



Full Length Article

Prevalence and predictors of potentially inappropriate prescribing of central nervous system and psychotropic drugs among elderly patients: A national population study in Korea



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ABSTRACT

Objectives: To investigate the prevalence of potentially inappropriate prescribing (PIP) of central nervous system and psychotropic (CNS-PS) drugs to the Korean elderly population, and to identify PIP-associated factors.

Methods: Ambulatory care visits were identified from the 2013 National Aged Patient Sample (HIRA-APS-2013) data, composed of 20% random samples of all enrollees in the universal health security program aged ≥ 65 years. The CNS-PS section of Screening Tool of Older Person's potentially inappropriate Prescriptions (STOPP) criteria version 2 was used to identify PIP at these visits.

Results: A total of 24,427,069 prescription claims records and 1,122,080 patients were included in the study; 10.73% of the claims and 53.64% of the patients satisfied at least one STOPP criterion in the prescription of CNS-PS drugs. The highest prevalence of PIP was observed for the criteria of "first-generation antihistamines" (FGAH), followed by tricyclic antidepressants (TCA) in patients with prostatism and TCA in patients with dementia. The generalized estimating equation logistic regression analysis showed that the PIP of FGAH was significantly associated with polypharmacy (5–9 drugs: odds ratio (OR) 4.965, 95% confidence interval (CI) 4.936–4.994; ≥ 10 drugs: OR 5.704, 95% CI 5.604–5.807), less severe health conditions (Charlson Comorbidity Index (CCI) = 2: OR 0.852, 95% CI 0.842–0.862; CCI = 1: OR 0.975, 95% CI 0.964–0.986), prescriptions from clinics (OR > 1.0), and outpatient care by general practitioners (OR > 1.0).

Conclusions: Appropriate interventions to reduce PIP should be made, especially for the criteria that indicate a high PIP prevalence. Targeted strategies are necessary to modify the risk factors of PIP identified from this study.

1. Introduction

The majority of the elderly adult population has one or more chronic conditions that require lifetime treatment. Since pharmaceutical intervention is the major treatment strategy for chronic conditions, the safe and optimal use of drugs is important to achieve treatment effectiveness. In general, elderly people receive multiple drug therapy, rendering them vulnerable to drug–drug interaction and duplication of prescriptions (Cahir et al., 2010; Moriarty, Bennett, Fahey, Kenny, & Cahir, 2015; Moriarty, Hardy, Bennett, Smith, & Fahey, 2015). In addition, due to the aging process, the pharmacokinetics and

pharmacodynamics become unstable in elderly patients. This makes it difficult to accurately predict the response to drug therapy and the possibility of adverse reactions among elderly patients. Therefore, pharmacotherapy in elderly patients requires appropriate drug and dose selection.

To improve the safety and the appropriateness of prescription drug use among senior citizens, efforts have been made to develop explicit criteria for guiding avoidable and recommended drug use. For example, Beers criteria were the first to detect potentially inappropriate prescribing (PIP) to elderly patients and is widely used (Bradley et al., 2012). To overcome the shortcomings of Beers criteria—which include

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drugs that are mainly used in the U.S. and which do not consider drug–drug interactions and drug class prescription duplication (O'Mahony et al., 2010)—various criteria have been developed in the Western world. These include the Canadian McLeod's criteria, French Consensus Patient list, Screening Tool of Older Persons' Prescriptions (STOPP) and Screening Tool to Alert to Right Treatment (START) criteria, Australian Prescribing Indicators Tool, Norwegian General Practice (NORGEP) criteria, German PRISCUS list, and Swedish indicators (Fastbom & Johnell, 2015).

There is a large number of empirical studies showing that PIP among elderly adults detected by these criteria is associated with adverse health outcomes such as adverse drug reactions (Chang et al., 2005; Fick, Mion, & Beers, 2008; Stockl, Le, Zhang, & Harada, 2010), emergency department visits (Chen et al., 2009; Lai et al., 2009; Perri, Menon, Deshpande, Shinde, Jiang, & Cooper, 2005), hospitalization (Chen & Cheng, 2016), admission to a nursing home (Fillenbaum et al., 2004; Zuckerman et al., 2006), poor health-related quality of life (Chin et al., 1999; Franic & Jiang 2006), and death (Perri et al., 2005). Furthermore, PIP increases unnecessary health care costs. According to a retrospective national population study using a pharmacy claims database in Ireland, PIP accounts for 9% of the overall expenditure on pharmaceuticals in adults ≥ 70 years old (Cahir et al., 2010).

Thus, in order to improve clinical and economic outcomes of drug therapy in the elderly population it is essential to prevent PIP. In particular, in rapidly aging countries such as Korea where the proportion of the elderly, age ≥ 65 years, has increased by 81.9% (i.e., from 7.2% in 2000 to 13.1% in 2015), appropriate interventions to reduce PIP need to be developed (Statistics Korea, 2015). To our knowledge, there has been little study on the assessment of PIP among Korean elderly by using nationally representative data. Therefore, here, we investigated the prevalence of PIP among the Korean elderly population using pre-existing criteria. Patient and provider characteristics associated with the instance of PIP were also investigated to identify potential strategies to minimize the use of potentially inappropriate drugs in Korean society.

2. Materials and methods

2.1. Study subjects and data source

To ensure representativeness of the study findings, a national population study was designed using the National Health Insurance claims database. We used the 2013 National Aged Patient Sample data (HIRA-APS-2013), which are nationally representative cross-sectional data provided by the government agency Health Insurance Review and Assessment Service (HIRA). The HIRA-APS-2013 are composed of 20% random samples of patients aged ≥ 65 (approximately one million elderly) enrolled in the National Health Insurance (NHI) or Medical Aid (MA) in 2013. Korea has two tiers of the universal health security system: The NHI program is a wage-based, contributory insurance program covering about 96% of the population, while the MA program is a government-subsidized public assistance program for poor and medically indigent individuals (Shin, Kang, Kim, & Kim, 2012).

Study subjects were defined as elderly patients aged ≥ 65 years who had at least one claim record for outpatient prescription. Since drug utilization characteristics are distinct between inpatient and outpatient care, and the outpatient drug use is more prevalent among the elderly population, we focused on outpatient prescriptions in our analysis. From the total of 1,161,198 elderly patients in HIRA-APS-2013, we excluded patients with no claim records for outpatient prescription during the year. Thus, 1,122,080 elderly patients with 24,427,069 claim records for outpatient prescription were selected for our study.

2.2. Selecting and localizing criteria

Among the various criteria used to detect potential errors of

prescribing commissions, we chose the STOPP criteria for the following reasons. First, the contents of the criteria have been validated in a number of studies (Gallagher, Ryan, Byrne, Kennedy, & O'Mahony, 2008; Gallagher et al., 2009; Ryan, O'Mahony, & Byrne, 2009). Second, they are one of the most updated criteria, which were initially developed in 2008 and were updated in 2013 (Gallagher et al., 2008; O'Mahony et al., 2015). Third, they are comprehensive in considering both drug–drug and drug–disease interactions (Corsonello et al., 2012; Fastbom & Johnell, 2015; Lam & Cheung, 2012; Levy, Marcus, & Christen, 2010). Fourth, they are widely used in Europe, Asia, and North America (Hill-Taylor et al., 2013). Lastly, they have a proven feasibility of estimating PIP prevalence from administrative insurance claims data. There are several examples of cases where the STOPP criteria were applied on the basis of the analysis of insurance claims records (Bradley et al., 2012; Brown, Hutchison, Li, Painter, & Martin, 2016; Cahir et al., 2010; Cahir, Bennett, Teljeur, & Fahey, 2014; Kim, Jang, Kim, Kim, & Sohn, 2015; Moriarty, Bennett et al., 2015; Moriarty, Hardy et al., 2015).

The STOPP criteria consist of 80 evidence-based criteria for PIP, including drug–disease and drug–drug interactions, drug doses, and duration of treatment (O'Mahony et al., 2015). Each STOPP criterion was proposed by several studies providing clinical evidence, and was validated by an expert panel using the Delphi method. Among the drug categories included in the STOPP criteria, the present study focused on central nervous system (CNS) and psychotropic (PS) drugs (section D of STOPP criteria version 2), since the prevalence of diseases associated with the use of CNS-PS, such as dementia and depression, is increasing and the drugs included in this category are widely used among the Korean elderly population (Hwang, Kim, & Lee, 2015; Kim et al., 2015; Lim et al., 2016).

The initial number of the STOPP criteria in CNS-PS sections was 14. To calculate the proportion of claims for or patients taking a specific drug for a particular disease, the 14 initial criteria were subdivided into criteria describing drug–disease interactions. For example, the following criterion, “Tricyclic antidepressants with dementia, narrow angle glaucoma, cardiac conduction abnormalities, prostatism” was separated into 4 different criteria by each disease. By establishing a separate criterion for each diagnosis included in the same criteria, the initial number of CNS-PS sections of the STOPP criteria became 19.

The following two steps were carried out to improve the feasibility and the validity of using the STOPP criteria in a local health care setting. First, two of the co-authors independently reviewed each of the criteria assessing whether PIP could be determined on the basis of information provided by a one-year insurance claims record. This is important because some criteria require information acquired during more than one year of observation or information that is not included in the claims record. “As first-line antidepressant treatment,” “with a history of previous urinary retention,” and “to treat extra-pyramidal side-effects of neuroleptic medications” are examples of such cases. Only criteria both reviewers deemed appropriate for inclusion were selected in the present study. As a result, 12 out of 19 criteria were selected for the analysis.

As a next step, a clinician panel composed of two family medicine doctors and two psychiatrists independently reviewed whether each criterion was appropriate to determine PIP in the clinical practice environment of Korea. Out of the 12 criteria reviewed, 10 were selected as a final list since three of the four panel members agreed upon their clinical validity in Korea (Table 1).

2.3. Data analysis

The proportion of outpatient prescription claims for CNS-PA drugs that satisfied one or more of the 10 STOPP criteria was calculated as “claim-level overall PIP prevalence rate.” Similarly, the proportion of patients that had outpatient prescription claim records satisfying at least one of the 10 criteria was calculated as “patient-level overall PIP

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