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Utility of a computer tool for detection of potentially inappropriate medications in older patients in a tertiary hospital.

González-Rojano E[1], Marcotegui J[*2], Sampedro R[3], Valdez-Acosta S[1], Abad-Santos F[1].

[1]Department of Clinical Pharmacology, Hospital Universitario de la Princesa, Teófilo Hernando Instituto, Universidad Autónoma de Madrid (UAM), Instituto de Investigación Sanitaria la Princesa, Madrid, Spain.
[2]Department of Anesthesiology, Reanimation and Pain Treatment, Hospital Clínico San Carlos, Universidad Complutense de Madrid (UCM), Madrid, Spain.
[3]Department of Internal Medicine, Hospital Universitario de la Princesa, Madrid, Spain.

Correspondencia:
Elene González-Rojano. Department of Clinical Pharmacology, Hospital Universitario de la Princesa, Teófilo Hernando Instituto, Universidad Autónoma de Madrid (UAM), Instituto de Investigación Sanitaria la Princesa, Madrid, Spain.
Email: egonzalezrojano@gmail.com.

Abstract:
As we believe it is an important problem in our environment, we determined the prevalence of potentially inappropriate medications (PIM) using the STOPP/START, Beers and PRISCUS criteria, and also determined the clinical variables related to the prescription of PIMs in older adults. It is a retrospective cross-sectional study in Geriatrics. Participants were all patients over 65 years discharged from the Internal Medicine Service of La Princesa hospital during February 2014. We measured inappropriate prescriptions detected with CheckTheMeds® computer tool. The study included 143 participants, mean age 87±7 years. Using Beers criteria, 421 PIMs were identified in 114 patients, with STOPP criteria, 277 PIMs were identified in 111 patients, with START criteria 279 PIMs were identified in 113 patients and using PRISCUS 47 PIMs were identified in 42 patients. Correlation between STOPP and Beers was 70%. An association between PIM prescribing and polypharmacy was detected with different criteria. Check-TheMeds® is a useful tool to improve detection and management of PIM in order to obtain evidence-based pharmacological treatment.

Keywords: CheckTheMeds®, Potentially Inappropriate Prescribing, STOPP – START, Beers, PRISCUS.
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INTRODUCTION

Increased life expectancy means that the number of older people is growing and they are becoming more important in society. As a consequence, the global pop-ulation is aging. Population over 65 years was 35 million in 2000 and is expected to exceed 71 million people in 2030. By 2050, the global average life expectancy is predicted to increase 10 years compared to 2000 (1). In Spain the population is also becoming more aged. The census registered 8,573,985 people over 65 (18.4% of the total population) in January 1ist 2015, and more than 16 million seniors (38.7% of the total) are predicted for 2061 (2).

Old people are a heterogeneous group of patients with multiple comorbidities which receives a large number of prescriptions. Moreover, the physiological changes of aging modify the pharmacokinetics and pharmacodynamics of drugs, making older people a particularly vulnerable group to suffer adverse effects as a result of medication (3).

In fact, polypharmacy is one of the geriatric syn-dromes. In many cases there is inappropriate prescription (IP), especially to those who live in institutions. Appro-priate prescribing of medications is a major challenge in daily prescription of older adults. It is well known that IP is a major cause of comorbidity that in some cases can be lethal (4). It also increases the risk of mortality and hos-pitalization (5). Moreover, it generates a misuse of health resources, not only related to the excessive use of drugs but also related to visits to general practitioners with unrec-ognized symptoms (6). Sometimes the proper medication is not prescribed to the elderly simply because of their age (7). Therefore, in elderly people, drug prescription is quite specific and should be a part of geriatric assessment (8).

Different screening tools are available to detect potentially inappropriate medication (PIM) and to facilitate drug prescription. The list of suitable drugs for the elderly varies depending on the country, due to different drug approvals or differences in prescribing behavior. The main criteria for detecting inappropriate prescription are three: Beers, PRISCUS and STOPP-START.

Beers criteria were developed by a panel of experts in USA. They were published in 1991, later revised and updated in 1997, 2003 (9), 2012 (10) and 2015 (11). The last update incorporated a list of drugs that should be avoided or need their dose adjusted based on kidney function, and a list of drug-drug interactions (11). However, Beers criteria have several limitations, because some drugs on the list are rarely used or unavailable in most of the European countries.

In Germany the first black list 'PRISCUS' (PRereq-uISites for a new health Care model for elderly people with mUltiple morbiditieS) was consensually developed in 2010 by a group of various medical specialists as a goal of the German Health Ministry Drug Safety Initiative. PRISCUS includes a list of potentially inappropriate medications specifically for use in Germany. A total of 83 drugs are rated as potentially inappropriate for elderly patients. Moreover, the list contains recommendations for clinical practice, e.g. monitoring of laboratory values, dose adaptation or therapeutic alternatives. It was created using the Delphi method so it is not devoid of subjectivity. (12)

Another tool, called STOPP (Screening Tool of Older Persons Prescriptions) and START (Screening Tool to Alert doctors to Right Treatment), was developed in 2008 by an Irish group of experts in geriatrics and pharmacology for validation using the Delphi consensus technique. The STOPP/START criteria are sorted by physiological sys-tems thus speeding implementation. They consist of 22 START and 65 STOPP criteria (7). This tool was updated in 2014 incorporating clinical evidence that eliminates criteria which lack clinical importance and incorporates new criteria. The expert panel agreed a final list of 114 criteria after two Delphi validation rounds (80 STOPP criteria and 34 START criteria) (13).

Several studies have been performed in Spain to determine the incidence of IP in elderly patients using different tools that improve the care of older adults (3, 6). Polypharmacy is a very common problem in our hospital, especially in elderly patients (2). The systematic revision of the medication can improve the quality of life of these patients as well as reduce the pharmaceutical cost.

Due to the fact that the population that supports our hospital is mainly elderly, we wanted to study the number of potentially inappropriate prescriptions in patients discharged from the Internal Medicine Service and to investigate about the utility of a computer tool (Check-TheMeds®) in this evaluation.

MATERIALS & METHODS

This is a retrospective cross-sectional study that was coordinated at the Department of Clinical Pharmacology, Hospital Universitario La Princesa, Madrid. The study was conducted in cooperation with the Department of Internal Medicine. Hospital de la Princesa is a tertiary hospital, located in the centre of Madrid. Approximately 20 per cent of the population covered by this hospital is over 65 years of age (14).

The study was approved by the Clinical Research Ethics Committee of Hospital Universitario de la Princesa, and complies with the ethical rules for human experimentation from Declaration of Helsinki.

2.1 Inclusion of study participants

We reviewed all patients discharged from the Internal Medicine Department during February 2014, who were at least 65 years old. We excluded the exitus, palliative patients, and those relocated to other centers.

2.2 Data collection

Patients who met inclusion criteria were included in a database program. Data were anonymized to avoid using

any patient identifier, such as clinical history number. Once data were loaded by the investigators, an exhaustive review was conducted with CheckTheMeds®, a computer program that processes globally all the information related to drugs: not only criteria of inappropriate drugs in older patients (it automatically applies BEERS, START/STOPP and PRISCUs criteria), also underdosing, overdosing or duplication. It requires the introduction into its database of some patient data, being the more relevant: age, sex, weight, height, arterial blood pressure, hospi-talization or not, allergies, current diagnostics, current or past signs or symptoms, on-going treatments with po-sology, and some analytical data such as creatinine level and ions. In order to assure the quality of the data which are been used by CheckTheMeds, all data introduced were double-checked by another investigator, different from the one who originally entered them. Using this system we consider no relevant inter-investigator variability or ran-dom error should be expected.

RESULTS

3.1 Characteristics of the study population

Among the total of 194 patients discharged from the Internal Medicine Department during February 2014, we selected 143 patients (table 1). The reasons for exclusion were: 25 exitus (12.9%), 22 younger than 65 years (11.3%), 2 relocations to another hospital (1.0%), 1 lacking report (0.5%) and 1 palliative patient (0.5%). The mean age was 87.9±7.8 years, 60% were women, mean number of total chronic disease was 10.3±3.4, and mean number of drugs was 8±3.6. Charlson Comorbidity Index was 7.6±2, which represents an estimated survival at ten years of 5.0±14.2%.

From 143 patients, a total of 1180 medication items were reviewed. The prevalence of use of ≤5 drugs was 20.98%, for 6–10 drugs was 54.55%, and for >10 drugs was 24.47%, respectively (table 2).

3.2 Comparison of the different tools

STOPP criteria detected 277 PIM in 111 (77.6%) patients, no PIM in 32 (22.4%) patients, one PIM in 30 (21.0%) patients, two PIM in 35 (24.5%) patients, three or more PIM in 46%.

The most common criteria were drugs prescribed without an evidence-based clinical indication (71.3% of total patients) or drugs that increase the risk of falls in the elderly such as antipsychotic (15.38% patients) or antidepressant (12.59% patients). Among these drugs, drugs for acid disorders (omeprazole, pantoprazole, esomeprazole, ranitidine) 22.4% (32) or anxiolytic drugs (lorazepam, alprazolam, bentazepam, bromazepam, clonazepam, clorazepate, diazepam, lormetazepam) 17.5% (25) are the most relevant (table 3).

Beers criteria detected 421 PIM in 114 (79.7%) patients with no PIM in 29 (20.98%), one PIM in 19 (13.29%) patients, two PIM in 19 (13.29%) patients and three or more PIM in 76% (table 2 and 3).

The most common criteria (in 71.3% patients) are related to different drugs that need to be dose adjusted for the risk of producing hyponatremia (quetiapine, torasemide, furosemide, citalopram, haloperidol) or the use of antidepressants alone or in combination (in 11.2% patients).

Combination of STOPP and Beers tools, detected PIM in 102 (71.3%) patients, whereas STOPP alone detected PIM in 9 (6.3%) and Beers alone detected PIM in 12 (8.4%) patients. In 20 (14.0%) patients, there was not any PIM detected by any of the tools. Kappa analysis showed a high concordance between the tools (kappa: 0.7).

START criteria detected 279 PIM in 113 (79%) patients, no PIM in 30 (21%) one PIM in 37 (25.9%) patients, two PIM in 21 (14.7%) patients and three or more PIM in 55% (tables 2 and 3). The most frequent criteria are the recommendation to use angiotensin converting enzyme (ACE) inhibitors in chronic heart failure (systolic dysfunction) and / or documented coronary heart disease (15%) or the use of a suitable beta blocker (bisoprolol, nebivolol, metoprolol, carvedilol) in stable heart failure (systolic dysfunction) (27.3%) or the initiation of vitamin D treatment and calcium supplementation in patients with long-term systemic corticosteroid therapy (23.8%). A number of 17 (11.8%) patients did not meet STOPP or START criteria.

PRISCUS criteria detected 47 PIM in 42 (29.37%) patients, no PIM in 101 (70.63%), one PIM in 38 (26.57%) patients, two PIM in 3 (2.10%) patients and three PIM in 1 (0.70%) patients (tables 2 and 3). Among the 42 patients meeting PRICUS criteria, 40 patients also met STOPP and Beers criteria. The most frequent PIM were related to digoxin (36.2%) and to the prescription of long-acting benzodiazepines (17.0%).

Regarding the time needed to introduce the data into the CheckTheMeds program, starting from a complete clinical report and using the Hospital's electronical system to complete the missing data, we timed the last 20 patients of each researcher, obtaining an average time of 10 minutes per patient. CheckTheMeds gives away its results almost immediately once all the data has been entered. We also measured the time used for each researcher to obtain all the needed data using manual pre-printed tools and we obtained an average time of 19 minutes per patient.

Table 1: Characteristics of the study population (n=143)	
Age (years)	
mean ± SD	84.9±7.9
median	85
Female % (n)	60.1 (86)
Living in institution % (n)	8.4 (12)
CCI (co-morbidity Charlson Index)	
mean ± SD	7.6± 2.0
median	7.4
< 3.9	3.5 (5)
4-7.9	53.9 (77)
8-11.9	41.3 (59)
>12	1.4 (2)
Ten year survival (%)	5±14.2
Hospitalisation in the preceding year % (n)	23.1 (33)
Cognitive disorder % (n): Dementia	32.2 (46)
Psychiatric disorders % (n)	
Depression	9.1 (13)
Cardiovascular disease % (n)	
Arterial hypertension	82.5(118)
Diabetes Mellitus	25.2 (36)
Dyslipidaemia	44.8 (64)

Table 2: Patients' characteristics	
Prescription drugs and PIM	
Total number of prescription	623
mean ± SD	8.0± 3.6
median	8
0 medications % (n)	0
1–5 medications % (n)	30 (21.0)
6–9 medications % (n)	78 (54.6)
=10 medications % (n)	35 (24.5)
Potentially inappropriate medication	
According to STOPP criteria % (n)	
mean ± SD	1.94±1.6
median	2
0 PIM% (n)	22.4 (32)
1–2 PIM% (n)	45.5 (65)
3–5 PIM% (n)	28.7 (41)
=6 PIM% (n)	3.5 (5)
According to START criteria % (n)	
mean ± SD	2.1±1.8
median	2
0 PIM% (n)	21.0 (30)
1–2 PIM% (n)	40.6 (58)
3–5 PIM% (n)	33.6 (48)

Table 3: D rugs prescribed without an evidence-based clinical indication according to ST OPP criteria. AT C Anatomical Therapeutic Chemical Classification System)	No. PIM
A02B (Drugs for acid related disorders: Aluminium compound)	32
N05B (anxiolytic drugs)	25
N05A (antipsychotic drugs)	21
A12A (Mineral supplements: calcium)	13
M04A (Anti-gout preparations)	8
B03A (anti-anemic drugs: iron preparations)	8
G04C (Drugs used in benign prostatic hypertrophy)	7
B01A (Anti-thrombotic agents)	5
Others (sertraline, gabapentine, folic acid, vitamin B 12...)	54

DISCUSSION

This retrospective study of the patients discharged from the Internal medicine Department shows the high rate of PIM in this population. In our study, STOPP/START and Beers are the most sensitive criteria to detect PIM, because in nearly 80% of the patients at least one PIM was detected, whereas PRISCUS only detected PIM in 30% of the patients. Moreover, only 27% of the patients present at the same time some criteria, either STOPP/START, Beers or PRISCUS.

A recently published inter-rater reliability study has shown that the median kappa coefficient between raters was 0.93 for STOPP criteria and 0.85 for START criteria, tested by multiple physicians across six European centres (15). The correlation between STOPP and Beers obtained in our study was around 70%.

Screening with STOPP criteria within 24 hours of hospitalisation reduces the rate of inappropriate prescriptions (16) . The use of screening criteria allows identifying PIMs and changing prescriptions for patients in agreement with the geriatrician. A Belgian study showed that START criteria were identified at hospital admission in 34% of the patients and only in 7% at the discharge report (17) . In contrast with these results, in our study STOPP criteria were detected in 77% of the patients, START criteria in 79%, and Beers in 79%. Other studies made in European countries show a prevalence for STOPP criteria of 55%, and for Beers criteria of 50% (18). Moreover, patients with PIM at the time of discharge are more likely to report adverse drug events (ADE) in the future (19).

Elderly people are a vulnerable group of patients to suffer adverse effects related to drugs. They consume a high number of drugs that increase their risk of morbidity and mortality. Numerous authors have concluded that avoiding PIMs reduces problems related to drugs (20). There are numerous strategies to improve prescribing; most of them are based on screening tools. Unfortunately these tools are costly and time-consuming, so having a computer-based tool such as CheckTheMeds® would facilitate the process.

The manual use of these tests may also lead to random errors. The use of the computer program CheckTheMeds automatizes the process reducing time and effort and producing more reliable and exhaustive results. Therefore, this program is a very effective way to extend the use of these tests by making them more affordable to the clinicians. As it is an improved way to use previously validated tests, we can conclude that CheckTheMeds facilitates the professional optimization of drug therapy (especially in polymedicated pluripathological patients) and therefore contributes to the best care of chronic patients. It improves the quality of life of patients and their survival, because it helps the professional to improve the pharmaco-therapeutic effectiveness and to reduce unwanted drug effects. The comprehensive review of the treatment of a polymedicated patient using databases and books is a very complex manual task that is highly time-consuming; with CheckTheMeds the time required for this review can be reduced to minutes thanks to its automatized algorithm.

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