Original Research Article

Potentially inappropriate medications in nursing homes of Iraqi elders: Pharmacists’ assessment and intervention based on 2019 Beers criteria

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A R T I C L E  I N F O

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ABSTRACT

The number of elderly people worldwide is growing with the increasing life expectancy of the human population; in Iraq, the number of elderly people aged ≥65 years was estimated to be 1.34 million in 2019. The use of potentially inappropriate medications (PIMs) is high among older adults, which is associated with an increased risk of adverse drug reactions. This study investigated the use of PIMs among elderly nursing home (NH) residents in Iraq based on 2019 Beers criteria and the application of the criteria and intervention by pharmacists. An interventional study was conducted from January 2019 to April 2019 at 2 NHs in Baghdad, Iraq. A total of 109 NH residents aged ≥65 years that were using ≥1 daily medicine were included. Patients discharged before completion of the assessment were excluded. Patients with PIMs were using significantly more medications (5.7 ± 3.2) than those without PIMs (2.0 ± 1.46) (p < 0.0001). The total number of PIMs identified according to the 2019 Beers criteria was 163; for 140 of these (85.9%), pharmacists recommended changing the prescription, with 112 (68.7%) discontinued/changed as a result for an acceptance rate of 80% by physicians. Our results indicate that the use of PIMs for the treatment of Iraqi NH residents is associated with polypharmacy. Thus, prescriptions for elderly people in Iraq with polypharmacy or multiple concurrent diagnoses should be reviewed for PIMs by pharmacists to reduce the risk of adverse events.

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1. Introduction

The number of elderly people worldwide is growing with an increase in human life expectancy. In Iraq, the number of people aged ≥65 years was estimated to be 1.34 million in 2019; this number is predicted to double by 2050—that is, the proportion of elderly people in the population will increase from 3.4% to 7.1%. Age-related changes in pharmacodynamics and pharmacokinetics predispose older people to various drug-related problems (DRPs) including drug–drug or drug–disease interactions and adverse drug reactions (ADRs). It has been reported that 10%–30% of elderly people admitted to hospitals have DRPs, which are also more common among nursing home (NH) residents and are preventable in ~50% of cases; in fact, fatal, serious, and life-threatening ADRs are more preventable than those that are less severe.

Potentially inappropriate medications (PIMs) prescribed to older adults are usually drugs with higher potential risks than benefits. NH residents in the United States use on average 6 different drugs while ≥20% use 10 or more different drugs. Around 43% of NH residents are exposed to PIMs; the prevalence increased between 1994 and 2014.

The American Geriatrics Society (AGS) Beers criteria and STOPP–START criteria are commonly used to identify PIMs. The former are a widely used resource that were initially published in 1991 and updated in 1997, 2003, 2012, 2015, and 2019. The 2019 Beers criteria were

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formulated after many changes to the rationale and levels of evidence, with some criteria deleted or modified and others added; they comprise 30 criteria pertaining to different classes of medication that should not be administered to older adults, along with 16 criteria for ≥40 medications that must be administered with caution or completely avoided in some specific disorders or diseases.\(^\text{11}\)

Intervention by pharmacists according to STOPP–START\(^\text{12}\) and Beers criteria\(^\text{13}\) can reduce the use of PIMs in elderly patients. However, previous studies have not reported the prevalence of PIMs identified using the updated Beers criteria or systematically investigated these in the elderly population in Iraq. The main objective of the present study was to assess the prevalence of PIMs in NHs in Iraq and the effectiveness of pharmacists’ interventions based on the 2019 Beers criteria.

2. Materials and Methods

2.1. Study design and settings

This interventional study was conducted from January 2019 to April 2019 at 2 NHs in Baghdad, Iraq. All elderly residents of Al-Suleikh and Al-Rahma NHs were assessed for possible inclusion in the study. Al-Suleikh is a public NH run by the Baghdad governorate with 1 physician, 1 pharmacist, and nurses; and Al-Rahma is a private NH run by a charitable organization with allied nurses and a volunteer physician who is occasionally present, but no pharmacist. Neither NH had medication review services in any form before this study.

2.2. Pharmacists’ assessment and intervention

Two pharmacists (PhD candidates) specializing in geriatric care were assigned to the NHs in sequence. They were familiar with the Beers criteria before the start of the study and could detect PIMs. The pharmacists first obtained patients’ medical history and laboratory data through a manual search of their medical records and through interviews. After performing an assessment based on treatment guidelines and the 2019 Beers criteria, medication reconciliation was carried out and identified PIMs were evaluated and appropriate interventions were recommended to the NH physician.

2.3. Minor considerations for the use of Beers criteria

The primary goal of the AGS Beers criteria is to decrease DRPs in the elderly. It also serves to educate healthcare providers on rational drug use in this group and assess the quality of care provided to older adults in healthcare settings.

Hyoscine butyl bromide (used in Iraq but not available in the United States) was considered as an antispasmodic in Table 2 and as an anticholinergic in Tables 4 and 5. Procyclidine was considered as an anticholinergic in Tables 2, 3 and 5. Both were included due to their strong anticholinergic activity.

2.4. Study subjects and recruitment

NH residents aged ≥65 years that were using ≥1 medicine daily were included in the study. Patients discharged before the completion of the assessment were excluded. Patient characteristics (age, sex, number of medications, and symptoms) were compared between groups. Medicines used were classified according to Anatomical Therapeutic Chemical (ATC) Classification System and detected PIMs were classified according to their pharmacologic category. Vitamins, minerals, and herbs were not considered as medicines in this study.

The number of patients with PIMs identified according to Beers criteria, PIMs recommended for modification, physician acceptance rate, and time required for the pharmacist’s assessment and intervention were recorded. The study was approved by the managers of the NHs and the governor of Baghdad. The privacy of the study participants was fully respected.

2.5. Data collection and analysis

Descriptive statistics were applied to the data, including frequency and percentage to categorical variables and weighted mean, median, standard deviation (SD), and minimum and maximum to continuous variables. The Kolmogorov–Smirnov test of normality was performed and since the data did not support parametric assumptions, the Mann–Whitney U test was used when applicable. Pearson’s chi-squared test and Fisher’s exact test were used to evaluate the associations between categorical variables. The level of significance was defined as \(\alpha=0.05\). All calculations and analyses were carried out using SPSS v22.0 software (SPSS Inc, Chicago, IL, USA).

3. Results

3.1. Characteristics of the study population

The characteristics of the study population are shown in Table 1. A total of 109 NH residents aged ≥65 years were screened for enrollment. Of these, 9 residents were not using medication at the time of the study and 1 was discharged during data collection; these subjects were excluded from the study.

PIM, potentially inappropriate medication of the 99 remaining patients, the mean age (±SD) was 72.0 (±6.2) years. There were 57 males (57.6%) and 42 females (42.4%). The median (range) number of medications was 4 (1–14) drugs per patient. Polypharmacy occurred in 47.5% of patients. Vertigo was the most predominant symptom (51.5%), followed by dry mouth (47.5%), history
Table 1: Characteristics of the study population

| Characteristics                        | Patients with PIMs (%) | Patients without PIMs (%) | Total patients | P value* |
|----------------------------------------|------------------------|---------------------------|----------------|----------|
| Total                                   | 69 (69.7)              | 30 (30.3)                 | 99             | 0.011    |
| Male                                    | 34 (59.6)              | 23 (40.4)                 | 57             |          |
| Female                                  | 35 (83.3)              | 7 (16.7)                  | 42             |          |
| Age, years                              |                        |                           |                |          |
| 65–74                                   | 41 (62.1)              | 25 (37.9)                 | 66             | 0.020    |
| ≥75                                     | 28 (84.8)              | 5 (15.2)                  | 33             |          |
| Number of medications                   |                        |                           |                |          |
| 1–4                                     | 25 (48.1)              | 27 (51.9)                 | 52             | <0.0001  |
| ≥5                                      | 44 (93.6)              | 3 (6.4)                   | 47             |          |
| Symptoms                                |                        |                           |                |          |
| Constipation                            | 23 (88.5)              | 3 (11.5)                  | 26             | 0.015    |
| Delirium                                | 33 (89.2)              | 4 (10.8)                  | 37             | 0.001    |
| Dry mouth                               | 39 (83)                | 8 (17)                    | 47             | 0.006    |
| History of fall                         | 36 (87.8)              | 5 (12.2)                  | 41             | 0.001    |
| Memory problems                         | 27 (87.1)              | 4 (12.9)                  | 31             | 0.011    |
| Sleep difficulties                      | 25 (80.6)              | 6 (19.4)                  | 31             | 0.110    |
| Urinary retention                       | 20 (87)                | 3 (13)                    | 23             | 0.040    |
| Vertigo                                 | 43 (84.3)              | 8 (15.7)                  | 51             | 0.001    |
| Medication classification               |                        |                           |                |          |
| Alimentary tract and metabolism         | 44 (84.6)              | 8 (15.4)                  | 52             | 0.001    |
| Anti-infective for systemic use         | 12 (92.3)              | 1 (7.7)                   | 13             | 0.10     |
| Antiparasitic products, insecticides, and repellents | 1 (50)                | 1 (50)                    | 2              | 0.54     |
| Blood and blood-forming organs          | 30 (76.9)              | 9 (23.1)                  | 39             | 0.20     |
| Cardiovascular system                   | 45 (70.3)              | 19 (29.7)                 | 64             | 0.97     |
| Dermatologic                            | 4 (100)                | 0                         | 4              | 0.31     |
| Genitourinary system and sex hormones   | 3 (100)                | 0                         | 3              | 0.55     |
| Musculoskeletal system                  | 23 (92)                | 2 (8)                     | 25             | 0.005    |
| Nervous system                          | 46 (83.6)              | 9 (16.4)                  | 55             | 0.001    |
| Respiratory system                      | 15 (93.8)              | 1 (6.3)                   | 16             | 0.03     |
| Systemic hormonal preparations, excluding sex hormones and insulin | 9 (81.8)                | 2 (18.2)                  | 11             | 0.50     |

*Chi-squared test and Fisher’s exact test were used where applicable.

of fall (41.4%), delirium (37.4%), memory problems and sleep difficulties (both 31.3%), constipation (26.3%), and urinary retention (23.2%). About 65% of patients used cardiovascular medications, which were the most commonly used drug type (28.6%).

3.2. Characteristics of identified PIMs

There were 163 PIMs identified according to 2019 Beers criteria, which were categorized by pharmacologic class: 69 patients (69.7%) had ≥1 PIM. The mean age (±SD) of patients with PIMs (73.2±6.3 years) was significantly higher than that of patients without PIMs (69.2±5.1 years) (P=0.001). The mean number of medications per patient (±SD) was significantly higher in patients with PIMs (5.7±3.2) compared to those without PIMs (2.0±1.46) (P<0.0001). There was a significant association between PIMs and sex: among males, the percentage using PIMs (n=34, 59.6%) was higher than those who did not (n=23, 40.4%) (X²=6.42, p=0.01)
Table 2: Pharmacologic class of PIMs identified according to the 2019 Beers criteria and those that were discontinued/changed based on pharmacists’ recommendations

| Pharmacologic class                  | Identified, n (%) | Changed, n (%) |
|--------------------------------------|------------------|---------------|
| Total                                | 163 (100)        | 115 (100)     |
| NSAIDs                               | 22 (13.5)        | 22 (19.1)     |
| Benzodiazepines                      | 21 (12.9)        | 21 (18.3)     |
| Gastrointestinal drugs               | 21 (12.9)        | 21 (18.3)     |
| Sulfonylureas                         | 20 (12.3)        | 3 (2.6)       |
| Diuretics                            | 19 (11.7)        | 0             |
| Anticholinergics or antispasmodics   | 16 (9.8)         | 16 (13.9)     |
| Antipsychotics                       | 13 (8)           | 6 (5.2)       |
| Antplatelets                          | 10 (6.1)         | 10 (8.7)      |
| Skeletal muscle relaxants            | 8 (4.9)          | 8 (7)         |
| Antiepileptics                       | 7 (4.3)          | 4 (3.5)       |
| Antidepressants                      | 4 (2.5)          | 2 (1.7)       |
| Antibacterial                        | 1 (0.6)          | 1 (0.9)       |
| Cardiovascular agents                | 1 (0.6)          | 1 (0.9)       |

The percentage of patients with polypharmacy who had ≥1 PIM was 94.6%. The most frequent PIMs were nonsteroidal anti-inflammatory drugs (NSAIDs) (13.5%), followed by benzodiazepines and gastrointestinal drugs (both 12.9%), sulfonylureas (12.3%), diuretics (11.7%), anticholinergics or antispasmodics (9.8%), antipsychotics (8%), antplatelets (6.1%), skeletal muscle relaxants (4.9%), antiepileptics (4.3%), antidepressants (2.5%), and antibacterial and cardiovascular agents (both 0.6%) (Table 2).

3.3. Pharmacist interventions and acceptance

Of the 163 PIMs, 140 (85.9%) were recommended to doctors to be changed and 112 (68.7%) were discontinued/changed after the pharmacists’ assessment and intervention; that is, the acceptance rate of pharmacists’ recommendations by physicians was 80% (112/140). Details on the PIMs and the number of medications that were changed after the pharmacist’s intervention are shown in Table 3. Drugs that should be avoided were the most frequent PIMs (69.3%), followed by drugs that should be used with caution (19.6%), drug–disease or drug–syndrome interaction (9.2%), drug–drug interactions that should be avoided (1.2%), and drugs that should be avoided or reduced with impaired kidney function (0.6%). The least frequently changed/discontinued medications after intervention were diuretics (0), sulfonylureas (n=3, 15.0%), antipsychotics (n=6, 46.1%), antidepressants (n=2, 50.0%), and antiepileptics (n=4, 57.1%). The median time required for the pharmacist’s assessment was 13 min/patient (interquartile range [IQR], 8–18 and range, 3–31).

There was a significant association between PIMs and the following categories of medication: alimentary tract and metabolism drugs ($X^2=11.54$, $p=0.001$), musculoskeletal system drugs ($X^2=7.88$, $p=0.005$), nervous system drugs ($X^2=11.39$, $p=0.001$), and respiratory system drugs ($X^2=5.23$, $p=0.03$).

4. Discussion

There were 2 major findings from this study. Firstly, PIMs are extensively used by the elderly residents of NHs in Iraq, with the prevalence being 1.63 times higher among females than among males in accordance with earlier findings: the most common PIMs were NSAIDs and benzodiazepines. Secondly, there was an 80% acceptance rate among physicians of pharmacists’ recommendations to modify or discontinue a prescription for PIMs, which is higher than the rates reported by others. On the other hand, earlier studies have demonstrated that pharmacists’ intervention in NHs had positive effects, resulting in a reduction in the use of PIMs and promoting the proper use of medicines by the elderly, which is supported by our findings.

Several independent factors contribute to the use of PIMs. Polypharmacy, which is the concurrent use of ≥1 medicines by an individual, is associated with a higher prevalence of PIMs, especially in individuals aged > 75 years who are prone to having comorbidities because of their advanced age. Additionally, there is no health insurance in Iraq and electronic health records are not used; as such, patients are usually treated by multiple healthcare providers, who may prescribe different medicines in the absence of information concerning previous prescriptions. The prevalence of the most common PIMs was 13.5% for NSAIDs and 12.9% for benzodiazepines; gastrointestinal medicines were used as frequently as the latter (12.9%). In a study conducted in Malaysia, the most prevalent PIMs were benzodiazepines and first-generation antihistamines; and in a study carried out in Argentina, the most frequent PIMs were diazepam and diuretics (both 11.7%) and aspirin (6.1%) for...
Table 3: Number of potentially inappropriate medications identified according to the 2019 Beers 2019 criteria and those that were modified after pharmacists’ intervention

| Drugs that should be avoided               | Total (n=113) | Total, %   | Changed (n=94) | Changed %=83.2 |
|-------------------------------------------|---------------|------------|----------------|----------------|
| **Anticholinergics**                      |               |            |                |                |
| Chlorphenamine                            | 3             | 1.8        | 3              | 100            |
| Diphenhydramine                           | 2             | 1.2        | 2              | 100            |
| Procyclidine                              | 2             | 1.2        | 2              | 100            |
| Triprolidine                              | 1             | 0.6        | 1              | 100            |
| **Antispasmodics**                        |               |            |                |                |
| Hyoscine                                  | 6             | 3.7        | 6              | 100            |
| Clidinium bromide/chlordiazepoxide        | 2             | 1.2        | 2              | 100            |
| **Cardiovascular**                        |               |            |                |                |
| Amiodarone                                | 1             | 0.6        | 1              | 100            |
| **Antidepressants**                       |               |            |                |                |
| Amitriptyline                             | 1             | 0.6        | 1              | 100            |
| Clomipramine                              | 1             | 0.6        | 1              | 100            |
| **Antipsychotics**                        |               |            |                |                |
| Prochlorperazine                          | 2             | 1.2        | 1              | 50             |
| Trifluoperazine                           | 2             | 1.2        | 1              | 50             |
| **Benzodiazepines**                       |               |            |                |                |
| Alprazolam                                | 1             | 0.6        | 1              | 100            |
| Clonazepam                                | 1             | 0.6        | 1              | 100            |
| Diazepam                                  | 19            | 11.7       | 19             | 100            |
| **Gastrointestinal**                      |               |            |                |                |
| Glibenclamide                             | 17            | 10.4       | 2              | 11.8           |
| Glimepiride                               | 3             | 1.8        | 1              | 33.3           |
| **NSAIDs**                                |               |            |                |                |
| Diclofenac                                | 3             | 1.8        | 3              | 100            |
| Ibuprofen                                 | 5             | 3.1        | 5              | 100            |
| Mefenamic acid                            | 8             | 4.9        | 8              | 100            |
| Meloxicam                                 | 6             | 3.7        | 6              | 100            |
| **Skeletal muscle relaxants**             |               |            |                |                |
| Chlorzoxazone                             | 2             | 1.2        | 2              | 100            |
| Orphenadrine                              | 6             | 3.7        | 6              | 100            |

NSAID, nonsteroidal anti-inflammatory drug.

Table 4: Drug–disease or drug–syndrome interaction

| Drug–disease or drug–syndrome interaction | Total (n=15) | Total, %   | Changed (n=7) | Changed %=46.7 |
|-------------------------------------------|---------------|------------|----------------|----------------|
| **Delirium**                              |               |            |                |                |
| Olanzapine                                | 1             | 0.6        | 0              | 0              |
| Quetiapine                                | 1             | 0.6        | 0              | 0              |
| Ranitidine                                | 2             | 1.2        | 2              | 100            |
| Trifluoperazine                           | 1             | 0.6        | 0              | 0              |
| **Dementia**                              |               |            |                |                |
| Fluphenazine                              | 1             | 0.6        | 0              | 0              |
| Olanzapine                                | 2             | 1.2        | 0              | 0              |
| Trifluoperazine                           | 1             | 0.6        | 0              | 0              |
| **Fall**                                  |               |            |                |                |
| Gabapentin                                | 5             | 3.1        | 4              | 80             |
| **Syncope**                               |               |            |                |                |
| Olanzapine                                | 1             | 0.6        | 1              | 100            |
Table 5:

| Drugs that should be used with caution | Total (n=32) | Total, % | Changed (n=10) | Changed %≈31.3 |
|----------------------------------------|-------------|----------|----------------|---------------|
| Aspirin for primary prevention of cardiovascular disease | 10          | 6.1      | 10             | 100           |
| Diuretics                              | 19          | 11.7     | 0              | 0             |
| Carbamazepine                          | 2           | 1.2      | 0              | 0             |
| Olanzapine                             | 1           | 0.6      | 0              | 0             |

Table 6:

| Drug–drug interactions that should be avoided | Total (n=2) | Total, % | Changed (n=0) | Changed %≈0 |
|---------------------------------------------|-------------|----------|---------------|-------------|
| Escitalopram with ≥2 central nervous system-active drugs | 2           | 1.2      | 0             | 0           |

Table 7:

| Drugs that should be avoided or reduced with impaired kidney function | Total (n=1) | Total, % | Changed (n=1) | Changed %≈100 |
|-----------------------------------------------------------------------|-------------|----------|---------------|--------------|
| Ciprofloxacin                                                         | 1           | 0.6      | 1             | 100          |

cardiovascular disease prevention. The use of NSAIDs substantially increases the risk of falls and fractures, especially in the elderly. The high rate of benzodiazepine usage may be attributable to the high prevalence of mental disorders in Iraq.

We determined that 68.7% of PIMs used in this study were either modified or discontinued after intervention by pharmacists according to the 2019 Beers criteria; NSAIDs (19.1%) and benzodiazepines (18.3%) were the 2 most frequently modified classes of medicine. The rate of prescription change was higher than those reported by other researchers with one exception, and may be attributed to pharmacists not suggesting modification/discontinuation of medications because of the potential risk of withdrawal symptoms or worsening of the patient’s condition weighed against the potential benefits of reducing the consumption of PIMs. In our study, the rate of acceptance of pharmacists’ recommendations by physicians was >80%, which is much higher than the previously reported rate of 36%.

The mean time required for pharmacists’ assessment in this study was 13 min/patient (IQR, 8–18 and range, 3–31), which is higher than that in an earlier report. This may be explained by the high incidence of polypharmacy (up to 14 drugs per patient). Moreover, the doctors implemented prescription changes according to pharmacists’ recommendations while considering the associated benefits and risks. Nonetheless, the acceptance ratio in this study was lower than that of the previous study in which the mean duration of pharmacists’ intervention was 30 min per patient. Pharmacists’ recommendations to physicians and nurses included information on drug initiation/discontinuation; dose adjustment; laboratory monitoring; and evaluation of medication adherence and efficacy and adverse effects to ensure that the appropriate medication was being used in elderly NH residents. The Framework for Older People proposes that medications should be reviewed to minimize the incidence of DRPs in the elderly, and extensive research has been carried out to assess the impact of such reviews.

This study had several strengths. This is the first study to evaluate the prevalence of PIMs in geriatric patients in Iraq according to the 2019 Beers criteria. We used the latest revision of the criteria, which are evidence-based standards that are regularly updated by the Institute of Medicine in collaboration with the AGS. Two pharmacists were tasked with independently identifying and classifying the PIMs, which helped to avoid information bias. Additionally, comprehensive assessments of patients that included several types of geriatric syndrome were carried out. It should be noted that most of the earlier investigations on the association between PIM and geriatric syndromes did not report the different aspects of the assessment. In this study we first examined the prescription trends for elderly patients in Iraq, followed by the application of the 2019 Beers criteria to identify PIMs by pharmacists and the changes recommended to physicians, which led to a high rate of acceptance.

This study also had certain limitations. The fact that it was conducted at just 2 NHs in Baghdad in a relatively small population limits the generalizability of our findings. Additionally, there was a potential for selection bias because there were no electronic medical records and all of the elderly subjects were NH residents, who are likely to be more frail than their counterparts who are not in NHs. Finally, self-reported health conditions are susceptible to memory bias and can vary according to patients’ level of health knowledge. These factors could have influenced the degree of association between PIMs and health-related parameters.
5. Conclusion

The results of this study indicate that the use of PIMs, identified using the 2019 Beers criteria, is associated with polypharmacy among elderly NH residents in Iraq. Based on these findings, pharmacists—especially those in NHs—should closely review the medications prescribed to older adults with geriatric syndromes to avoid PIM use and reduce the risk of adverse events.

6. Ethical Consideration

This was approved by governor of Baghdad for the affairs of the elderly and health care homes.

7. Source of Funding

None.

8. Conflict of Interest

None.

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