Review Article

Determinants of Potentially Inappropriate Medication Use in Long-Term and Acute Care Settings: A Systematic Review

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ABSTRACT

Background: Potentially inappropriate medications (PIMs) are widely used in institutionalized older adults, yet the key determinants that drive their use are incompletely characterized.
Methods: We systematically searched published literature within MEDLINE and Embase from January 1998 to March 2017. We searched for studies conducted in the United States that described determinants of PIM use in adults ≥60 years of age in a nursing home or residential care facility, in the emergency department (ED), or in the hospital. Paired reviewers independently screened abstracts and full-text articles, assessed quality, and extracted data.
Results: Among 30 included articles, 12 examined PIM use in the nursing home or residential care settings, 4 in the ED, 12 in acute care hospitals, and 2 across settings. The Beers criteria were most frequently used to identify PIM use, which ranged from 3.6% to 92.0%. Across all settings, the most common determinants of PIM use were medication burden and geographic region. In the nursing home, the most common additional determinants were younger age, and diagnoses of depression or diabetes. In both the ED and hospital, patients receiving care in the West, Midwest, and South, relative to the Northeast, were at greater risk of receiving a PIM. Very few studies examined clinician determinants of PIM use; geriatricians used fewer PIMs in the hospital than other clinicians.
Conclusions: Among older adults, those who are on many medications are at increased risk for PIM use across multiple settings. We propose that careful testing of interventions that target modifiable determinants are indicated to assess their impact on PIM use.

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Clinicians have long recognized the risks from inappropriate use of medications in older adults. Of the 10 recommendations from the American Geriatrics Society to the Choosing Wisely initiative, 6 were about the use of medications in this patient population.[1] Despite this, inappropriate medication use remains prevalent.[2] Risky medication use is associated with falls,[3] adverse drug events,[4] hospitalization, and increased health care costs.[5]

However, inappropriate medication use is challenging to define. It is often referred to as *potentially* inappropriate medication (PIM) use, as there may be situations in which the use of the medication is appropriate. There are several published definitions for PIM,[6–14] centered on these being medications in which the risks from their use likely exceeds their benefits.[6]

Older adults residing in institutional settings, such as nursing homes, are at particularly high risk for PIM use.[15] Hospitalization is also a setting in which older adults are likely to be exposed to PIMs.[16] It remains unclear, however, what drives PIM use in these settings, which is central to the design of interventions to curb PIM use. Therefore, we sought to systematically review the literature to identify the determinants of PIM use in older adults in institutional settings: in nursing homes, emergency departments (EDs), and hospitals.

Methods

Data Sources and Searches

We registered the protocol for this systematic review in Prospero (no.42015029482). We searched MEDLINE and Embase from January 1998 through March 2017 using terms reflecting medical subject heading (MeSH) terms and keywords relevant to the overuse of health care services. The literature addressing this key question about PIM use was identified among the results generated by the broader search for literature about overuse of health care services. We then updated the search from January 1998 through March 2017 for articles specifically addressing PIM use in nursing homes, EDs, and hospitals. The following search terms were used:

First search: "medical overuse" OR "health services misuse" OR health services overutilization OR "unnecessary procedures" OR medically unnecessary procedures OR Diagnostic Tests, Routine/utilization OR Defensive Medicine OR Practice Patterns OR Health Services Abuse OR Health Services Overuse OR medical overutilization OR inappropriate utilization.

Second focused search: Overmedication OR "Potentially Inappropriate Medication List" "inappropriate prescribing" OR "polypharmacy" OR "inappropriate medication" OR "prescribing patterns" OR Prescription Drug Misuse OR Prescription Drug Overuse.

Searches were limited to human studies in the English language for relevancy. We hand searched the reference lists of each included article as well as related systematic reviews for additional articles. The results of the searches were downloaded and imported into EndNote (New York, NY), duplicates were screened out, and the remaining articles were uploaded to DistillerSR (Evidence Partners, Ottawa, Ontario, Canada), a Web-based software package developed for systematic review data management. This database was used to track the search results at the levels of title review, abstract review, and article inclusion/exclusion.

Study Selection

Four authors (SN, RS, AO, MJ) participated in the review process, including 2 medical students (see Acknowledgments). Two reviewers independently screened titles, abstracts, and the full text in parallel and came to agreement on appropriateness for inclusion. Studies were included if they tested determinants of use of medications considered inappropriate or potentially inappropriate based on defined criteria (ie, Beer's list). We included studies examining patients older than age 60, written in English, and that did not exclusively describe care outside of the United States. We further restricted the study to data collected after 1996, given the substantial changes in the US health care system in the past 2 decades. We did not include studies testing interventions targeting medication use, except for a single study, which was a pragmatic trial of different existing care settings.[17] Titles were included if at least 1 reviewer marked it for inclusion; titles were excluded only if 2 reviewers agreed it was ineligible. At the abstract level, both reviewers had to indicate that an article was ineligible for it to be removed (Appendix Figure 1). Articles promoted on the basis of abstract review underwent another independent parallel review to determine if they should be included for data extraction (Appendix Figure 1). Differences between reviewers were resolved through consensus adjudication.

Data Extraction, Quality, and Applicability Assessment

Four authors (SN, RS, AO, MJ) participated in the abstraction and quality evaluation process, including 1 medical student (see Acknowledgments). We created and piloted data extraction forms in Excel (Microsoft, Redmond, WA). Reviewers extracted information on the study characteristics, study participant characteristics, methods of data collection, criteria used to define PIM, the determinants evaluated by the investigators, and the determinants identified as being significantly associated with the overuse event. The determinants were classified as related to the patient, the clinician, or the environment, including the region and health system. We used the criteria for determining statistical significance as had been defined by each article. One article reported only descriptive statistics, which we used to calculate unadjusted odds ratios.[18] One reviewer completed data abstraction and a second reviewer checked the first reviewer's abstraction for completeness and accuracy. We resolved differences between reviewer pairs by discussion and, as needed, through full-team meetings.

Using the same parallel independent process, 2 reviewers assessed risk of bias in included articles using an adaptation of an assessment tool for cohort studies and an adaptation of a survey appraisal instrument.[19] Differences between reviewers were resolved through consensus.

Data Synthesis and Analysis

Four authors (SN, RS, AO, MJ) created detailed evidence tables and synthesized the results by setting and type determinants studied to create summary tables of the results (Appendix Table 1). The results were not amenable to quantitative pooling given the heterogeneity in design across studies.

Role of the Funding Source

The funding source had no role in this project.

Results

We identified 12,500 titles meeting our criteria (Appendix Figure 1). From these, we selected 730 articles for full-text review, of which 30 met our final criteria.

Risk of Bias

The risk of bias was determined to be low for 25 of the 30 studies; 4 were determined to have a moderate risk of bias.[18,20–22] Only 1 study was considered to have a high risk of bias.[23] The primary source of bias was potential confounding due to inadequate adjustment of effect estimates. One cohort study did not clearly describe the characteristics of the study participants at enrollment.[24]

Determinants of PIM Use in Nursing Homes and Residential Care

Twelve studies evaluated determinants of PIMs use by residents of nursing homes or residential care facilities (ie, assisted living facilities).[20,24–34] Additionally, 2 studies of Medicaid claims examined populations of older adults that included a subgroup in the nursing home.[29,35] Three of the studies limited their analyses to nursing home residents with dementia.[25,31,32] All used multivariable analysis adjusting for some combination of patient and system-level factors, except one.[18] Individuals were demographically similar across studies and 9 of the 11 studies used a version of the Beers list to define PIM (Table 1). Frequently examined determinants of PIM use are summarized in Table 2.

Patient Factors

Twelve studies evaluated patient factors contributing to PIM use in this setting (Appendix Table 1).[20,24–34] The 4 largest studies reported