Vol. 14(11), pp. 386-394, December, 2020
DOI: 10.5897/AJPP2020.5191
Article Number: 55B165865619
ISSN: 1996-0816

http://www.academicjournals.org/AJPP

African Journal of Pharmacy and Pharmacology

Full Length Research Paper

Patterns of prescription and inappropriate medications use in elderly patients of Makkah community in Saudi Arabia

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Received 5 September 2020; Accepted 30 November, 2020

Polypharmacy and the prescription of inappropriate medications are common in elderly patients due to the high rate of morbidity in this population. However, this information is scarce about patients in this age group in Saudi Arabia. In general, this study was conducted to investigate the drug prescriptions in elderly patients in Makkah city of Saudi Arabia. This topic threw light mainly on the pattern of drug utilization and the prevalence of potentially inappropriate medications in this population of patients. Data of drugs utilization in elderly patients was collected from King Abdul-Aziz hospital in Makkah city, Saudi Arabia during January and February of 2018. The 2019 updated Beers criteria were applied to identify the potentially inappropriate medications use in these patients. A total of 1256 prescriptions were found to be given to 129 elderly patients, with a 9.7 as the average number of drugs prescribed per elderly patient. Polypharmacy in this age group was very common reaching about 90% of patients. The most commonly prescribed drug was omeprazole followed by aspirin. Around 18% of drug prescriptions were considered to be inappropriate according to the 2019 updated Beers criteria. Omeprazole and aspirin were also the inappropriate drug with the highest rate of prescription. Based on the 2019 updated Beers criteria, inappropriate medications use and polypharmacy are prevalent in elderly patients in Makkah city of Saudi Arabia. More attention should be taken by health care providers as some of the commonly prescribed drugs in elderly patients are considered to be inappropriate.

Key words: Potentially inappropriate medications, drug prescribing, polypharmacy, elderly, geriatrics, Beers.

INTRODUCTION

Inappropriate drug prescribing is an important issue in clinical practice, since it increases the risk of drug-related harms, with significant clinical and economic consequences. This concern is particularly true for the frail elderly people. The elderly population are the segment of society most exposed to medication. The people aged 65 years or more make up less than 15% of the population but they consume nearly one third of all

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drug prescriptions (Marengoni et al., 2014). Older people are more likely to have multiple chronic diseases, further increasing the risk for polypharmacy (commonly defined as the concurrent regular use of five or more medications (Masnoon et al., 2017)) and drug interactions in ambulatory and hospital care settings (Nobili et al., 2009). The use of potentially inappropriate medications (PIMs) by the elderly population represents a major health problem associated with adverse health outcome. Also, the prevalence of multi-morbidity increases with age, along with polypharmacy. Older patients are particularly vulnerable to adverse events from drug-drug interactions. With advancing of age, several physiological changes occur in the pharmacodynamics and pharmacokinetics of many drugs, therefore, certain drugs should be prescribed according to the recommended guidelines. Failure to follow these guidelines makes these medications potentially inappropriate for elderly patients and increases the risk of harmful consequences e.g. increases the prevalence of drug interactions (Cerreta et al., 2012). Improving medication safety requires that potentially dangerous drugs prescribing patterns be quickly detected and managed. Better health education for patients and continuous training of health care providers about the detection and reporting of these events is utmost importance.

Various strategies have been developed to identify inappropriate drug prescription patterns, using implicit clinical judgment based on the medical literature such as Medication Appropriateness Index (MAI) (Hanlon et al., 1992), and explicit criteria, based on the expert consensus about lists of drugs that should be avoided (AGS, 2012). One of the most commonly used lists of inappropriate drugs for elderly population is the Beers criteria drug list, developed in 1991, updated in 1997 and was recently updated in 2019 by the American Geriatrics Society (Beers et al., 1991; Beers, 1997; AGS, 2019). Epidemiological studies in US and Canada, have demonstrated a widespread use of PIMs among nursing home residents (up to 40%) and community health care facilities for elderly patients (14-37%) (Fick et al., 2003; Zhan et al., 2001). In addition to the prescribed medications, it is reported that 47.3% of these older age group take at least one over-the-counter medication and 54.2% of them use a dietary supplement (Qato et al., 2008). It is estimated that about 58.6% of the elderly patients take one or more unnecessary prescribed drug (Maher et al., 2014).

There is a common deficiency in evidence-based practice regarding the pattern of drug prescribing for the elderly population, especially those with comorbidities requiring multiple medications or for those with disabilities (Hilmer et al., 2007). The application of clinical guidelines to elderly patients with multiple medical conditions increase the potential for polypharmacy, associated with high prevalence of drug-drug interactions and adverse reactions (Boyd et al., 2005). The “appropriateness” of drug prescribing is commonly measured according to the updated Beers criteria (Beers, 1997). However, these Beers criteria do not provide guidance on use of drug combinations for comorbid conditions. Currently, geriatric drug prescribing relies on expert evaluation of the efficacy and safety of each medicine or the drug combination for each patient (Hilmer et al., 2007). A high prevalence of serious adverse drug reactions (ADRs) occurs in geriatric patients (Moore et al., 2007), with increased hospital admissions related to these drug events over the past 20 years in older patients (Burgess et al., 2005). Moreover, the exposure of elderly patients to “inappropriate” medications, as revealed by Beers criteria, was shown to be associated with impaired physical performance in a cross-sectional study (Pitkala et al., 2002). Thus, awareness of health care providers about the use of inappropriate medications can help to improve drug therapy and decrease inappropriate prescribing for geriatric patients as revealed by previous studies (Kaur et al., 2009).

Medication exposure studies used to evaluate the effectiveness of drug therapy in elderly people have changed from simple counting the number of prescribed drugs, to considering the action and kinetic features of the drug such as the half-life, dose response, and drug combinations. A measure of drug exposure that is associated with clinical outcomes and considering multiple medications might be a more useful prescribing tool to detect the risks associated with drug therapy (Maher et al., 2014). Criteria for inappropriate medications use among elderly populations have been widely utilized in many epidemiological studies to target the people at risk and the strategies for management. However, little information is available about potentially inappropriate medication use and polypharmacy in elderly patients having comorbidities in the Saudi population. This investigation aims to identify the pattern of drug utilization, prevalence of polypharmacy and potentially inappropriate medication use in geriatric patients along with the common drug prescriptions and correlate them with different variables, to support evidence-based clinical practice and rational drug prescribing in this frail group of patients in Makkah city of Saudi Arabia.

METHODOLOGY

This is a retrospective observational study. The study population was constituted by elderly patients with 65 years or older, admitted to the medical wards of King Abdul-Aziz hospital in Makkah city, Saudi Arabia during the period of 1.1.2018 until 28.2.2018. This hospital is one of the main hospitals in Makkah community that offer health care services to a large population of elderly patients.

Demographic, medical and drugs prescriptions details of the recruited patients were collected from the medical records department. The study protocol was approved by the Committee of

Bio-Medical Ethics of the Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia (HAPO-02-K-012-2017-06-236) and the Institutional Review Board of the Ministry of Health in Saudi Arabia (H-02-K-076-1802-004). In addition, all the necessary measures were taken to keep the data collected as confidential as possible e.g. limited access and deleting patients' names from the database.

The most recent version of Beers criteria developed on 2019 by the American Geriatrics Society (AGS, 2019) was applied in the study to identify the appropriateness of drugs prescription to the recruited elderly patients.

Based on the common definition in literature (Masnoon et al., 2017), polypharmacy was considered to be receiving of five or more medications together while "non-polypharmacy" was considered as the administration of less than 5 drugs simultaneously.

The parameter "average number of drugs prescribed" was used to detect any relationship between the number of PIMs received by patients and the total number of drugs these patients are receiving. It was calculated based on the total number of drugs administered by a certain population of patients receiving certain number of PIMs divided by number of patients in that population.

Data were recorded and analyzed using the software Microsoft® Excel worksheets. The mean and standard deviation of normally distributed variables were compared using paired *t* tests and for categorical variables, the Chi-square test (χ^2) test was used. A value of $p < 0.05$ was considered as the level of statistical significance.

RESULTS

Demographic data

The total number of admissions of elderly patients (≥ 65 years old) to King Abdul-Aziz hospital in Makkah city during the period of 1.1.2018 – 28.2.2018 was 129. These patients were admitted for various diagnoses such as heart and respiratory diseases. The ages of the recruited patients ranged from 65 to 105 years old. Focusing only on elderly patients, the study population was distributed according to their age groups (Table 1). Male patients constituted 65% of the study population (n=84) while female patients were 35% (n=45). The distribution of age and gender is demonstrated in Table 1.

Table 1. Age groups and gender of the study population.

Age group	n	Males (%)	Females (%)
65 - 74	59	42 (50)	17 (37.8)
75 - 84	47	29 (34.5)	18 (40)
≥ 85	23	13 (15.5)	10 (22.2)
Total	129	84	45

Polypharmacy vs. non-polypharmacy

Number of the prescribed drugs

One of the main targets of the current investigation is to study the pattern of drugs prescription in elderly patients when admitted to the hospitals. A total of 1256 prescriptions were given for the 129 patients recruited in the study, corresponding to 154 drugs, with an average number of drugs per patient as 9.7. The maximum number of drugs prescribed to elderly patients while admitted in the hospital in this study was 26 and the minimum was 1 drug. Number of drugs applied was distributed in groups (Table 2).

Patients on polypharmacy (≥ 5 drugs) constituted the majority of the study population (n=115) with an overall rate of polypharmacy as 89.1%. In comparison, it was observed that the prescription of less than 5 drugs (non-polypharmacy) constituted the lowest rate of drugs prescription (i.e. 10.9% of the recruited patients, n=14). Among those on polypharmacy regimens, the highest rate of drugs prescription lied in the group of patients receiving between 9 and 12 drugs (40.3%, n=52) while staying in hospital (Table 2).

Number of drugs with gender

Again, the group of patients with number of drugs applied between 9 and 12 represented the highest rate of prescription among male patients (45.2%, n=38) while in females, it was the group with 5 to 8 drugs (i.e. 37.8%, n=17).

Patients receiving less than 5 drugs (non-polypharmacy) constituted the group with the lowest rate of drug prescription for both sexes (11.9% of the male patients (n=10) and 8.9% of females (n=4)). It was observed that the minimum number of drug prescription in male patients was 1 drug while maximum number was 26 drugs, compared to 1 drug also as the minimum and 21 as maximum in females (Table 2). The most common number of drugs prescribed in relation to gender was found to be 11 drugs for males (n=11) in comparison to 10 drugs for females (n=8). Among gender, the rate of polypharmacy was 88.1% for males and 91.1% for females. There was insignificant correlation between gender and number of drugs prescribed (polypharmacy or non-polypharmacy) with a p-value of 0.7.

Number of drugs with age groups

Patients with "number of drugs" of 9 - 12 drugs showed the highest rate of prescription among all age groups in the study. On the other hand, patients with "number of drugs" of less than 5 drugs (non-polypharmacy) demonstrated the lowest prescription rate among all other age groups (Table 2). Rate of polypharmacy among age groups of the patients is illustrated in Table 3. Within the polypharmacy), p-value = 0.6 (Table 3).

Table 2. Number of drug prescriptions in the study.

Number of drugs	n (%)	Males (%)	Females (%)	Age Groups		
				65-74 (%)	75-84 (%)	≥ 85 (%)
1 - 4	14 (10.9)	10 (11.9)	4 (8.9)	5 (8.5)	7 (14.9)	2 (8.7)
5 – 8	37 (28.7)	20 (23.8)	17 (37.8)	20 (33.9)	14 (29.8)	3 (13)
9 -12	52 (40.3)	38 (45.2)	14 (31.1)	23 (39)	19 (40.4)	10 (43.5)
≥ 13	26 (20.2)	16 (19)	10 (22.2)	11 (18.6)	7 (14.9)	8 (34.8)
Total	129	84	45	59	47	23

Table 3. Age groups vs. number of drug prescriptions (non-polypharmacy or polypharmacy).

Age group	n	Non-polypharmacy (< 5 drugs) (%)	Polypharmacy (≥ 5 drugs) (%)
65 - 74	59	5 (35.7)	54 (91.5)
75 - 84	47	7 (50)	40 (85.1)
≥ 85	23	2 (14.3)	21 (91.3)
Total	129	14	115

Commonly prescribed drugs

Commonly prescribed drug for the patients in this study was omeprazole 77.5% (n=100) followed by aspirin 55% (n=71) and enoxaparin 53.4% (n=69) (Table 4). For omeprazole (n=100), the rate of prescription among gender was almost similar (79.8% of male patients received omeprazole compared to 73.3% of females) without a significant difference between them (p-value = 0.4). Its prescription among age groups of patients showed a gradual decline pattern with advancing in age lacking any significant difference (p-value = 0.2).

The situation was also similar for the next 2 commonly prescribed drugs (aspirin and enoxaparin) among gender and age groups. None of these 2 drugs showed a significant difference among gender and age groups i.e. aspirin with gender (P-value = 0.6) and with age groups (P-value = 0.8) while enoxaparin with gender (P-value = 0.8) and with age groups (P-value = 0.6). The most commonly prescribed drugs in this investigation are listed in Table 4.

Potentially inappropriate medications (PIMs)

In order to determine the potentially inappropriate medications (PIMs) use in elderly patients in this study, Beers List 2019 (AGS, 2019) was applied. This study showed that out of 154 drugs applied, 134 were found to be safe to be prescribed to geriatric patients in comparison to 20 that were inappropriate. Out of 1256 drug prescriptions given to patients, the inappropriate prescriptions constituted 18.6% (n=234). These were prescribed to 120 patients with an average of 1.95 inappropriate prescriptions per patient. The inappropriate drug with the highest rate of prescription was found to be omeprazole (n=100) followed by aspirin (n=71) and pantoprazole (n=13) (Table 5).

Out of the 234 inappropriate drug prescriptions administered by some patients, 156 prescriptions (66.7%) were found to be given to male patients compared to 78 (33.3%) to females. Receiving PIMs did not show any significant statistical difference among both gender (p-value = 0.2) and different age groups as well (p-value = 0.7).

Only 9 patients (7%) of the study population did not receive any PIMs. Among all patients on PIMs, the most common number of these medications prescribed simultaneously was found in 50 patients (38.8%) who received 2 inappropriate drugs together. The maximum number of PIMs given together was 7 which were received by one patient (0.8%) while 43 patients (33.3%) received 1 of these agents. The highest average number of drugs prescribed was noticed in patients taking 3 PIMs simultaneously which was 14.3 compared to other treatment regimens. Among gender, the highest rate of prescription of PIMs was found in the patients receiving 2 PIMs ((41.7%, n=35) for males and (33.3%, n=15) for females). The same treatment regimen (i.e. patients on 2 PIMs together) showed the highest rate of PIMs prescriptions among most of the age groups compared to those in other treatment regimens. This study was not able to demonstrate any statistical correlation between number of drugs prescribed and PIMs (p-value = 0.3) (Table 6).

DISCUSSION

Elderly population are more prone to chronic diseases

Table 4. Analysis of the commonly prescribed drugs in the study.

Drug	n (n=129; %)	Males (n=84; %)	Females (n=45; %)	Age groups		
				65-74 (n=59; %)	75-84 (n=47; %)	≥ 85 (n=23; %)
Omeprazole	100 (77.5)	67 (79.8)	33 (73.3)	49 (83.1)	36 (76.6)	15 (65.2)
Aspirin	71 (55)	45 (53.6)	26 (57.8)	32 (54)	25 (53.2)	14 (60.9)
Enoxaparin	69 (53.4)	44 (52.4)	25 (55.6)	29 (49.2)	27 (57.4)	13 (56.5)
Ceftriaxone	53 (41.1)	34 (40.5)	19 (42.2)	27 (45.8)	14 (29.8)	12 (52.2)
Atorvastatin	46 (35.7)	31 (36.9)	15 (33.3)	23 (39)	15 (31.9)	8 (34.8)
Clopidogrel	44 (34.1)	24 (28.6)	20 (44.4)	23 (39)	13 (27.7)	8 (34.8)
Furosemide	44 (34.1)	28 (33.3)	16 (35.6)	24 (40.7)	14 (29.8)	6 (26.1)
Amlodipine	40 (31)	28 (33.3)	12 (26.7)	16 (27)	14 (29.8)	10 (43.5)
Captopril	37 (28.7)	23 (27.4)	14 (31.1)	21 (35.6)	12 (25.5)	4 (17.4)
Isosorbide dinitrate	36 (27.9)	23 (27.4)	13 (28.9)	17 (28.9%)	14 (29.8)	5 (21.7)

Table 5. The potentially inappropriate drug prescriptions in the study*.

Inappropriate drug prescriptions*	n (n=234; %)	Males (n=156; %)	Females (n=78; %)	Age groups		
				65-74 (n=59; %)	75-84 (n=47; %)	≥ 85 (n=23; %)
Amiodarone	4 (1.7)	2 (1.3)	2 (2.6)	4 (6.8%)	0	0
Aspirin	71 (30.3)	45 (28.8)	26 (33.3)	32 (54.2)	25 (53.2)	14 (60.9)
Atropine	1 (0.4)	1 (0.6)	0	1 (1.7)	0	0
Chlorpheniramine	3 (1.3)	2 (1.3)	1 (1.3)	2 (3.4)	1 (2.1)	0
Chlorpromazine	2 (0.9)	1 (0.6)	1 (1.3)	1 (1.7)	0	1 (4.3)
Desmopressin	1 (0.4)	1 (0.6)	0	0	0	1 (4.3)
Diclofenac diethylamine	2 (0.9)	2 (1.3)	0	0	0	2 (8.7)
Digoxin	5 (2.1)	4 (2.6)	1 (1.3)	5 (8.5)	0	0
Esomeprazole	6 (2.6)	4 (2.6)	2 (2.6)	4 (6.8)	2 (4.3)	0
Haloperidol	3 (1.3)	2 (1.3)	1 (1.3)	2 (3.4)	0	1 (4.3)
Ibuprofen	1 (0.4)	1 (0.6)	0	1 (1.7)	0	0
Ketoprofen	1 (0.4)	1 (0.6)	0	1 (1.7)	0	0
Methyldopa	3 (1.3)	3 (1.9)	0	2 (3.4)	1 (2.1)	0
Metoclopramide	8 (3.4)	3 (1.9)	5 (6.4)	3 (5.1)	4 (8.5)	1 (4.3)
Nifedipine	5 (2.1)	4 (2.6)	1 (1.3)	4 (6.8)	0	1 (4.3)
Omeprazole	100 (42.7)	67 (42.9)	33 (42.3)	49 (83.1)	36 (76.6)	15 (65.2)
Pantoprazole	13 (5.6)	9 (5.8)	4 (5.1)	6 (10.2)	3 (6.4)	4 (17.4)
Prazosin	2 (0.9)	2 (1.3)	0	2 (3.4)	0	0
Promethazine	2 (0.9)	2 (1.3)	0	2 (3.4)	0	0
Risperidone	1 (0.4)	0	1 (1.3)	0	1 (2.1)	0
Total	234	156 (66.7)	78 (33.3)	121 (51.7)	73 (31.2)	40 (17.1)

*According to Beers List 2019 (AGS, 2019).

and consequently more likely to have increased utilization of drugs over the general population (Nobili et al., 2009; Sisay et al., 2017). Little data are available on drug use and polypharmacy among elderly people in Saudi Arabia (Bahlas et al., 2017; Al-Omar et al., 2013). The rising number of aging population and increasing drug utilization among this age group leads to progressive increase in health care expenditure (Sarwar et al., 2017). Appropriateness of drugs prescription in elderly patients (through following the recommended guidelines e.g. correct dose, duration and indications) ensures the safety of these medications and reduces the risk of adverse drug reactions and drug interactions. The rising demographic of elderly populations and scarcity of literature about

Table 6. Average number of drugs prescribed for patients on potentially inappropriate medications.

Patients on	n (%)	Average number of drugs prescribed	Males (n=84' %)	Females (n=45; %)	Age Groups		
					65-74 (n=59; %)	75-84 (n=47; %)	≥ 85 (n=23 %)
0 PIMs	9 (7)	37/9=4.1	4 (4.8)	5 (11.1)	3 (5.1)	4 (8.5)	2 (8.7)
1 PIMs	43 (33.3)	345/43=8	29 (34.5)	14 (31.1)	18 (30.5)	17 (36.2)	8 (34.8)
2 PIMs	50 (38.8)	496/50=9.9	35 (41.7)	15 (33.3)	21 (35.6)	22 (46.8)	7 (30.4)
3 PIMs	21 (16.3)	301/21=14.3	11 (13.1)	10 (22.2)	11 (18.6)	4 (8.5)	6 (26.1)
4 PIMs	4 (3.1)	39/4=9.8	3 (3.6)	1 (2.2)	4 (6.8)	0	0
5 PIMs	1 (0.8)	12/1=12	1 (1.2)	0	1 (1.7)	0	0
6 PIMs	0	0	0	0	0	0	0
7 PIMs	1 (0.8)	26/1=26	1 (1.2)	0	1 (1.7)	0	0
Total	129		84	45	59	47	23

drug use and prescribing in geriatrics, promoted us to investigate the patterns of drug prescription and polypharmacy in older adults in the hospitals of Makkah city of Saudi Arabia.

The current study investigated a total of 1256 prescriptions given to 129 elderly patients, corresponding to 154 drugs, and found a 9.7, which is the average number of drugs prescribed per patient. The elderly population on polypharmacy (≥5 drugs) constituted the majority of patients (89.1%). Among gender, the rate of polypharmacy is 88.1% for males and 91.1% for females. More than 40% of patients were receiving 9 - 12 drugs, of these, 73% were males and 27% were females, constituting the highest rate of prescription among all age groups. However, there was no correlation between gender or age group and number of drugs prescribed (polypharmacy or non-polypharmacy). The most commonly prescribed drug was omeprazole (77.5%), followed by aspirin (55%) and enoxaparin (53.4%). None of these drugs showed a significant difference regarding gender or age groups. In the study of Sarwar et al. (2017), on prescribed medication for hospitalized patient in Pakistan, they found that drugs with the highest rate of prescribing include omeprazole (51.3%), followed by paracetamol (50.8%) and then ceftriaxone (40.2%). The male gender and presence of comorbidity were independent factors related to increased drug utilization among those elderly patients on polypharmacy (Sarwar et al., 2017).

Using the 2019 updated Beers criteria to determine the use of PIMs showed that out of 154 drugs applied, 20 were inappropriate. Out of 1256 drug prescriptions, 234 prescriptions (18.6%) were considered inappropriate, prescribed to 120 patients with an average of 1.95 inappropriate prescriptions per patient. Among the 234 PIMs prescriptions, 156 prescriptions (66.7%) were given to male patients compared to 78 (33.3%) given to female patients. Only 9 patients (7%) did not receive any PIMs. Among all patients on PIMs, 50 patients (38.8%) received 2 of these medications simultaneously, while 43 patients (33.3%) received one. Similar previous studies reported range of 18.3 to 48.0% of PIMs according to the 2003 version of the Beers criteria (Saab et al., 2006; de Oliveira et al., 2006; Buck et al., 2009; Ryan et al., 2009; Faustino et al., 2013), and range of 37 to 59.2% according to the 2012 Beers criteria (Baldoni et al., 2014; Blanco-Reina et al., 2014; Nishtala et al., 2014; Zeenny et al., 2017; Al Odhayani et al., 2017). Awad and Hanna (2019), reported a prevalence of PIMs use among geriatric patients in primary care setting in Kuwait of 53.1%, based on 2015 Beers criteria. Few other studies were published using the updated Beers Criteria at the inpatient settings of hospitalized elderly patients (Sheikh-Taha and Dimassi, 2017; Zhang et al., 2017; Komagamine, 2018). To the best of our knowledge, this is the first study investigating drug utilization in elderly hospitalized patients using the 2019 updated Beers Criteria. However, all these previous results should be considered with caution due to several factors of variability in methodological procedures including health care settings, time and duration of data collection, prescribing patterns and availability of medications.

The inappropriate drug with the highest rate of prescription was omeprazole (n=100) followed by aspirin (n=71) and pantoprazole (n=13). Polypharmacy may partially explain the observed inappropriate prescribing practice. Several previous studies have identified polypharmacy as a significant predictor for the use of PIMs among elderly patients (Buck et al., 2009; Baldoni et al., 2014; Nishtala et al., 2014; O'Sullivan et al., 2013; Alhmoud et al., 2015; Tommelein et al., 2015). However, this study was not able to demonstrate statistical correlation between number of drugs prescribed and PIMs. Other factors that may contribute to the use of PIMs in elderly include inadequate awareness of health care providers about the risks of using PIMs (i.e. prescription of medications without an evidence-based clinical indication), deficient

continuous medical education for physicians and pharmacists, lack of specialized geriatric centers, lack of geriatric specialists and the comorbid condition of the elderly patients. This indicates the unmet need for comprehensive evaluations of drug prescribing for elderly patients and raising the level of awareness among health care providers regarding the use of PIMs in the elderly. Also, patient age and gender have been reported to be independent predictors for inappropriate prescribing and use of PIMs among elderly patients (Buck et al., 2009; Nishtala et al., 2014; Morgan et al., 2016; Lai et al., 2009). However, the present study did not detect significant association between age and gender with inappropriate prescribing in elderly patients. These findings are consistent with previous studies that showed variable associations of age and gender with inappropriate prescribing (Blanco-Reina et al., 2014; Tommelein et al., 2015).

Earlier studies indicated significant variations in the prevalence rate and pattern of using PIMs among elderly patients, according to the different screening criteria. Two European studies showed detection of the highest number of PIMs using the 2012 Beers criteria (Blanco-Reina et al., 2014; Di Giorgio et al., 2016). It was reported that, the MAI implicit criteria can also detect higher number of PIMs in comparison with the explicit criteria (Beers, FORTA and STOPP) (Awad and Hanna, 2019; Steinman et al., 2007). However, Awad and Hanna (2019), found no significant difference between STOPP and 2015 Beers criteria, in detecting the number of prescribed PIMs for elderly patients in primary care setting.

Rational prescribing and appropriate use of medicines are of great importance, especially in the frail elderly. Special attention should be given to rational drug therapy for patients on polypharmacy. Irrational medication use can lead to serious adverse effects on the quality of health care and health care costs (Moore et al., 2007; Burgess et al., 2005). Irrational use of drugs is a common problem leading to increased morbidity and mortality (Maher et al., 2014; Moore et al., 2007). Main reasons for irrational drug prescribing include lack of information about new drugs, insufficient training of physicians, lack of diagnostic facilities, poor communication between patients and health care providers and patient demand assuming that ‘every ill has a pill’ (Sisay et al., 2017).

The current findings indicate the prevalence of inappropriate prescribing among elderly patients, which could be the initial step for suggesting future recommendations and interventional strategies that can improve drug prescribing pattern for older people in the Saudi hospitals. These include continuous professional education for the healthcare providers in geriatric care; together with the implementation of decision-support systems for electronic prescribing with alerts for PIMs (Lai et al., 2009; Di Giorgio et al., 2016; AGS, 2019). Moreover, establishment of a multidisciplinary team for care of geriatric patients and supporting the role of pharmacists in collaboration with the physicians for optimizing medication therapy. The tertiary care hospitals in Saudi Arabia are similar regarding operation system, professional staff and patient population, indicating closely similar prescribing practices. This indicates the need for formulation of a specific PIMs list, adapted and tailored to the Saudi hospitals. These tailored specific explicit criteria should reflect the available drugs in the local market and prescribing practices, to provide a guide to rational drug therapy and medication safety for geriatric patients.

Limitations to this study include that the physicians were not interviewed about their reasons for prescribing PIMs and polypharmacy, and whether they follow up patients for detection of adverse events related to use of PIMs. Also, the exclusion of herbal medicines could underestimate the number of used PIMs. Further studies are warranted to evaluate the clinical outcome of the inappropriate prescribing including adverse drug events, drug-drug interactions, hospitalization, morbidity and mortality among the older patients.

Conclusions

Polypharmacy and inappropriate dug prescribing is prevalent among geriatric patients in Makkah, Saudi Arabia as defined by explicit criteria such as updated Beers list 2019. With increase in the proportion of elderly people, inappropriate use of medication becomes a major health concern. This indicated the need for multidisciplinary approach to develop interventional strategies to improve the quality of prescribing and decrease polypharmacy in older patients. Research in drug utilization provides a valuable tool to support decision making by policy-makers regarding rational use of medicines.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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