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Research Article

THE APPLICATION OF THE STOPP/START CRITERIA IN GERIATRIC PATIENTS: A SYSTEMATIC REVIEW

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A R T I C L E   I N F O

A B S T R A C T

To provide a systematic review on the application of STOPP/START criteria in geriatric patients. A literature search was done in MEDLINE (PubMed), Science direct, BMJ, and Cochrane databases published from 2011 to November 2020. The overview of the articles included in this study was published in English that indicated the application and to evaluate polypharmacy, the progress of physician-pharmacist in geriatric patients. The literature identified through the database is 107 records. Full-text screening 15 articles were included in the study. While following the STOPP/START criteria by physician-pharmacist can reduce the hospital admissions and polypharmacy, PIP and PPO in geriatric patients. The studies show that there is an effective improvement in choosing appropriate medication for geriatric patients. Further research could be conducted on the role of physician-pharmacist using the STOPP/START criteria in the geriatric population.

INTRODUCTION

Appropriate prescribing has benefits that outweigh the risks and maximizes the individual health gains.[1] Elderly people prescribing and the selection of appropriate pharmacotherapy is a challenging complex process due to multimorbidity, polypharmacy, and age-specific changes in pharmacokinetics and pharmacodynamics [2,3]. In 2019 703 million people aged 65 years over the world, projected to double to 1.5 billion in 2050[4]. In India, the proportion of elderly persons is increased since 1951 and has reached 10.1% in 2021 and is likely to increase to 13.1% in 2031[5]. Polypharmacy and inappropriate prescribing (IP) are well-known risk factors that increase adverse drug reactions (ADRs). These factors expose geriatric patients to potentially inappropriate prescribing (PIP) which encompasses potentially inappropriate medications (PIMs) and potentially prescription omissions (PPOs) [6]. The term PIM is defined as medications that have an adverse effect and may outweigh the clinical advantages of the drug in older adults which leads to mental and functional decline, adverse drug events, drug interactions, unplanned hospitalization, morbidity and mortality. The studies show the prevalence of polypharmacy and potentially inappropriate prescribing (PIP) 49% and 28% among Indian older patients [4]. Clinical practice guidelines (CGPs) that help to guide healthcare professionals in patient care [7] A number of screening tools were developed to measure and assist prescribers in detecting potentially inappropriate prescribing [2]. Explicit screening tools such as STOPP/START (Screening Tool for Older Persons Prescription and Screening Tool to Alert doctors to

Right Treatment) criteria which encompass PIMs (STOPP criteria) for the overtreatment and PPOs (START criteria) undertreatment. The updated STOPP/START criteria version 2 in 2014 includes the 80 STOPP criteria and 34 START criteria compared with 65 STOPP and 22 START criteria version 1, a 31% increase in prescribing criteria.8 STOPP/START version 2 criteria include the STOPP categorise namely antiplatelet/anticoagulant drugs, drugs affecting, renal function and drugs that increase disease burden; new START categories included urogenital system drugs analgesics and vaccines [6].

This systematic review aims at the application of STOPP/START criteria in geriatric patients. The studies in India related to STOPP/START criteria version 2 application is limited. In addition to evaluating the application of STOPP/START criteria to measure the prevalence studies conducted by the researchers and clinical outcomes. To provide systematic reporting the search was done in multiple search engines and most of the data were strained from MEDLINE (PubMed), Science direct, BMJ and Cochrane databases. The search of articles done from 2011-2020in all of the databases selected for the systematic review. The search term used Potentially Inappropriate Medication AND polypharmacy AND STOPP criteria AND START criteria MEDLINE (PubMed) (2011-2020). In the Science direct, BMJ and Cochrane databases the search terms were used as same as in PubMed. The search term was changed exact to the topic application AND STOPP criteria AND START criteria AND geriatric patients (2011-2021). Only English language articles were considered in the literature evaluation. Finally, few articles were selected highly relevant to the study. This

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systematic review included database searches such as PubMed. Science direct, BMJ, Cochrane databases and Data abstraction process (Table 1, Table 2).

Table 1 Database research description and each database covered by general subjects

Database	Restrictions added to a search	Dates Included in the database search	General subjects covered by Database
MEDLINE(PubMed)	Full Text; English Language; Abstract Available.	2010 through 2021	Nursing and medical topics, dentistry, veterinary science, the healthcare system and preclinical sciences
Science Direct	Full Text; English Language; Abstract Available.	2010 through 2021	Medicine and dentistry. Nursing and health professionals, pharmacology, Toxicology and Pharmaceutical Science.
BMJ	Full Text; English Language.	2000 through 2021	Medicine, healthcare topics, Clinical Trials
Cochrane	Full Text	2000 through 2021	Systematic reviews of primary research in human health care and policy.

Table 2 Data abstraction Process

Date of search	Keywords	Medline(PubMed)	Science Direct	BMJ	Cochrane
05.07.21	STOPP/START criteria	1077	560	347	51
05.07.21	STOPP criteria AND START criteria	231	560	32472	73
05.07.21	Potentially in appropriate medication AND poly pharmacy AND STOPP criteria AND START criteria	75	319	184	19
05.07.21	Potentially in appropriate medication AND poly pharmacy AND Potentially prescription omission AND STOPP criteria AND START criteria	26	94	70	4
05.07.21	Potentially in appropriate medication AND poly pharmacy AND Potentially prescription omission AND STOPP criteria AND START criteria AND older patients.	21	94	55	4
05.07.21	Application AND STOPP criteria AND START criteria AND geriatric patients	15	74	4	0

The search strategy includes 106 papers from PubMed, Science direct BMJ and Cochrane databases. The records were screened to 31 papers. The articles were considered according to the PICO model and by considering the inclusion and exclusion criteria articles were selected under eligibility criteria were 18 articles, by considering the full-text articles and best-supporting articles were 15 articles considered for the study (Figure 1)

Figure 1 Flow chart of study inclusion and exclusion criteria.

Inclusion Criteria

Based on the study design, Studies were included and eligible if they met the following criteria:

- The study articles of hospitalized geriatric inpatients ≥65-year age, both male and female patients, admitted to various departments.
- Research and review articles of STOPP/START criteria
- The articles in English language text and free full-text articles.

Exclusion criteria

- The research articles and review articles of patients in casualty and ventilator, Patients in a community-dwelling.
- Research and review articles other than STOPP/START criteria.
- Exclusion criteria are mostly unrelated, duplicated, unavailable full texts, or abstract-only papers

This systematic review aimed for reviewing the application of STOPP/START criteria in geriatric patients 'and focuses on the prevalence of PIPs and PPOs and physician-pharmacist usage of STOPP/START criteria in the geriatric population used in various studies. The objective of the study is to assess the application of STOPP/START criteria in geriatric patients. The outcome of the study is vital in understanding the use of STOPP/START criteria by physicians and pharmacists in geriatric assessment, where it helps to reduce the inappropriate use of medication and improve the quality of life in older patients.

Characteristics of selected study

This systematic review includes the studies related to the application of STOPP/START criteria in geriatric patients and the prevalence of PIPs and PPOs useful for prescribing quality in older patients in future. Participants included in the studies were at least 65 years of age and older. RCTs studies show that sustained improvements in the prescribing appropriateness in reducing overuse, misuse and underuse of medication physician implementation rate is higher than the pharmacist implementation rate while using the STOPP/START criteria. Prospective studies of the prevalence of inappropriate prescribing results that the rate of prevalence of PIPs and PPOs decreased over time when corrected for changes in patient characteristics, such as diagnoses. The studiesshow that the most commonly used PIMs were benzodiazepines with a history or risk of falls, Proton pump inhibitors, opiates whereas in PPOs were calcium, vitamin D, bisphosphonates, ACE inhibitors. Retrospective study results in the prevalence of polypharmacy, PIM, and PPO could be decreased by CGA
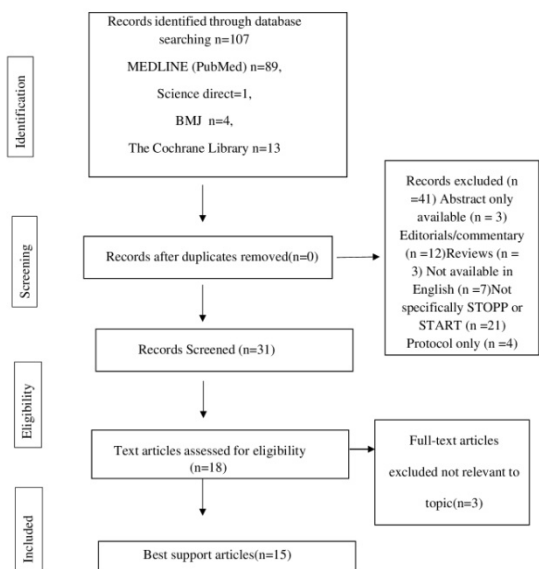
including START/STOPP criteria in older adults, this will have beneficial effects on economical parameters due to decreasing drug-related health care costs. A comparison study between PIMs and PPOs was identified by STOPP/START criteria V_1 and V_2 in geriatric patients. This study suggests that updated STOPP/START v2 criteria have a significantly better potential of targeting PIMs and PPOs associated with preventable medication-related harm. (Table 3)

Cardiovascular system

According to the recent study conducted by Damoiseaux-Volman *et al.*, loop diuretic treatment for hypertension prevalence rate is high in STOPP criteria according to STOPP/START version 2 newly added indicators such as antiplatelet/anticoagulant drugs, drugs affecting, or affected by, renal function and drugs that increase anticholinergic burden; new START categories included urogenital system drugs, analgesics and vaccines prevalence of 1% [3].

Table 3 Characteristics of Literature Included and Excluded

Reference	Included or Excluded	ationale
Damoiseaux-Volman BA, MedlockS, RavenK,SentD, RomijnJA,vanderVeldeN,Abu HannaA. Potentially in appropriate prescribing in older hospitalized Dutch patients according to the STOPP/START criteriav 2: alongitudinal study. Eur J Clin Pharmacol 2021;77:777-85.	Included	The study investigates the prevalence of potentially in appropriate prescribing in older patients using STOPP/START criteria.
Sallevelt BTGM, Huibers CJA, Knol W, PuijenbroekEV, EgbertsT, Wilting I. Evaluation of clarity of the STOPP/START criteria for clinical applicability in prescribing for older people: a quality appraisal study. BMJOpen2020; 10:e033721.	Included	Clinical applicability of STOPP/START criteria in daily patient care improves appropriate prescribing.
DaltonK, O'Mahony D,O'SullivanD, O'ConnorMN, ByrneS. Prescriber Implementation of STOPP/START Recommendations for Hospitalised Older Adults: A Comparisonofa Pharmacist Approach and a Physician Approach. Drugs Aging 2019;36:279-88.	Included	RCTs conducted with STOPP/START criteria recommendations to prescribers by a physician or pharmacist can reduce ADRs and provide comparable clinical outcomes.
ThevelinS, Mounaouar LE, MarienS, Boland B, Henrard S, Dalleur O. Potentially Inappropriate Prescribing and Related Hospital Admissions in Geriatric Patients: A Comparative Analysis between the STOPP and START Criteria Versions 1 and 2. Drugs Aging2019;36:453-59.	Included	Compared with STOPP/START.v1,STOPP/STA RT.v2 not only yielded more instances of inappropriate prescribing but also targeted significantly more PIMs and PPOs associated with preventable DRAs
Brunetti E, AurucciML, Boietti E, GibelloM, Sappa M, Falcone Y *et al.*, Implications of Potentially Inappropriate Prescribing According to STOPP/START Version 2 Criteria in Older Polymorbid Patients Discharged from Geriatric and Internal Medicine Wards: A Prospective Observational Multicenter Study. J Am MedDir Assoc2019;20:1476-76.	Included	To evaluate the prevalence and potential clinical implications (death and unplanned readmissions) of PIPs according to STOPP/START v2 among older patients.
De Bock L, Tommelein E, Baekelandt H,MaesW, BousseryK, Somers A. The Introduction of a Full Medication Review Process in a Local Hospital: Successes and Barriers ofaPilot Projectin the Geriatric Ward. Pharmacy (Basel) 2018;6:21.	Included	Clinical pharmacists optimize the usage of the drug in older people through the implementation of a full medication review process.
BoM,GibelloM, BrunettiE, BoiettiE, Sappa M, Falcone Y *et al.*, Prevalence and predictors of in appropriate prescribing according to the Screening Tool of Older People's Prescriptions and Screening Tool to Alert to Right Treatment version 2criteriainolder patients discharged from geriatric and internal medicine wards: A prospective observational multicenter study. Geriatr Gerontol Int 2019;19:5-11.	Included	The study investigates the prevalence of PIM and PPO using STOPP/START criteria in older patients.
HernandezMartinJ, Merino-SanjuánV, Peris-MartíJ, Correa-BallesterM, Vial-EscolanoR, Merino-SanjuánM. Applicability of the STOPP/START criteria To older polypathological patients in along- term care hospital. Eur J Hosp Pharm 2018;25:310-16.	Included	Applicability of STOPP/START tool to identify patients with PIM to improve prescriptions for elderly patients.
BorneE, MeyerN, Rybarczyck-VigouretMC, Blanchard O, Lombard M, Lang PO *et al.*, Potential Statin Overusein Older Patients: A Retrospective Cross-Sectional Study Using French Health Insurance Databases. Drugs Aging. 2019; 36:947-55.	Excluded	A study was conducted on 80 age delderly patients in nursing homes.
Santolaya-PerrínR, Calderón-HernanzB, Jiménez-Díaz G, Galán-Ramos N, Moreno-CarvajalMT, Rodríguez-Camacho JM *et al.*, The efficacy of a medication review programmeconducted in an emergency department. Int J Clin Pharm.2019; 41:757-766 .	Excluded	The study is conducted in Patients over 65 years of age presenting to the ED of the participating sites.
Gleich J, Pfeufer D, Zeckey C, Böcker W,GoschM, Kammerlander C *et al.*, Orthogeriatrictreatment reduces potential in appropriate medication in older trauma patients: a retrospective, dual-centre study comparing conventional trauma care and co-managed treatment. Eur J Med Res.2019;24:4.	Excluded	Inter disciplinary treatment PIMs in older adult trauma Patients undergo trauma surgery.

STOPP/START Interventional Recommendation

This systematic review includes the PIMs and PPOs studies prevalence according to each physiological system. The use of STOPP/START recommendation helps to find the potentially inappropriate medication and potentially prescription omission.

High consideration should be given to the drugs such as aspirin dosage 150mg per day prevalence rate about 5.9% in Frely *et al* study while comparing with another study the in Lozano-Montoya *et al* high rate of prevalence of 17% [9,10].

In the study done by Thevelin *et al*, the PPOs of cardiovascular system drugs accounted for 33% The main physiological system affected by applying START criteria, both admission and at discharge, the cardiovascular system by the omission of antiplatelet therapy [8].Statin therapy in diabetic Mellitus with

cardiovascular risk factors 22.5% of prevalence rate in a prospective study done by kara *et al* [11].

Central Nervous System and Psychotropic drugs

The STOPP criteria Benzodiazepines (sedative, may cause reduced sensorium, impair balance) having 18.5% of prevalence rate in a prospective observational study conducted by Bo *et al*.12 In a cross-sectional study done by Dalleur *et al* in central nervous system drugs in tricyclic antidepressants in glaucoma considered as potentially inappropriate medication with less prevalence[13]. The studies,[14,15,9,10,11] shows that long-acting benzodiazepine has high inappropriate prescribing.

Gastrointestinal system

PPI for peptic ulcer disease at full therapeutic dosage for >8 weeks shows a high rate of inappropriate prescribing of 34 % in a study conducted by gallagher *et al*.[14] Most omission in prescribing is in fibre supplement for chronic, symptomatic disease with constipation in studies of Lozano-Montoya *et al* and kara *et al* of 6% and 2.9% respectively[10,11]. In the respiratory system STOPP criteria of inappropriate medication are Antimuscarinic bronchodilators (e.g., ipratropium, tiotropium) with a history of narrow-angle glaucoma of 5% prevalence rate in a recent of Bo *et al*. [12] Omission rate is high for regular inhaled beta 2 agonist or anticholinergic agent in asthma/COPD in kara *et al* study [11].NSAID with moderate-to-severe hypertension and Calcium and vitamin D supplements in patients with known osteoporosis are the drugs under the musculoskeletal system having PIMs and PPOs respectively.According to the recent study, Damoiseaux-Volman *et al* Benzodiazepines with a history or risk of falls is 22.1% while compared with other studies [3]. The classes such as Analgesics and duplicate drugs potentially inappropriate prescribing results in the long-term use of opiates for mild to moderate pain 5% in research done by Dalleur *et al* [13]. PPOs in analgesics of laxatives in patients receiving opioids 17.3% mention in the 2020 study of Damoiseaux-Volman *et al* and colleagues [3]. Frély *et al* results illustrations STOPP criteria duplicate drug class prescriptions 2% and In Lozano-Montoya *et al* duplicate drug classes had 9.9% [9,10].

Applicability of STOPP/START criteria

According to the 2019 Brunetti *et al* study results, a larger number of PIMs, coupled with renal and cardiac comorbidities, was independently related to unexpected readmissions in home-discharged patients. In the overall sample and each subgroup analysis, PPOs were not shown to be independently linked with either outcome. There was no significant interaction between the presence of renal, cardiac, or hepatic disease, moderate-severe cognitive impairment, or functional dependence and significant drug exposures or drug numbers [16]. The studies were excluded because of not meeting the study criteria [17,18,19,20]In these two RCTs that are likely to adopt STOPP/START guidelines, the medications recommended by physicians in southern Ireland hospitals were statistically considerably higher than those prescribed by pharmacists. The physician had statistically significantly higher implementation rates than the pharmacist for 10 of the 30 specific STOPP/START recommendations included in both regimens, including instructions to deprescribe benzodiazepines and proton pump inhibitors. The physician-delivered intervention was narrowly focused on making

recommendations based exclusively on the STOPP/START criteria, whereas the pharmacist-delivered intervention addressed both STOPP/START and a broader range of drug-related problems [1]. According to the research, the prevalence of STOPP cardiovascular medicines blockers-aspirin>150mg/day is high. Cardiovascular drugs, such as statins for vascular disease and angiotensin-converting enzyme inhibitors for chronic heart failure, have a high prevalence of PPOs in START criteria. According to prior research, benzodiazepines taken for more than one month in the class of central nervous system and psychotropic medications have a high incidence of improper prescription. According to STOPP guidelines, administering high dose proton pump inhibitors for peptic ulcers for more than 8 weeks in the gastrointestinal system should be terminated. According to studies, fibre supplements have a strong potential for prescription omission for diverticular illness with constipation-Start criteria.

The limitation of this study is that it does not involve the use of STOPP/ START criteria in community settings or emergency rooms. As a result, the findings cannot be generalized. Urogenital System findings are restricted. The studies include the role of physician and pharmacist using the STOPP/START criteria in the geriatric population is limited. For the future development of clinical practice guidelines (CPGs), STOPP/START tool recommends prescribing the right drug to the right patient at the right time.

CONCLUSION

In conclusion, this systematic review provides the application of STOPP/START criteria which concluded based on Action. Condition and Explanation. The STOPP criteria explain the overtreatment and the START criteria explain the undertreatment. The study indicates that there is a high prevalence of PIM and PPO detected using STOPP/START criteria among hospitalized geriatric patients aged above 65 years and highlights about the most prevalent morbidity found among the elderly were diabetes mellitus and falls.Using of screening tool of STOPP/START criteria in the reduction of inappropriate prescribing improves the valuable aid to routine pharmacotherapy and pharmaceutical care between physicians andpharmacists. As a healthcare professional, the clinical pharmacist has a key role in improving geriatric care, providing rational pharmacotherapy.Inappropriate prescription among the elderly is undesirable, and there should be consensus on using evidence-based screening methods when prescribing medications to the elderly to promote rational drug therapy

Conflict of Interest

The authors declare no conflict of interest

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