

Use of potentially inappropriate medications in long-stay institutions for the elderly: systematic review

Uso de medicamentos potencialmente inapropiados en instituciones de larga estancia para ancianos: revisión sistemática

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ABSTRACT

Objective To analyse the prevalence of the use of potentially inappropriate medications (PIM) in Long Stay Institutions for the Elderly (LSIE).

Method Systematic review was used to obtain articles from online databases BVS, Google Scholar, MEDLINE, SciELO and CINAHL. The search and selection process of the studies followed the PRISMA 2020 recommendations. The eligibility criteria were observational and experimental studies, in English and Portuguese languages, conducted in the last 10 years with elderly patients ≥ 60 years and studies of the prevalence of PIM use in elderly residents in LSIE.

Results The final sample comprised 11 articles. The main type of study was cross-sectional with 10 (90.90%) articles, published between 2012 and 2019, with 2012 being predominant (36.36%). The mean prevalence of PIM use was 43.86% (7.8%-80%), highlighting greater relationship with female gender (58.5%) and polypharmacy (58.7%).

Discussion The observed results point out high and worrisome prevalence of PIM for institutionalized elderly. It is essential the proposition and implementation of strategies aimed at reducing the use of these drugs. The educational interventions, deprescription and computerization of the prescription systems stood out. Therefore, the identification of such drugs and the discussion, together with the prescriber and other members of the health team, becomes of great value in the process of prescription review and decrease in the use of PIM.

Conclusion The results of this study reinforce the need for the reduction of inappropriate prescriptions and the importance of rational use of medicines for residents in LSIE.

Key Words: Drug therapy; aged; inappropriate prescribing; homes for the aged; nursing homes; potentially inappropriate medication list (*source: MeSH, NLM*).

RESUMEN

Objetivo Analizar la prevalencia del uso de medicamentos potencialmente inapropiados (PIM) en las instituciones de larga estancia para ancianos (IEP).

Método Se utilizó una revisión sistemática para obtener artículos de las bases de datos en línea BVS, Google Scholar, MEDLINE, SciELO y CINAHL. El proceso de búsqueda y selección de los estudios siguió las recomendaciones PRISMA 2020. Los criterios de elegibilidad fueron estudios observacionales y experimentales, en idiomas inglés y portugués, realizados en los últimos 10 años con pacientes ancianos ≥ 60 años y estudios de prevalencia de uso de PIM en ancianos residentes en LSIE.

Resultados La muestra final estuvo compuesta por 11 artículos. El tipo de estudio principal fue el transversal con 10 (90,90%) artículos, publicados entre 2012 y 2019, predominando el año 2012 (36,36%). La prevalencia media de uso de PIM fue del 43,86% (7,8%-80%), destacando una mayor relación con el género femenino (58,5%) y la polifarmacia (58,7%).

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Discusión Los resultados observados señalan una alta y preocupante prevalencia de PIM en los ancianos institucionalizados. Es fundamental el planteamiento y la implementación de estrategias dirigidas a reducir el uso de estos fármacos. Destacan las intervenciones educativas, la desprescripción y la informatización de los sistemas de prescripción. Por tanto, la identificación de tales medicamentos y la discusión, junto con el prescriptor y otros miembros del equipo de salud, se vuelve de gran valor en el proceso de revisión de la prescripción y la disminución del uso de PIM.

Conclusiones Los resultados de este estudio refuerzan la necesidad de reducir las prescripciones inadecuadas y la importancia del uso racional de los medicamentos para los residentes en LSIE.

Palabras Clave: Quimioterapia; anciano; prescripción inadecuada; hogares para ancianos; casas de salud; lista de medicamentos potencialmente inapropiados (*fuente: DeCS, BIREME*).

Changes in society have repercussions on the care of the elderly. The decrease in the number of children and the insertion of women in the labour market mean that the attributions of elderly care are no longer exclusive to the family but also to Long-Stay Institutions for the Elderly (LSIE) (1,2).

Studies indicate a higher prevalence of chronic diseases among elderly residents in nursing homes, in addition to a higher average use of medication when compared to the elderly living in the community (3,4). It is noteworthy that, while pharmacotherapy provides health benefits to these individuals, it is observed that they are more vulnerable to drug-related problems, mainly due to pharmacodynamic and pharmacokinetic changes, typical of aging. Moreover, the use of various pharmacological formulas favours interactions and adverse drug reactions (ADR) (4,5).

In this sense, the inadequacy of prescriptions for elderly patients is a public health problem given its association with morbidity and mortality, in addition to the costs to health services resulting from adverse reactions. Potentially inappropriate medications (PIM) for the elderly stand out, in which the risks associated with their use may outweigh the therapeutic benefits (6). Even though PIM are associated with negative outcomes in this group, they continue to be prescribed and used without caution as first-line treatments in the elderly population, even in situations where they can be avoided or substituted (7).

In view of this panorama, lists of PIM and instruments for their identification were developed and published. The Beers Criteria (8), the Screening Tool of Older Person's Prescriptions (STOPP) and Screening Tool to Alert doctors to Right Treatment (START) (9) stand out, aiming to facilitate the adaptation of pharmacotherapy for the elderly and help health professionals prescribe more safely. The importance of these criteria is reaffirmed as important tools used in specific geriatric assessment in choosing the use of medication (10).

It is perceived the importance of conducting research that analyses the pharmacotherapy prescribed to elderly residents in LSIE, since this is an environment with high rates of drug use and prone to the occurrence of complica-

tions involving them. Such research allows an overview of the use of PIM, and may provide important data to health teams, so that they can promote the rational use of medicines, weighing the risks and benefits resulting from the proposed therapy. From this perspective, the present study aims to analyse the prevalence of the use of PIM in LSIE.

METHOD

This is a systematic review, which aims to analyse the bibliographic production in each subject area and compiles studies developed by means of various methodologies, which allows the researcher a synthesis of results (11,12).

The Population, Concept and Context (PCC) strategy was used to construct the research question to guide the search (13). The following were defined: P- elderly, C- prevalence of PIM use and C- long-stay institutions for the elderly. Based on these definitions, the guiding question was established: "What is the prevalence of the use of potentially inappropriate medications for the elderly in Long Stay Institutions?"

To select the articles, a survey was conducted in the electronic databases Virtual Health Library of the Ministry of Health\Brazil (BVS/MS), Google Scholar, Medical Literature Analysis and Retrieval System Online (MEDLINE), SciELO (Scientific Electronic Library Online) and Cumulative Index to Nursing and Allied Health Literature (CINAHL). The combination of health descriptors was used, with minor adaptations, according to the specificities of each database: ("Inappropriate Prescribing" OR "Potentially Inappropriate Medication List") AND ("Homes for the Aged" OR "Nursing Homes). The search was executed on 08/09/2021.

The eligibility criteria were observational and experimental studies, conducted in the last 10 years with elderly patients ≥ 60 years old; studies that analysed the use of medications used by elderly residents in LSIE and that defined the prevalence of the use of PIM. Articles that could not contribute effectively to the construction of this work and that were duplicated, without scientific support, review articles, case studies, animal studies, let-

ters to the editor, and those that were not in English, or Portuguese were excluded.

The following steps were established for the selection of articles: 1) two trained reviewers (R1 and R2) read and evaluated the titles and abstracts independently and according to the eligibility criteria; 2) the selected articles were read in full, and the final selection was made. In case of any disagreement between the two reviewers, the opinion of a third reviewer (R3) was considered.

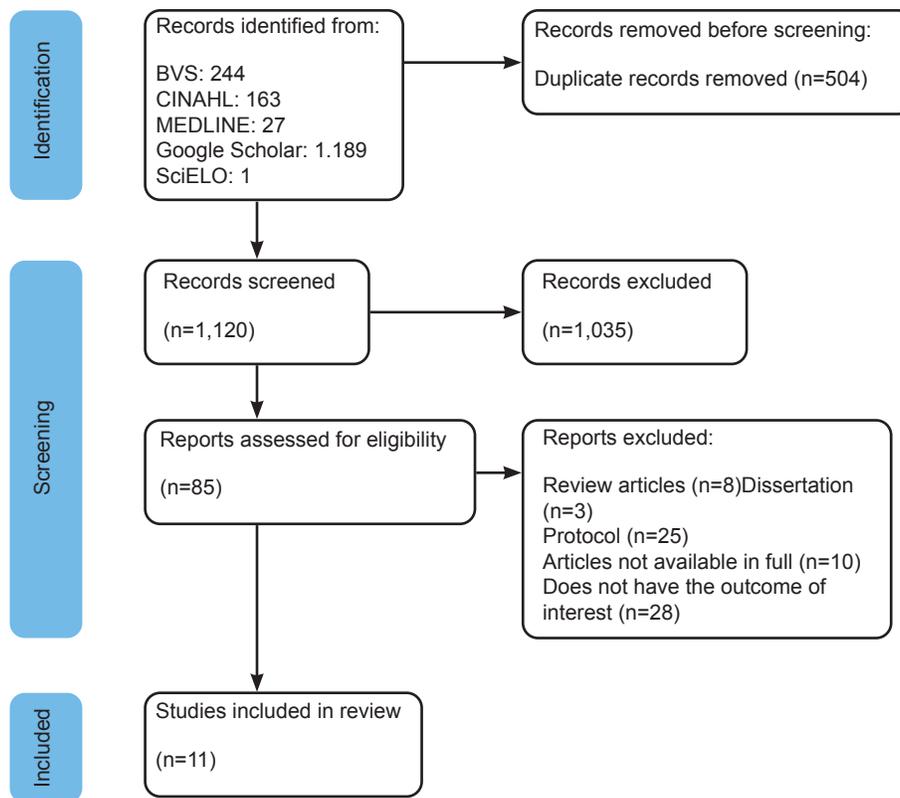
The process of search and selection of studies followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) (14). The extracted data were identified, explored,

and synthesized in narrative form with the tabulation of the results of the included studies, and these were conducted from descriptive analysis. The methodological quality of observational studies was analysed using the Newcastle-Ottawa Scale. The satisfactory quality of this scale should ≥ 6 , in which the score of 9 points represents high methodological quality (15).

RESULTS

The search process resulted in the identification of 1,624 studies and after the selection steps, 11 observational studies were included (Figure 1).

Figure 1. Flow diagram of study selection, adapted from PRISMA 2020



Among the studies included, six (54.54%) were published in Brazil, two (18.18%) in Malaysia and one each in Australia, Ireland, and Spain, respectively. In this selection, the main type of study was cross-sectional with 10 (90.90%) articles published between 2012 and 2019, with 2012 being predominant (36.36%). The sample size, by the sum of all studies, was 1,999 elderlies. The mean age was 79.9 years (of the studies that presented such variable as continuous). The criterion most used to identify the PIM for the elderly was the Beers Criteria, present in 7 (63.6%)

articles. All studies showed good methodological quality according to the Newcastle-Ottawa scale. The general characteristics of the studies are summarized in Table 1.

From the data analysis, it was observed that the mean prevalence of use of PIM was 43.86% (7.8%-80%). The prescription for the gastrointestinal system (34.5%), pain medications (15.1%) and central nervous system (14.9%) stood out. The main ones were proton pump inhibitors (PPIs) (34.5%), benzodiazepines (30.4%) and antipsychotics (26.3%) (Table 2).

Table 1. General characteristics of the studies included in the systematic review, 2021

| Author/Year | Country | Type of study | Sample (n) | Average Age (years) | Instrument | Prevalence of PIM (%) | Quality score |
|---------------------------|-----------|---------------|------------|---------------------|--|-----------------------|---------------|
| Fochat et al. 16 | Brazil | Transversal | 122 | 80,3 | Beers criteria (2003) | 7,8 | 6 |
| Garbin et al. 17 | Brazil | Transversal | 261 | ≥60 | Beers criteria (2003) | 50,6 | 6 |
| García-Gollarte et al. 18 | Australia | Transversal | 100 | 84,7 | STOPP-START (2008) | 79 | 7 |
| Gautério-Abreu et al. 19 | Brazil | Transversal | 39 | 80-89 | Beers criteria (2003) | 33,3 | 6 |
| Liew et al. 20 | Malaysia | Transversal | 155 | 75 | STOPP/START and the Beers criteria (2015) | 21,3 | 7 |
| Lima et al. 21 | Brazil | Transversal | 253 | 77 | Beers criteria (2015) | 80 | 7 |
| Lima; Garbin; Garbin. 22 | Brazil | Transversal | 261 | ≥60 | Beers criteria (2003) | 32,4 | 7 |
| Ryan et al. 23 | Ireland | Cohort | 313 | 84,4 | STOPP- START (2009) | 59,8 | 7 |
| Al Aqqad et al. 24 | Malaysia | Transversal | 211 | 77,7 | STOPP-START (2008) | 23,7 | 6 |
| Smanioto; Haddad. 25 | Brazil | Transversal | 203 | 76,4 | Canadian Mcleod criteria, (1997) | 58,1 | 6 |
| Ubeda et al. 26 | Spain | Transversal | 81 | 84 | Beers criteria (2003) and STOPP-START 2010 | 36,5 | 7 |

Table 2. Prevalence of potentially inappropriate medications for the elderly

| Organ System, Therapeutic Category | Average prevalence (%) | Medication (%) | Average prevalence (%) |
|------------------------------------|------------------------|---|------------------------|
| Antianemic | 4,0 | Ferrous sulphate ²⁵ | 4,0 |
| Anticholinergic | 13,1 | Anticholinergic ^{18,24} | 17,2 |
| Anti-infective | 4,9 | First generation antihistamines ²⁴ | 15,6 |
| Cardiovascular | 4,7 | Promethazine ¹⁶ | 6,6 |
| Endocrine | 10,9 | Nitrofurantoin ¹⁶ | 4,9 |
| Gastrointestinal | 34,5 | Antiarrhythmics ²¹ | 7,2 |
| Pain medication | 15,1 | Acetylsalicylic acid ²⁵ | 5,1 |
| Central nervous system | 14,9 | Simvastatin ²⁵ | 4,3 |
| | | Hydrochlorothiazide ²⁵ | 4,3 |
| | | Enalapril ²⁵ | 4,0 |
| | | Captopril ²⁵ | 3,2 |
| | | Glibenclamide/Chlorpropamide ²⁴ | 10,9 |
| | | Proton pump inhibitors ^{18,23} | 34,5 |
| | | Analgesics ^{21,22} | 15,1 |
| | | Benzodiazepines ^{18,23} | 30,4 |
| | | Antipsicóticos ^{18,21-22} | 26,3 |
| | | Anxiolytics ²¹ | 12,5 |
| | | Diazepam ^{16,17} | 7,0 |
| | | Antidepressants ²¹ | 6,8 |
| | | Fluoxetine ¹⁶ | 6,3 |

DISCUSSION

After successive readings of the studies selected for the present review and the grouping of information it was possible to identify three categories for discussion: Use of potentially inappropriate medications; Factors associated with the use of potentially inappropriate medications and Strategies to reduce the use of potentially inappropriate medications.

Use of potentially inappropriate medications

The use of PIM is a frequent and serious problem among the elderly. The present IR identified a high prevalence (43.86%) of the use of inappropriate medications for residents in LSIE. Studies have pointed out different prevalence, reaching 80% in Brazil (21) and 79% in Australia (18). Such findings point to the magnitude of the problem and the need for greater attention from public health policy managers and health professionals.

Comparison of the results of studies conducted around the world is not straightforward. Thus, it is observed that inequalities in the prevalence of medicines use may reflect differences between populations regarding health status and specific health care model in each country, in addition to different demographic and cultural traits related to medicines consumption (17).

The analysed studies show that some medications have a higher prevalence of use in LSIE, such as PPIs, benzodiazepines, and antipsychotics. PPIs were the most prescribed PIM. The drugs of this class are among the most used worldwide and their use increases with age, as they are effective in reducing gastric acid secretion and considered the best therapeutic option against gastroesophageal reflux disease, esophagitis, dyspepsia, symptomatic treatment of peptic ulcer, besides being used to reduce the risk of gastrointestinal bleeding related to the use of nonsteroidal anti-inflammatory drugs and low-dose aspirin (27). Their inappropriate and prolonged use compromises the elder-

ly's safety and may cause other more important problems, such as increased bone fractures, diarrhoea associated with *Clostridium difficile* and increased risk of respiratory infection. It is worth noting that unnecessary long-term use of PPIs should be avoided in the elderly population and, when necessary, individualization and dose adequacy should be considered, according to well-defined parameters (28). Studies have observed that in Australia most PPIs were used without clear indication (52.0%), without associated pathology or in association with another drug (18) and in Ireland, overdose (17.0%) (23), which can lead to intoxication and/or death.

Benzodiazepines also showed significant prevalence of use. Their use is associated with a higher risk of falls, bone fractures, delirium, and contribution to mental deterioration in the elderly population (26). With aging, more elderly suffer from chronic pain, insomnia, and depression, and consequently use these drugs more frequently (29). There is wide variation in the prescription of benzodiazepines, such as in Australia (35%) (18), Ireland (25.8%) (23), Brazil (21.1%) (29) and Spain (12.5%) (26). To reduce the prevalence of these drugs, non-drug therapy is recommended as a first-line method for the treatment of chronic pain or insomnia, as it stimulates changes in lifestyle and the adoption of healthier habits, thus ensuring a higher quality of life for residents in LSIE (30). However, when non-pharmacological measures are not possible, the follow-up of possible ADR is of utmost importance (28).

Besides the drugs already mentioned, antipsychotics are commonly prescribed inappropriately for institutionalized elderly individuals, demonstrating high prevalence in some studies. In the American population it was 31.63% (31), in the Brazilian population 26.5% (21) and in the Australians 26% (18). The use of these medications among residents of nursing homes reflects the high number of elderly individuals affected by mental or behavioural disorders (32,33). Thus, it is recommended to optimize their use considering efficacy, possible adverse reactions, and safety.

Factors associated with the use of potentially inappropriate medicines

The studies selected for analysis also observed some variables in relation to the use of PIM, among which we highlight the female gender and polypharmacy. A higher prevalence of PIM use was observed in females, with a mean of 58.5% (17-20,24,26). It is necessary to understand that there are clear biological differences in anatomical and physiological terms between females and males and, therefore, differences in the effect of aging on organic functions, which are not reduced to the reproductive system, but include several other aspects, such as musculo-

skeletal and cardiovascular, causing different reactions in response to the drugs used (34).

Given this panorama in addition to being concerned with the use of PIM, it is important and necessary to analyse aspects related to biological sex, seeking to pay attention to the specificities and not to universalize treatments, because anatomophysiological changes have pharmacokinetic and pharmacodynamic consequences, determining great individual variability in response to drugs (35). This attitude will enable more effective drug interventions, reducing possible ADR and ensuring the safety of patients living in LSIE.

The high prevalence of polypharmacy in the elderly, identified in some studies, with a mean of 58.7% (17,18,20,21,24-26), is directly associated with polymorbidity (42.35%) (17,21) which, in turn, leads to higher consumption of drugs and increases the probability of inappropriate prescription. A study showed that the use of multiple medications (5+) was a risk factor for the use of inappropriate medications (odds ratio 4.81; 95% confidence interval 2.31-10.0; $p < 0.001$) (20). Furthermore, the complexity of pharmacotherapy generated by polypharmacy, with the existence of multiple schedules, forms of administration, different dosages, and special instructions for use, may put residents at risk of clinical incidents and worse health outcomes (36).

Therefore, it is necessary to emphasize the importance of care in the simultaneous administration of drugs that may interact with each other, and the monitoring of ADR involved in negative outcomes. When these issues are not taken into consideration, a vicious cycle is generated, in which polymorbidity associated with polypharmacy tends to intensify the use of PIM and these, in turn, tend to increase the rate of other/new complications, making the health of elderly residents in LSIE increasingly compromised (37).

Strategies to reduce the use of potentially inappropriate medications

Given the high prevalence rates indicated by the selected studies, it is essential to identify and encourage the use of strategies focused on reducing the use of PIM for the elderly. Among some strategies, there are the educational interventions, which can help in the dissemination and use of instruments capable of identifying the PIM, such as the Beers (8) and STOOOP-START criteria (9). A study in Spain (26) obtained modification of prescriptions in 53% of patients with the use of the STOOOP-START criteria (9). Interventions using the Beers criteria collaborate to reduce the use of PIM from 61% to 29.5% (38).

Results point out that Beers Criteria (8) and STOOOP-START (9) should be used by health professionals as a support guide, to ensure greater safety in the use of med-

ications, since the use of drugs in the treatment of elderly patients should be careful, based on individualized clinical judgment regarding institutionalized elderly people (17,39). Thus, it is demonstrated that such instruments can be used in educational processes and contribute to the reduction of inappropriate prescriptions in LSIE. However, for such processes to be successful, it is essential the involvement and acceptance of the prescriber to change their practice and the participation of a multidisciplinary team, specifically physician, pharmacist, and nurse.

In this sense, professional training can effectively contribute to harm reduction and positively influence the safety of the elderly patient (40). A study showed that training actions for nurses who oversee the integral care of the elderly person can reduce the use of PIM. It was observed that the prevalence of PIM use decreased significantly in the intervention group (11.7, 95% confidence interval (CI) 95% 20.5 to 2.9; $P < 0.009$) (41). This demonstrates the importance of training the health care team in this process of adequacy of the proposed pharmacotherapy, aiming at reducing the number of PIM in institutionalized elderly patients.

The interventions mentioned above cannot affirm the clinical benefits achieved, which often have not been assessed clinically in a meaningful way, not considering factors such as mortality and quality of life. However, effective implementation of educational interventions tends to improve drug prescribing and increase safety in the use of medicines (28).

It is worth noting that there are other important initiatives to reduce the use of PIM, such as prescription review with drug deprescribing and computerized systems. Deprescribing is the planned and supervised process of interrupting or reducing the dose of a pharmacotherapeutic treatment that is not being beneficial to the patient, causing some adverse event or rebound symptoms due to a drug interaction (42). This attitude demonstrates an effective action in reducing inappropriate polypharmacy and reducing harm to the patient (43). In a study conducted in Australia with elderly people living in nursing homes, individualized medication reviews significantly reduced the number of regular medications by 2.0 ± 0.9 (95% confidence interval 0.08-3.8, $p = 0.04$) (44). Furthermore, in a systematic review performed, it was observed that deprescribing enabled comprehensive medication review, with a reduction in all-cause mortality (odds ratio 0.74, 95% CI: 0.58 to 0.95) and PIM prescribing (45).

Also noteworthy is the decision making based on computerized systems that enable electronic prescribing and registration of the medications used by the patient, which issue risk alerts and provide information on drug interactions (46). It observed that computerisation of the prescription system, in support of decision making, was able

to significantly ($p = 0.02$) reduce PIM prescribing for the elderly (odds ratio = 0.55, 95% CI = 0.34 - 0.89) (47). Systematic reviews also noted that such systems were able to reduce the average number of potentially inappropriate prescriptions per patient, as well as increasing their discontinuation (48). Thus, the need for increased use of electronic systems that enable information sharing and enhanced interoperability of clinical information from residents of LSIE is highlighted (49).

Another strategy identified for the proper use of medication was the use of health protocols, considered strategic for minimizing avoidable adverse events in health care (50). Protocols for the prescription, use and administration of medicines ensure greater safety to the proposed pharmacotherapy, besides enabling the implementation of health indicators that will subsidize the actions of managers for improvements in the assistance provided.

The elderly living in long-stay institutions are more prone to drug iatrogenesis, which contributes to negative clinical outcomes, compromising their health status. In this sense, the prevention of errors and the risk of harm due to their occurrence should be identified early, to outline strategies for their prevention (51). Understanding the aging process and the proposed pharmacotherapy is essential for the proposition and implementation of strategies aimed at greater safety for the elderly population.

Study limitations

Some limitations deserve mention. Relevant studies may not have been captured, despite the strict follow up of the recommended methodology. The search strategy used could not have detected non-indexed documents or those employing specific terms related to PIM for the elderly. The wide methodological heterogeneity in the selected studies and the possibility of publication bias should also be considered, which may have caused limitation. However, despite the limitations, we identified the high prevalence of PIM in LSIE, places that have been little studied about the pharmacotherapy used in the elderly population, which reaffirms the importance of intensifying this type of study.

Based on the evidence found, it was possible to identify a high and worrying prevalence of PIM, as well as the most used medications by residents of LSIE. The results tend to sensitize health professionals, so that they can review the pharmacotherapy proposed to the elderly, to avoid or reduce the prescription of MPI and propose best practices to ensure safety, thus making rational and careful use of medicines.

Some strategies to reduce the use of PIM were highlighted, highlighting the importance of the multidisciplinary team involved in the medication process to reduce inappropriate prescriptions and occurrence of adverse events. Given the above and the low number of articles

identified, it is recommended that further research be conducted on this topic, which can contribute to educational activities for health professionals and, consequently, to reduce the prevalence rates of PIM ♣

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REFERENCES

- Oliveira JM de, Rozendo CA. Instituição de longa permanência para idosos: um lugar de cuidado para quem não tem opção?. *Rev Bras Enferm.* 2014; 67(5):773–9. <https://doi.org/10.1590/0034-7167.2014670515>.
- Gerlack LF, Cuentro VDS, Estrela MFB, Karnikowski MG de O, Pinho DLM, Bós ÂJG. Interações medicamentosas na farmacoterapia prescrita a idosos residentes em uma instituição de longa permanência brasileira. *Estud Interdiscip sobre o Envelhec.* 2014; 19(2). <https://doi.org/10.22456/2316-2171.43273>.
- Shah SM, Carey IM, Harris T, DeWilde S, Cook DG. Quality of prescribing in care homes and the community in England and Wales. *Br J Gen Pract.* 2012; 62(598):e329–36. <https://doi.org/10.3399/bjgp12X641447>.
- Salcher EBG, Dellani MP, Portella MR, Doring M. Factors associated with the use of medicines potentially inadequate for urban and rural. *Rev Saúde e Pesqui.* 2018; 11(1):139–49. <https://doi.org/10.17765/1983-1870.2018v11n1p139-149>.
- Krause O, Wiese B, Doyle IM, Kirsch C, Thürmann P, Wilm S, et al. Multidisciplinary intervention to improve medication safety in nursing home residents: protocol of a cluster randomised controlled trial (HIOPP-3-iTBX study). *BMC Geriatr.* 2019; 19(1):24. <https://doi.org/10.1186/s12877-019-1027-0>.
- Lutz BH, Miranda VIA, Bertoldi AD. Potentially inappropriate medications among older adults in Pelotas, Southern Brazil. *Rev Saúde Pública.* 2017; 51:52. <https://doi.org/10.1590/S1518-8787.2017051006556>.
- Endres HG, Kaufmann-Kolle P, Steeb V, Bauer E, Böttner C, Thurmann P. Association between potentially inappropriate medication (PIM) use and risk of hospitalization in older adults: an observational study based on routine data comparing PIM use with use of PIM alternatives. *PLoS One.* 2016; 11(2):e0146811. <https://doi.org/10.1371/journal.pone.0146811>.
- American Geriatrics Society 2019. Updated AGS Beers Criteria® for potentially inappropriate medication use in older adults. *J Am Geriatr Soc.* 2019; 67:674–94. <https://doi.org/10.1111/jgs.15767>.
- O'mahony D, O'sullivan D, Byrne S, O'connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: Version 2. *Age Ageing.* 2015; 44(2):213–8. <https://doi.org/10.1093/ageing/afu145>.
- Moreira FSM, Jerez-Roig J, Ferreira LM de BM, Dantas AP de QM, Lima KC, Ferreira MÁF. Use of potentially inappropriate medications in institutionalized elderly: Prevalence and associated factors. *Ciênc Saúde Colet.* 2020; 25(6):2073–82. <https://doi.org/10.1590/1413-81232020256.26752018>.
- Soares CB, Hoga LAK, Peduzzi M, Sangaleti C, Yonekura T, Silva DRAD. Revisão integrativa: conceitos e métodos utilizados na enfermagem. *Rev Esc Enferm USP.* 2014; 48(2):335–45. <https://doi.org/10.1590/S0080-6234201400002000020>.
- Mendes KDS, Silveira RC de CP, Galvão CM. Revisão integrativa: método de pesquisa para a incorporação de evidências na saúde e na enfermagem. *Texto Contexto Enferm.* 2008; 17(4):758–64. <https://doi.org/10.1590/S0104-07072008000400018>.
- Hortelan M dos S, Almeida M de L de, Fumincelli L, Zilly A, Nihei OK, Peres AM, et al. Papel do gestor de saúde pública em região de fronteira: scoping review. *Acta Paul Enferm.* 2019; 32(2):229–36. <https://doi.org/10.1590/1982-0194201900031>.
- Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ.* 2021; 372:71. <https://doi.org/10.1136/bmj.n71>.
- Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, Tugwell P. The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses [Internet]. The Ottawa Hospital; 2000. Available at: <https://bit.ly/3Z8fF17>.
- Fochat RC, de Oliveira Horsth RB, Sette MS, Barbosa Raposo NR, Chicourel EL. Perfil de utilização de medicamentos por idosos frágeis institucionalizados na Zona da Mata Mineira, Brasil. *Rev Ciênc Farm Básica Apl [Internet].* 2012; 33(3):447-54. Cited on March 2021. Available at: <https://bit.ly/3SnZH2C>.
- Garbin CAS, Lima TJV de, Araújo PC, Garbin AJ, Arcieri RM, Saliba O. Perfil da farmacoterapia utilizada por idosos institucionalizados. *Arch Heal Investig.* 2017; 6(7):322–7. <https://doi.org/10.21270/archi.v6i7.2083>.
- García-Gollarte F, Baleriola-Júvez J, Ferrero-López I, Cruz-Jentoft AJ. Inappropriate drug prescription at nursing home admission. *J Am Med Dir Assoc.* 2012; 13(1):83.e9-83.e15. <https://doi.org/10.1016/j.jamda.2011.02.009>.
- Gautério-Abreu DP, Santos SSC, Ilha, S, Piexak DR. Uso de medicamentos inapropriados por pessoas idosas residentes em instituições de longa permanência. *Rev Enferm UFPE on line [Internet].* 2016; 10(2):608-14. Available at: <https://bit.ly/3YCj9w5>.
- Liew NY, Chong YY, Yeow SH, Kua KP, Saw PS, Lee SWH. Prevalence of potentially inappropriate medications among geriatric residents in nursing care homes in Malaysia: a cross-sectional study. *Int J Clin Pharm.* 2019; 41(4):895–902. <https://doi.org/10.1007/s11096-019-00843-1>.
- Lima TJV de, Garbin CAS, Araújo PC, Garbin AJ, Roviada TAS, Saliba O. Reações adversas a medicamentos entre idosos institucionalizados: prevalência e fatores associados. *Arch Heal Investig.* 2017; 6(3):129–35. <https://doi.org/10.21270/archi.v6i3.1921>.
- Lima TJV de, Garbin C, Garbin A, Sumida DH. Potentially inappropriate medications used by the elderly: Prevalence and risk factors in Brazilian care homes. *BMC Geriatr.* 2013; 13:52. <https://doi.org/10.1186/1471-2318-13-52>.
- Ryan C, O'Mahony D, Kennedy J, Weedle P, Cottrell E, Heffernan M et al. Potentially inappropriate prescribing in older residents in Irish nursing homes. *Age Ageing.* 2013; 42(1):116-20. <https://doi.org/10.1093/ageing/afs068>.
- Al Aqqad SM, Chen LL, Shafie AA, Hassali MA, Tangiisuran B. The use of potentially inappropriate medications and changes in quality of life among older nursing home residents. *Clin Interv Aging.* 2014; 22; 9:201-7. <https://doi.org/10.2147/CIA.S52356>.
- Smanioto FN, Haddad M do CL. Evaluation of pharmacotherapy prescribed to institutionalized elderly. *Rev Bras Enferm.* 2013; 66:523-7. <https://doi.org/10.1590/S0034-71672013000400009>.
- Ubeda A, Ferrándiz ML, Maicas N, Gomez C, Bonet M, Peris JE. Potentially inappropriate prescribing in institutionalised older patients in Spain: the STOPP-START criteria compared with the Beers criteria. *Pharmacy Practice [Internet].* 2012; 10(2):83-91. Cited on March 2021. Available at: <https://bit.ly/3GJkWte>.
- Costa S de AL, Marques LF, Aleixo AG, Silva LF da, Santos NVP, Camalac Junior AR de, et al. Effects of prolonged use of Proton Pump Inhibitors in the elderly. *Brazilian J Heal Ver [Internet].* 2021; 4(2):4248–65. <https://doi.org/10.34119/bjhrv4n2-023>.
- Praxedes MFS, Pereira GCS, Lima CFM, Santos DS, Berhends JS. Prescrição de medicamentos potencialmente inapropriados para idosos segundo os Critérios de Beers: Revisão sistemática. *Cien Saude Colet [Internet].* 2020. Cited on June 2021. Available at: <https://bit.ly/4m5QHwN>.
- Gatto CM, Jorge MSG, Wibelinger LM, Bertolin TE, Portella MR, Doring M. Prevalência de polifarmácia, benzodiazepínicos e fatores asso-

- ciados em idosos institucionalizados. *Rev Bras Ciências do Envelhec Hum.* 2019; 16(3):47–58. <https://doi.org/10.5335/rbceh.v16i3.7797>.
30. Li H, Pu S, Liu Q, Huang X, Kuang J, Chen L et al. Potentially inappropriate medications in Chinese older adults: The beers criteria compared with the screening tool of older persons' prescriptions criteria. *Geriatr Gerontol Int.* 2017; 17(11):1951–8. <https://doi.org/10.1111/ggi.12999>.
 31. Kamble P, Chen H, Sherer JT, Aparasu RR. Use of antipsychotics among elderly nursing home residents with dementia in the US: An analysis of national survey data. *Drugs Aging.* 2009; 26(6):483–92. <https://doi.org/10.2165/00002512-200926060-00005>.
 32. Converso MER, Iartelli I. Analysis and characterization of functional capacity and mental state in residents in old folk's home. *J Bras Psiquiatr.* 2007; 56:267–72. <https://doi.org/10.1590/S0047-20852007000400005>.
 33. Lenardt MH, Michel T, Wachholz PA, Borghi AS, Seima MD. O desempenho de idosas institucionalizadas no miniexame do estado mental. *Acta Paul Enferm.* 2009; 22(5). <https://doi.org/10.1590/S0103-21002009000500007>.
 34. Santalucia P, Franchi C, Djade CD, Tettamanti M, Pasina L, Corrao S, et al. Gender difference in drug use in hospitalized elderly patients. *Eur J Int Med.* 2015; 26(7):483–90. <https://doi.org/10.1016/j.ejim.2015.07.006>.
 35. Mosca C, Correia P. O medicamento no doente idoso. *Acta farmacêutica Port [Internet].* 2012; 1(2):75–8. Cited on March 2021. Available at: <https://bit.ly/4dc6dmk>.
 36. Sluggett JK, Hopkins RE, Chen EY, Ilomäki J, Corlis M, Van Emden J, et al. Impact of medication regimen simplification on medication administration times and health outcomes in residential aged care: 12 month follow up of the SIMPLER randomized controlled trial. *J Clin Med [Internet].* 2020; 9(4):1053. <https://doi.org/10.3390/jcm9041053>.
 37. Secoli SR. Polifarmácia: interações e reações adversas no uso de medicamentos por idosos. *Rev Bras Enferm.* 2010; 63(1):136–40. <https://doi.org/10.1590/S0034-71672010000100023>.
 38. Najjar MF, Sulaiman SAS, Jeraisy AIM, Balubaid H. The impact of a combined intervention program: an educational and clinical pharmacist's intervention to improve prescribing pattern in hospitalized geriatric patients at King Abdulaziz Medical City in Riyadh, Saudi Arabia. *Ther Clin Risk Manag.* 2018; 14:557. <https://doi.org/10.2147/TCRM.S157469>.
 39. Praxedes MFDS, Telles Filho PCP, Pinheiro MLP. Identificação e análise de prescrições de medicamentos potencialmente inapropriados para idosos em uma instituição hospitalar. *Ciênc Cuid Saúde.* 2011; 10(2):338–44. <https://doi.org/10.4025/ciencucidsaude.v10i2.10214>.
 40. Souza AAL, Néri EDR, Gomes GC, Lopes EM, Fonteles MDF, Meira AS et al. Avaliação do autoconhecimento da equipe médica, de enfermagem e farmácia sobre medicamentos potencialmente perigosos. *Rev Med UFC.* 2019; 59(1):21–29. <https://doi.org/10.20513/2447-6595.2019v59n1p21-29>.
 41. Pitkälä KH, Juola AL, Kautiainen H, Soini H, Finne-Soveri UH, Bell JS, Björkman M. Education to reduce potentially harmful medication use among residents of assisted living facilities: a randomized controlled trial. *J Am Med Dir Assoc.* 2014; 15(12):892–8. <https://doi.org/10.1016/j.jamda.2014.04.002>.
 42. Da Silva EF, Roderjan JG, Domingues JPF, De Oliveira W. Deprescrição/description. *Braz J Develop.* 2021; 7(8):80660–5. <https://doi.org/10.34117/bjdv7n8-332>.
 43. Scott IA, Hilmer SN, Reeve E, Potter K, Le Couteur D, Rigby D, et al. Reducing inappropriate polypharmacy: the process of deprescribing. *JAMA Intern Med.* 2015; 175:827–34. <https://doi.org/10.1001/jamainternmed.2015.0324>.
 44. Potter K, Flicker L, Page A, Etherton-Bear C. deprescribing in frail older people: a randomised controlled trial. *PLoS One.* 2016; 11:e0149984. <https://doi.org/10.1371/journal.pone.0149984>.
 45. Bloomfield HE, Greer N, Linsky AM, Bolduc J, Naidl T, Vardeny O, et al. Deprescribing for community-dwelling older adults: a systematic review and meta-analysis. *J Gen Intern Med.* 2020; 35(11):3323–32. <https://doi.org/10.1007/s11606-020-06089-2>.
 46. Santos NS dos, Marengo LL, Moraes F da S, Barberato-Filho S. Intervenções para reduzir a prescrição de medicamentos inadequados em pacientes idosos. *Rev Saúde Pública.* 2019; 53:7. <https://doi.org/10.11606/S1518-8787.2019053000781>.
 47. Terrell KM, Perkins AJ, Dexter PR, Hui SL, Callahan CM, Miller DK. Computerized decision support to reduce potentially inappropriate prescribing to older emergency department patients: a randomized controlled trial. *J Am Geriatr Soc.* 2009; 57:1388–94. <https://doi.org/10.1111/j.1532-5415.2009.02352.x>.
 48. Monteiro L, Maricoto T, Solha I, Ribeiro-Vaz I, Martins C, Monteiro-Soares M. Reducing potentially inappropriate prescriptions for older patients using computerized decision support tools: systematic review. *J Med Internet Res.* 2019; 21(11):e15385. <https://doi.org/10.2196/15385>.
 49. Makeham M, Pont L, Verdult C, Hardie RA, Raban MZ, Mitchell R, et al. The General Practice and Residential Aged Care Facility Concordance of Medication (GRACEMED) Study. *Int J Med Inform.* 2020; 143:104264. <https://doi.org/10.1016/j.ijmedinf.2020.104264>.
 50. Anvisa. Agência Nacional de Vigilância Sanitária. Resolução da diretoria colegiada Nº 36, de 25 de julho de 2013 [Internet]. Cited on March 2021. Available at: <https://bit.ly/4m6ZEpo>.
 51. Cavalcante MLSN, Borges CL, Moura AMFTDM, Carvalho REFLD. Indicators of health and safety among institutionalized older adults. *Rev. Esc Enferm USP [Internet].* 2016; 50:0602–9. <https://doi.org/10.1590/S0080-623420160000500009>.