023 American Geriatrics Society Beers Criteria® Update Expert Panel. American Geriatrics Society 2023 updated AGS Beers Criteria® for potentially inappropriate medication use in older adults. *J Am Geriatr Soc.* 2023;71(7):2052-2081. doi:10.1111/jgs.18372.

[4]. Murthy MB, Jagtap K, Burute SR, Ramanand SJ, Pore SM, Patil PT. Geriatric prescription analysis with respect to "STOPP" and "START" criteria: a descriptive study in the Indian scenario. Int J Basic Clin Pharmacol 2017; 6:2864-70.

[5]. Candeias C, Gama J, Rodrigues M, Falcão A and Alves G (2021) Potentially Inappropriate Medications and Potential Prescribing Omissions in Elderly Patients Receiving Post-Acute and Long-Term Care: Application of Screening Tool of Older People's Prescriptions/Screening Tool to Alert to Right Treatment Criteria. Front. Pharmacol. 12:747523. doi: 10.3389/fphar.2021.747523.

[6]. Szoszkiewicz M, Deskur-Smielecka E, Styszyński A, Urbanska Z, Neumann-Podczaska A, Wieczorowska-Tobis K. Potentially inappropriate prescribing identified using STOPP/START version 3 in geriatric patients and comparison with version 2: A cross-sectional study. *J Clin Med.* 2024;13(20):6043. doi:10.3390/jcm13206043.

[7]. Nath HS, Abraham AT, Nongrum K, Subramanya C, Chand S, Nandakumar UP, George SM, Joel JJ. Evaluation of appropriateness of geriatric prescriptions based on Beers and START STOPP criteria. *Aging Med Healthc.* 2023;14(4):182-186. doi:10.33879/AMH.144.2021.07049.

[8]. Nyamagoud SB, Swamy AH, Purantar A, Jangliwale B, Kumar K, Rakshitha P. Assessment of START and STOPP in geriatric patients of tertiary care hospital: A prospective observational study. *Preprint.* October 2023. doi:10.22541/au.169746367.79670902/v1.

[9]. Lunghi C, Domenicali M, Vertullo S, Raschi E, De Ponti F, Onder G, Poluzzi E. Adopting STOPP/START Criteria Version 3 in Clinical Practice: A Q&A Guide for Healthcare Professionals. *Drug Saf.* 2024;47(8):1061-1074. doi: 10.1007/s40264-024-01453-1.

[10]. Rochon PA, Stall NM, Reppas-Rindlisbacher C, Gurwitz JH. STOPP/START version 3: even better with age. *Eur Geriatr Med.* 2023;14(4):635-637. doi:10.1007/s41999-023-00784-z.

[11]. Sallevelt BTGM, Egberts TCG, Huibers CJA, Ietswaart J, Drenth-van Maanen AC, Jennings E, et al. Detectability of medication errors with a STOPP/START-based medication review in older people prior to a potentially preventable drug-related hospital admission. *Drug Saf.* 2022;45(12):1501-1516. doi: 10.1007/s40264-022-01237-5.

[12]. Chandrasekhar D, Samjas M, Pattani D. Evaluation of potentially inappropriate medications among hospitalized geriatric patients in a tertiary care referral hospital using STOPP/START criteria. *Clin Epidemiol Glob Health.* 2019;7(2):268-273. doi:10.1016/j.cegh.2018.10.008.

[13]. Baré M, Lleal M, Ortonobes S, Gorgas MQ, Sevilla-Sánchez D, Carballo N, et al. Factors associated with potentially inappropriate prescribing in older patients according to STOPP/START criteria: MoPIM multicentre cohort study. *BMC Geriatr.* 2022;22:44. doi:10.1186/s12877-021-02715-8.

[14]. Agrawal N, Poluri S, Timsina L, Milton B. Evaluation of rationality of geriatric patients' prescriptions based on STOPP/START criteria in a tertiary care hospital. *Int J Basic Clin Pharmacol.* 2025;14(1):22-28. doi:10.18203/2319-2003.ijbcp20243831.

[15]. González-Munguía S, Munguía-López O, Sánchez Sánchez E. Application of STOPP/START criteria in older patients in primary care using RStudio®. *BMC Geriatr.* 2024;24:782. doi:10.1186/s12877-024-05376-5.

[16]. Lau S, Lun P, Ang W, Tan KT, Ding YY. Barriers to effective prescribing in older adults: applying the theoretical domains framework in the ambulatory setting – a scoping review. *BMC Geriatr.* 2020;20:459. doi:10.1186/s12877-020-01766-7.

[17]. Lemma W, Islam M, Loha E, Mahalwal VS. Drug prescribing patterns in geriatric patients in selected health facilities of Addis Ababa, Ethiopia. *J Appl Pharm Sci.* 2020;10(11):103-109. doi:10.7324/JAPS.2020.101114.

[18]. Mydhily S, Faiyza L, Sharma PS, Uma VM, Manikanta BD, Dheeresh KH. A study on prescribing patterns of drugs in geriatric patients in a tertiary care hospital: A cross-sectional study. *Indian J Pharm Pract.* 2023;16(2):131-136. doi:10.5530/ijopp.16.2.21.

[19]. Oliveira RMF, Gorzoni ML, Rosa RF. Potentially inappropriate medication use in hospitalized elderly patients. *Rev Assoc Med Bras.* 2022;68(6):797-801. doi:10.1590/1806-9282.20220015.

[20]. Bhatt AN, Krishnamoorthy S, Mathew A, Nair BR. Potentially inappropriate medications prescribed for older persons: A study from two teaching hospitals in Southern India. *J Fam Community Med.* 2019;26(3):163-170. doi: 10.4103/jfcm.JFCM_81_19.

[21]. Hosseini SR, Zabihi A, Jafarian Amiri SR, Bijani A. Polypharmacy among the elderly. *J Mid-life Health.* 2018;9(2):97-103. doi: 10.4103/jmh.JMH_87_17.

[22]. Delara M, Murray L, Jafari B, Bahji A, Goodarzi Z, Kirkham J, Chowdhury M, Seitz DP. Prevalence and factors associated with polypharmacy: a systematic review and meta-analysis. *BMC Geriatr.* 2022; 22:601. doi:10.1186/s12877-022-03279-x.

[23]. Khajuria K, Khajuria V. Prescribing pattern in geriatric patients in medical OPD of a tertiary care teaching hospital. *Asian J Pharm Clin Res.* 2021;14(5):123-128.

[24]. Faisal S, Zairina E, Nathishuwan S, Khotib J, Kristina SA, Nugraheni G. Prevalence and predictors of excessive polypharmacy in geriatric inpatients: A retrospective cross-sectional study in Indonesia. *J Prim Care Community Health.* 2023; 14:1-9. doi:10.1177/21501319231178595.

[25]. Hunt S. Quality Use of Medicines: Policy and Practice. In: Koch S, Gloth FM, Nay R, editors. *Medication Management in Older Adults: A Concise Guide for Clinicians.* Springer; 2010. p. 11-28. doi:10.1007/978-1-60327-457-9_2.

[26]. Kara Ö, Arık G, Kızılarslanoglu MC, Kılıc MK, Varan HD, Sümer F, Esme M, Altıner S, Kuyumcu ME, Yesil Y, Yavuz BB, Cankurtaran M, Halil M. Potentially inappropriate prescribing according to the STOPP/START criteria for older adults. Aging Clin Exp Res. 2016 Aug;28(4):761-8. doi: 10.1007/s40520-015-0475-4. Epub 2015 Dec 11. PMID: 26661647.

[27]. Ma Z, Tong Y, Zhang C, Liu L. Potentially inappropriate medications and potentially prescribing omissions in Chinese older patients: Comparison of two versions of STOPP/START. J Clin Pharm Ther. 2020 Dec;45(6):1405-1413. doi: 10.1111/jcpt.13237. Epub 2020 Aug 10. PMID: 32776599.

[28]. Fernández-Fradejas J, Delgado-Silveira E, González-Burgos E, Álvarez-Díaz AM, Vélez-Díaz-Pallarés M. Potentially inappropriate prescriptions and potential prescription omissions in older people living with HIV. HIV Med. 2024 May;25(5):587-599. doi: 10.1111/hiv.13616. Epub 2024 Jan 23. PMID: 38258538.

[29]. Baré M, Lleal M, Ortonobes S, Gorgas MQ, Sevilla-Sánchez D, Carballo N, De Jaime E, Herranz S; MoPIM study group. Factors associated to potentially inappropriate prescribing in older patients according to STOPP/START criteria: MoPIM multicentre cohort study. BMC Geriatr. 2022 Jan 11;22(1):44. doi: 10.1186/s12877-021-02715-8. PMID: 35016636; PMCID: PMC8751453.

[30]. Krustev T, Milushewa P, Tachkov K, Mitov K, Petrova G. Evaluation of potentially inappropriate medication in older patients with cardiovascular diseases-STOPP/START-based study. Front Public Health. 2022 Dec 22;10:1023171. doi: 10.3389/fpubh.2022.1023171. PMID: 36620233; PMCID: PMC9813954.

[31]. Thomas RE, Nguyen LT, Jackson D, Naugler C. Potentially Inappropriate Prescribing and Potential Prescribing Omissions in 82,935 Older Hospitalised Adults: Association with Hospital Readmission and Mortality Within Six Months. Geriatrics (Basel). 2020 Jun 12;5(2):37. doi: 10.3390/geriatrics5020037. PMID: 32545451; PMCID: PMC7344435.

[32]. Counter D, Millar JWT, McLay JS. Hospital readmissions, mortality and potentially inappropriate prescribing: a retrospective study of older adults discharged from hospital. Br J Clin Pharmacol. 2018 Aug;84(8):1757-1763. doi: 10.1111/bcp.13607. Epub 2018 May 22. PMID: 29744901; PMCID: PMC6046509.

[33]. Chand S, CS S, BC V, Ramesh B, Sujit KS, Bahadur RK. Brown, white, and blue bagging in special pharmacy: An emerging trend to minimize medication error. Journal of Global Pharma Technology. 2019;11(8):1–4.

[34]. Patel MM, Mark AS, Shah NA. Assessment of appropriateness of prescribing among Indian geriatric outpatients using STOPP and START criteria version 2 at a tertiary care teaching hospital. Natl J Physiol Pharm Pharmacol. 2022;12(10):1746-50.
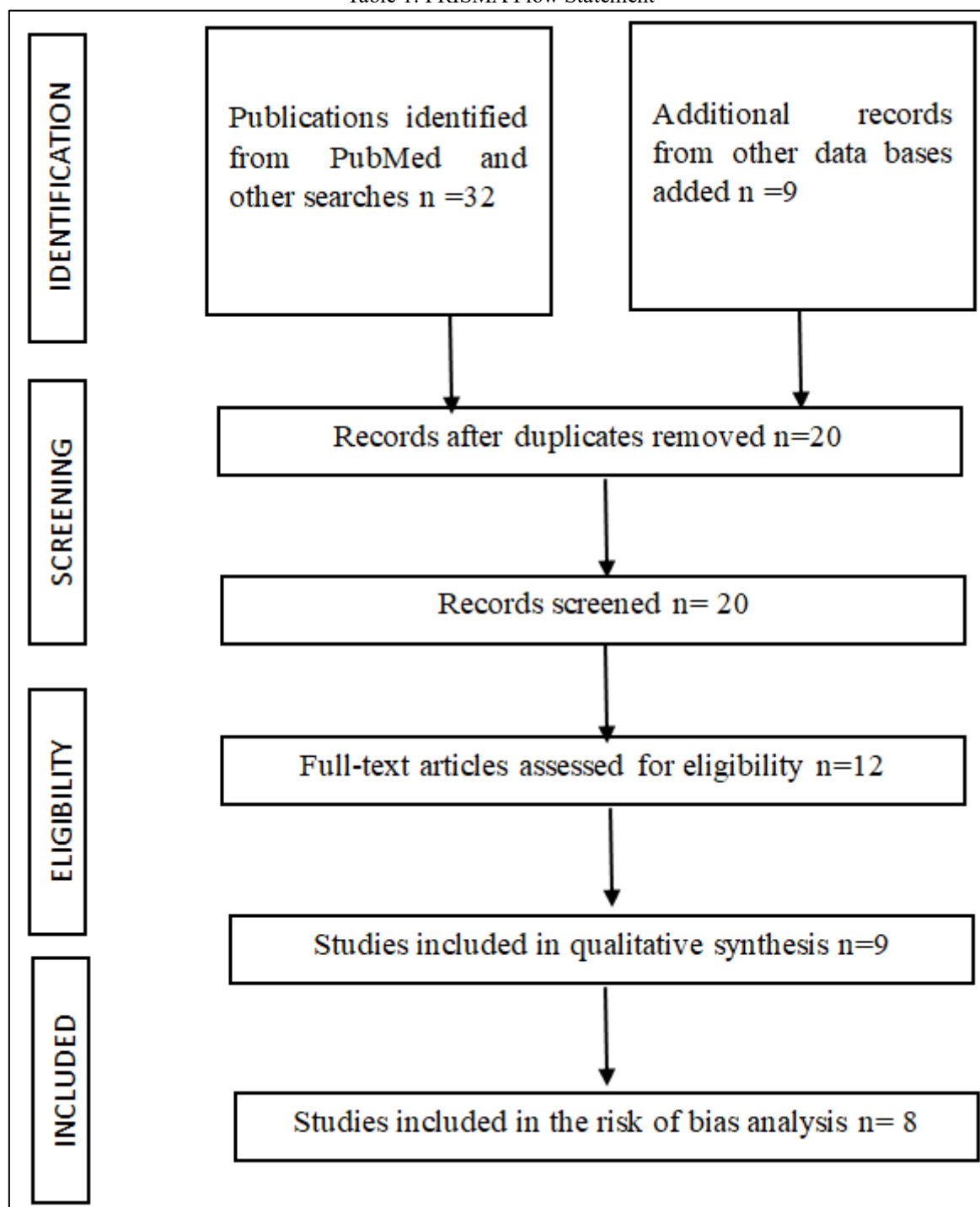
Table 1: PRISMA Flow Statement

Table 2 Evaluation of Other STOPP/START Studies

Study	Country & Year	Sample Size	Prevalence of PIMs	Prevalence of PPOs	Predictors of PIMs/PPOs	Polypharmacy Trends
Murthy et al. (2017)	India (2017)	138	21.01%	33.33%	Not reported	Avg. drugs per prescription: 6.94
Candeias et al. (2021)	Portugal (2021)	161	85.1%	81.4%	Female gender, hospital origin, polypharmacy, history of fractures	Median drugs per patient: 9
Szoszkiewicz et al. (2024)	Poland (2024)	100	73% (STOPP v3) vs. 56% (STOPP v2)	74% (START v3) vs. 57% (START v2)	Not reported	Patients with polypharmacy included
Nath et al. (2023)	India (2023)	385	19% (STOPP), 13.5% (Beers)	4.2% (START)	Not reported	34% had major polypharmacy, 46.5% minor polypharmacy
Nyamagoud et al. (2023)	India (2023)	210	18.1% (STOPP errors in 38 prescriptions)	62.2% (START errors in 103 prescriptions)	Illiteracy, rural residence, cardiovascular diseases	98.5% had polypharmacy, avg. drugs per patient: 10.8
Lunghi et al. (2024)	Europe (2024)	N/A	Not specified	Not specified	Need for digital integration and clinician training	STOPP/START v3 has 190 criteria, challenging implementation in busy settings
Rochon et al. (2023)	Europe (2023)	N/A	Not specified	Not specified	Female gender more prone to PIMs	Emphasis on technology for improved implementation
Agrawal et al. (2025)	India (2025)	193	40.4%	31.1%	Polypharmacy, multiple comorbidities	91.7% had polypharmacy, mean age: 72.4 years
González-Munguía et al. (2024)	Spain (2024)	2312	57%	38%	Polypharmacy, multiple prescribers	46.6% had polypharmacy, 9.3% excessive polypharmacy (≥10 drugs)