Applying Beers Criteria for Elderly Patients to Assess Rational Drug Use at a University Hospital in Northern Cyprus

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Background: Several regulations for potentially inappropriate medications (PIMs) have been published specifically for elderly patients to rationalize drug use in such vulnerable communities. Objectives: To determine the proportion and characteristics of PIMs in patients receiving one or more drugs according to Beers Criteria 2015. Materials and Methods: A cross-sectional prospective analysis of 451 inpatients admitted between September 25 and October 25, 2016, was conducted in Near East University Hospital, Northern Cyprus. Data were extracted from the patient medical records using special forms. Results: A total of 119 elderly patients were identified (26.4%) and evaluated, of which 107 were eligible and 12 were excluded. Of the 1039 prescribed medicines, 16.9% were PIMs during hospitalization, whereas 12% were at discharge. The most prevalent PIM group during hospitalization was identified as the “medications to be avoided in older adults” (48.8%), whereas it also formed 52% of medications prescribed at discharge. PIMs of the class “drugs used with caution” formed 19.4% of prescribed medicine during hospitalization and 18.4% on discharge. The prevalence of polypharmacy was 79.4%, mainly identified as unpreventable polypharmacy of elders. Conclusion: A significantly higher prevalence of PIMs was observed in hospitalized patients than those discharged, with high prevalence of polypharmacy. These results necessitate a nationwide assessment, and responsible bodies who adopt strategies should act to reduce or overcome the aforementioned high prevalence in Northern Cyprus.

Keywords: Beers Criteria, elderly tool, geriatric, pharmacy practice, potentially inappropriate medications, rational drug use

INTRODUCTION

Life expectancy has dramatically increased over the past 100 years. In 2015, the global elderly population increased by 55 million. On average, the individuals who are 65–69 years old take nearly 14 different prescription medications per year, and individuals who are aged 80–84 years take an average of 18 prescriptions per year. Age-related physiologic changes that occur in elderly individuals may affect drug pharmacokinetics and pharmacodynamics, thus increasing the risk of medication-related problems. The other reasons for drug-related problems are lack of continuity in physician contacts, lack of a consistent drug list, and inadequate prescription and monitoring of drug therapy. Also by advancing in age, a high prevalence of multiple chronic diseases and comorbidity occurs, leading to the use of complex therapeutic regimens and polypharmacy. Polypharmacy may become problematic for older adults due to its increasing risk of elderly syndromes, diminished
functional status, and health care costs. Polypharmacy is the concomitant administration and use of four or more medications and it is usually common among older adults. Underuse has an important relationship with older adults; it seems to have a negative effect on health outcomes for older people, which include functional disability, health services use, and death. Also medication nonadherence can have drastic deleterious health effects on the elderly. These factors cause the elderly patients to be treated with more attention.

Today, several tools are used to evaluate the prescription of potentially inappropriate medication (PIM) in older adults. PIM is a drug in which its risk of an adverse event outweighs its clinical benefit, particularly when there is a safer or more effective alternate therapy for the same condition. Since the early 1990s, the prevalence of PIM usage has been examined in more than 500 studies, including a number of long-term care, discharged, acute care, and community settings.

Nowadays there are tools that are used to evaluate PIM in elderly patients; a prior systematic review identified 14 criteria specific for individuals aged 65 years and older such as Beers Criteria (BC), the Screening Tool of Older Persons (STOPP), Rationalization of Home Medication by an Adjusted STOPP list in Geriatric patients, Improved Prescribing in the Elderly Tool, and the Medication Appropriateness Index.

The BC was first developed in 1991 by Dr. Mark Beers. The changes in the 2015 update were not as extensive as those in the previous update; however, two key components were added: drug dose adjustment, required based on kidney function, and drug-drug interactions. The Beers list was expanded to include all geriatric care settings, such as inpatient or outpatient and primary care. An important note is that the medications addressed in the list are not all absolute contraindications; furthermore, there are situations in which use of medications included in the criteria can be appropriate.

The American Geriatrics Society (AGS) Beers Criteria are one component of a comprehensive approach to medication use in older adults, and they should be used in conjunction with other tools. The goal of BC is to improve the care of older patients by decreasing the PIMs. It serves as a “warning light” to identify the medications that have an unfavorable balance of benefits and harms in older adults, particularly when compared with pharmacological and non-pharmacological alternatives. The BC is not a substitute for clinical judgment and individualized care, but is meant as a guide for health care providers to make clinical decisions and to develop a policy to improve quality and safety, and conduct research and training.

The aim of this study was to evaluate the rational use of prescribed drugs in elderly patients in light of the Beers Criteria 2015 recommendations in Near East University Hospital, Northern Cyprus.

**Materials and Methods**

A cross-sectional prospective study was conducted involving elderly patients (aged 65 years and older) who were admitted to Near East University Hospital in North Cyprus during September and October 2016.

**Inclusion criteria**

1. Patients who are aged 65 years or older “geriatrics”
2. Patients who were hospitalized between September and October 2016, whether in the geriatric clinic or other clinics

**Exclusion criteria**

1. Patients who were in hospice care or were receiving palliative care
2. Patients who were discharged before completing their data collection
3. Patients who died during collection of data

**Sample size and data collection**

In total, 451 patients who were admitted in the hospital during the study time were scanned. A total of 119 patients were eligible for the study, whereas 12 patients from them were excluded, which was due to incomplete data in 9 patients and 3 died during the course of data collection.

Data were collected by reviewing the case sheets of all elderly patients who were hospitalized or discharged during the study period. Data obtained from the patient medical records consisted mainly of the patients’ age, gender, date of admission, date of review, diagnosis, creatinine clearance, and all medications prescribed.

**Identification of PIMs**

A panel of pharmacologist, clinical pharmacist, medical doctor, and the researcher assessed all medications for PIM using the 2015 Beers Criteria.

The medications in the record listed in the BC were considered to be PIM according to the major components of the criteria, which include the following:

1. PIMs and older adults
2. Drug-disease and drug-syndrome PIMs
3. Drugs to be used with caution
4. Drug-drug interactions
5. PIMs based on kidney function
Statistical analysis
Collected data were entered in Microsoft Office Excel 2010 and analyzed by using Statistical Package for the Social Sciences (SPSS) statistical software (version 20, IBM, SPSS).

The methods used to analyze the data include an analysis of descriptive statistic variables such as frequency and percentages whereas chi-square test and Pearson correlation were used for statistical analysis of categorical variables and correlation analysis respectively. P values <0.05 were considered statistically significant.

Statement of ethics
The study was approved by the Near East Institutional Reviews Board (IRB) of Near East University Hospital that assigned this research as an observational study.

Results
Of 451 patients admitted to the hospital and scanned, 107 were enrolled, 57.9% (n = 62) being males and mainly aged 65–75 years (55.1% [n = 59]). The total number of medicines prescribed to the 107 patients was 1039. Polypharmacy was found in 79.4% (n = 85) of patients. In terms of the variation in polypharmacy with relation to age, patients aged 65–75 years with polypharmacy were 42.1% (n = 45) compared to 37.4% (n = 40) who were aged >75 years. On the basis of the patients’ file information, many of the patients were admitted to the cardiology clinic 39.3% (n = 43) [Table 1].

| Gender          | %  | (n) |
|-----------------|----|-----|
| Male            | 57.9% | 62  |
| Female          | 42.1% | 45  |
| Age:            |    |     |
| 65–75 Years     | 55.1% | 59  |
| > 75 Years      | 44.9% | 48  |
| Total number of evaluated drugs | 1039 |
| Range           | (1–23) |
| Number of prescribed medication |   |
| Mean±SD         | 9.7±4.6 |
| Number of prescribed medication per patient |   |
| Prevalence of poly-pharmacy | 79.4% | (n = 85) |

Distribution of patients across clinics

| Department        | %  | (n) |
|-------------------|----|-----|
| Cardiology        | 40.2% | 43  |
| Respiratory       | 13.1% | 14  |
| Internal          | 12.1% | 13  |
| Surgery           | 10.3% | 11  |
| Infection         | 7.5%  | 8   |
| Oncology          | 7.5%  | 8   |
| Geriatric         | 5.6%  | 6   |
| Neurology         | 3.7%  | 4   |

Of the total 1039 medicines prescribed, 16.9% (n = 176) were identified to be PIM used during hospitalization as determined by the Beers’ Criteria’s components; however, 12% (n = 125) PIMs were observed in the discharge medications. The total prescribed medications that included in Beers Criteria were 18.7% (n = 195) [Table 2].

Of the patients found to be using PIMs during hospitalization, one PIM was prescribed to 28% (n = 30). While at discharge, from 53.4% (n = 57) patients who had PIMs, one PIM was prescribed to 23.4% (n = 25) of the patients [Table 3].

From 107 patients, 76.6% (n = 82) had PIMs in their medications according to Beers Criteria; most potentially inappropriate medicines used during hospitalization were administered to cardiology patients (40.2%; n = 33), followed by internal medicine patients (13.4%; n = 11), respiratory patients (12.2%; n = 10), and then geriatrics (11%; n = 9), surgery (7.3%; n = 6), infections (6.1%; n = 5), oncology (6.1%; n = 5), and neurology patients (3.6%; n = 3).

Proton-pump inhibitors (PPIs) were the most prescribed PIM for patients during hospitalization (n = 69) and on discharge. From the PPIs, pantoprazole was prescribed most frequently during hospitalization, although some were stopped on discharge. Diuretics such as furosemide was the second most commonly prescribed PIM drug also classed as PIM even on discharge for a number of patients. Enoxaparin was the third most commonly prescribed medication during hospitalization; however, it was not the third prescribed PIMs furthermore it was stopped in all cases at discharge [Table 2].

In this study, there is a correlation between polypharmacy and the number of PIMs; patients who have polypharmacy significantly had more PIMs on both discharge and during hospitalization (r = 0.273).

PIMs Profile
According to the first component in BC, which are PIMs, there were 48.8% (n = 86) of PIMs included in this component. Of the drugs, 11.6% (n = 10) were recommended as to be avoided and 74.4% as to be avoided with exceptions, with 71.6% as high quality of evidence and 100% as strongly recommended. While for discharge, 52% of PIMs belonged to the absolute PIMs category and 62.2% of these drugs were recommended as to be avoided with exceptions. These groups of components involve drugs that require monitoring or avoidance during the selected period. In addition, some drugs should not be used as the primary choice and some should be avoided in elderly adults [Tables 4 and 5].
### Table 2: Prescribed medications included in Beers criteria

| PIMs medications | Frequency | Drug Class | Rationale | Beers Criteria Recommendation |
|------------------|-----------|------------|-----------|-------------------------------|
| 1. Pantoprazole   | 37        | Proton pump inhibitors (PPIs) | Risk of Clostridium difficile infection and bone loss and fractures | Avoid scheduled use for >8 weeks (Avoided with exceptions) |
| 2. Furosemide    | 28        | Diuretic   | May exacerbate or cause syndrome of inappropriate antidiuretic hormone secretion or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults. | Use with caution |
| 3. Omeprazole    | 19        | Proton pump inhibitors (PPIs) | Risk of Clostridium difficile infection and bone loss and fractures | Avoid scheduled use for >8 weeks. (Avoided with exceptions) |
| 4. Enoxaparin    | 26        | Anticoagulant | In CrCl<30 Increased risk of bleeding | Reduce dose 1. Avoid in older adults with or at high risk of delirium. 2. Avoid; if not possible, provide gastrointestinal protection |
| 5. Corticosteroids | 12 | Anti-inflammatory medications | 1. Potential of inducing or worsening delirium. 2. Corticosteroids with NSAIDs increased risk of Peptic ulcer disease or gastrointestinal bleeding. 1. Avoid 2. Avoid; if not possible, provide gastrointestinal protection |
| 6. Alprazolam    | 11        | Antianxiety | 1. Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents. 2. May cause ataxia, impaired psychomotor function, syncope, additional falls; shorter-acting benzodiazepines are not safer than long-acting ones 1. Avoid 2. Avoid in patients with History of falls or fractures unless safer alternatives are not available; (Avoided with exceptions) |
| 7. Lansoprazole  | 8         | Proton pump inhibitors (PPIs) | Risk of Clostridium difficile infection and bone loss and fractures. | Avoid scheduled use for >8 weeks. (Avoided with exceptions) |
| 8. Thiazide      | 5         | Diuretics  | May exacerbate or cause syndrome of inappropriate antidiuretic hormone secretion or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults. | Avoid |
| 9. Esomeprazole  | 5         | Proton pump inhibitors (PPIs) | Risk of Clostridium difficile infection and bone loss and fractures. | Avoid scheduled use for >8 weeks. (Avoided with exceptions) |
| 10. Spironolactone | 4       | Potassium-sparing diuretic | In CrCl<30 Increased potassium | Avoid |
| 11. Digoxin      | 4         | Antiarrhythmic | 1. Use in atrial fibrillation 2. Use in heart failure | 1. Avoid as first-line therapy for atrial fibrillation 2. Avoid as first-line therapy for heart failure. |
| 12. Amiodarone   | 4         | Antiarrhythmic | Amiodarone is effective for maintaining sinus rhythm but has greater toxicities than other antiarrhythmics used in atrial fibrillation. | Avoid amiodarone as first-line therapy for atrial fibrillation unless patient has heart failure or substantial left ventricular hypertrophy. |
| 13. Diazepam     | 4         | Antianxiety"calming agent" | May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, and periprocedural anesthesia | – |
| 14. Ranitidine   | 3         | Histamine H2 receptor antagonists | 1. Potential of inducing or worsening delirium. | 1. Avoid in older adults with or at high risk of delirium. |
| 15. Olanzapine   | 3         | Atypical antipsychotic | 1. Increases risk of orthostatic hypotension or bradycardia | 1. Avoid in patient with Syncope |
| 16. Famotidine   | 3         | Histamine H2 receptor antagonist | 1. Potential of inducing or worsening delirium. | 1. Avoid in older adults with or at high risk of delirium. |
| PIMs medications | Frequency | Drug Class | Rationale | Beers Criteria Recommendation |
|------------------|-----------|------------|-----------|-------------------------------|
| 17. Citalopram   | 3         | Antidepressant | 1. May exacerbate or cause syndrome of inappropriate antiuretic hormone secretion or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults. 2. Use with ≥2 other CNS-active drugs increased risk of Falls. | 1. Use with caution |
| 18. Tramadol     | 2         | Narcotic-like pain reliever. | 1. Lowers seizure threshold; may be acceptable in individuals with well-controlled seizures in whom alternative agents have not been effective. 2. Crcl<30 CNS adverse effects | 1. Avoid (Avoided with exceptions) |
| 19. Doxazosin    | 2         | Alpha-adrenergic blockers | 1. Increases risk of orthostatic hypotension or bradycardia. 2. Aggravation of incontinence. | 1. Avoid in patient with Syncope. 2. Avoid in women (Avoided with exceptions) |
| 20. Aspirin      | 2         | NSAIDs | 1. Aspirin >325 mg/d: Increased risk of gastrointestinal bleeding or peptic ulcer disease. Primary prevention of Lack of evidence of benefit versus risk in adults aged ≥80. | 1. Avoid chronic use, or with history of gastric or duodenal ulcers (Avoided with exceptions) 2. Use with caution in adults aged ≥80. |
| 21. Terazosin    | 1         | alpha-adrenergic blockers | 1, 2. Increases risk of orthostatic hypotension or bradycardia. | 1. Avoid in patient with Syncope. |
| 22. Modafinil    | 1         | Wakefulness-promoting agent. | CNS stimulant effects | Avoid in Insomnia |
| 23. Clonazepam   | 1         | Anti-anxiety and anti-convulsant | May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, and periprocedural anesthesia. | – |
| 24. Buprofen     | 1         | Nonsteroidal anti-inflammatory drug (NSAID) | Increased risk of gastrointestinal bleeding or peptic ulcer disease | Avoid chronic use (Avoided with exceptions) |
| 25. Rivaroxaban  | 1         | Anticoagulants | In Crcl 30-50 increased risk of bleeding (excludes ophthalmic) Highly anticholinergic, uncertain effectiveness. | Reduce dose Avoid |
| 26. Atropine     | 1         | Anticholinergic | May exacerbate or cause syndrome of inappropriate antiuretic hormone secretion or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults. | Use with caution |
| 27. Mirtazapine  | 1         | atypical antipsychotic | | Avoid in individuals with creatinine clearance <30 mL/min or for long-term suppression of bacteria. (Avoided with exceptions) |
| 28. Nitrofurantoin | 1     | Antibiotic | Potential for pulmonary toxicity, hepatotoxicity, and peripheral neuropathy, especially with long-term use. | |
| 29. Metoclopramide | 1     | Dopamine receptor blocker | 1. Can cause extrapyramidal effects, including tardive dyskinesia. | 1. Avoid, unless for gastroparesis (Avoided with exceptions) |
| 30. Scopolamine  | 1         | Anti-motion sickness | Highly anticholinergic, uncertain effectiveness | Avoid |
The drugs selected as the second component in BC for PIMs that may exacerbate the disease or syndrome were 22% \((n = 39)\). Of the drugs, 52.6% \((n = 20)\) interact with delirium whereas 3.9% \((n = 5)\) may interact with history of fall and history of syncope. Furthermore, 19.4% \((n = 34)\) of PIMs used during hospitalization were labeled to be used with caution in elderly patients (antipsychotic medications, diuretics, mirtazapine, and selective serotonin reuptake inhibitors [SSRIs]). While on discharge, there were 18.4% \((n = 23)\) drugs that should be used with caution in elderly patients. In the component of non-anti-infective drugs that should be avoided in older adults, 1.7% \((n = 3)\) were used in hospitalization and 0.8% \((n = 1)\) at discharge. Noninfective medications that should be avoided or have their dosage reduced with varying levels of kidney functions were found as 7.9% \((n = 14)\) during hospitalization and 3.1% \((n = 5)\) at discharge [Tables 4 and 5].

**DISCUSSION**

Pharmacists are increasingly requested by many health systems, providers, and primary care teams to improve outcomes and delivery of care.\(^{[10]}\) Evidence-based pharmacy practice or the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients is currently considered as a major requirement to assure good pharmacy practice. The use of the best available evidence by pharmacists in assessing patterns of drug use and guideline utilization periodically in hospitals aids in achieving rational drug use in these settings.

In this study, 107 prescriptions and 1039 medications were analyzed with the aim of evaluating the rational use of prescribed medicine to elderly patients in light of the Beers Criteria 2015 recommendations during hospitalization and at discharge in order to determine incidence of PIMs prescribed to them and to identify the drugs that require monitoring or caution during use. The majority of patients in this study were men aged 65–75 years, taking a minimum of 1 drug and a maximum of 23 drugs. In a comparable study that was conducted in Navodaya Medical College and Hospital, the majority of admitted patients were male and patients who were in the age group 60–79 years. It also reported that majority of patients were predominantly admitted to the respiratory clinic followed by cardiology clinic.\(^{[15]}\) Whereas in this study, majority of patients were admitted to the cardiology clinic followed by respiratory clinic.

According to guideline utilization studies and expert panels’ recommendations, the findings of this study appear to be comparable to ranges reported by other observers from different parts of the world. From all the 1039 prescribed medicines, 16.9% were classified as PIM, compared to 32.19% reported by Abraham et al.\(^{[16]}\) who used Beers 2012. In this study also, 76.6% of patients’ prescriptions were found to be compliant with the AGS Beers Criteria 2015 compared to a study in Japan that reported 63% patients’ prescriptions were in compliance with AGS Beers Criteria 2015.\(^{[17]}\)

Not surprisingly, polypharmacy was observed in 79.4% of all cases. The frequency of PIM was not associated with the patients’ gender or age; however, it was associated with polypharmacy. Similarly was reported by studies at San Cecilio University Hospital, Granada,\(^{[18]}\) and in Istanbul, Turkey, in which

### Table 3: Comparison of PIM use during hospitalization and at Discharge

| Number of PIM per patients | Number of PIMs During Hospitalization | Number of PIMs Patient at Discharge |
|----------------------------|--------------------------------------|-----------------------------------|
| 1                          | 36.6% \((n = 30)\)                   | 43.8% \((n = 25)\)                |
| 2                          | 30.5% \((n = 25)\)                   | 38.6% \((n = 22)\)                |
| 3                          | 23.2% \((n = 19)\)                   | 14% \((n = 8)\)                   |
| 4 or more                  | 9.7% \((n = 8)\)                     | 3.5% \((n = 2)\)                  |

### Table 4: Beers criteria recommendations for potentially inappropriate medications during hospitalization

| Beers criteria Components | Number of PIM | Recommendations |
|--------------------------|---------------|----------------|
| Drugs to be avoided      | 48% \((n = 86)\) | 11.6% \((n = 10)\), 13.9% \((n = 12)\), 74.4% \((n = 64)\) |
| Drug-disease interaction | 22% \((n = 39)\) | 52.6% \((n = 20)\), 34.2% \((n = 13)\), 13.2% \((n = 6)\) |
| Use with caution         | 19.4% \((n = 34)\) | –, –, –, 100% \((n = 34)\) |
| Drug-drug interaction    | 1.7% \((n = 3)\) | 33.3% \((n = 1)\), 66.7% \((n = 2)\) |
| Based in kidney function | 7.9% \((n = 14)\) | 42.9% \((n = 6)\), 21.4% \((n = 3)\), 35.7% \((n = 5)\) |
potentially inappropriate drugs were more prevalent in polypharmacy.[39]

PIMs during hospitalization were 16.9% \((n = 176)\) whereas at discharge were 12% \((n = 125)\). The decrease in PIMs at discharge comparing to in hospitalization may be due to the ability of monitoring patients during hospitalization because Beers Criteria 2015 included PIM that should be used with caution or adjusting the dose according the kidney function, while most of these medications are discontinued on discharge by physicians.

The drugs were classified according to the type of inappropriateness categories that were identified in the Beers Criteria 2015 components. During hospitalization, 86 PIMs (48% of total PIMs) belonged to the first component, which includes absolute PIMs in elderly patients, comparing to 256 PIMs (100% of total PIMs) that were reported in a study carried out by Goudanavar et al.[15] Also during hospitalization, it was found that 39 PIMs (22%) may interact with diseases and other syndromes. The most prevalent syndrome that patients were at risk of experiencing was delirium whereas in a study carried in an urban tertiary hospital at Sydney, Australia, 18.4% of the PIMs were identified as drugs that could interact with diseases and syndromes, and fall (or syncope) was the most prevalent syndrome associated with PIMs according to Beers Criteria 2012.[20]

| Beers criteria Components | Number of PIM | Avoid | Avoid as 1st choice | Avoid with exceptions | Use with caution | Reduce dose |
|---------------------------|--------------|-------|---------------------|----------------------|-----------------|------------|
| Drug to be avoided        | (n = 65)     | 52%   | 13.8%               | 16.9%                | 69.2%           | –          |
| Drug-disease interaction  | (n = 31)     | 24.8% | 61.3%               | 29%                  | 9.7%            | –          |
| Use with caution          | (n = 19)     | 18.4% | –                   | –                    | 100%            | –          |
| Drug-drug interaction     | (n = 1)      | 0.8%  | 100%                | –                    | –               | –          |
| Based in kidney function  | (n = 5)      | 3.1%  | 80%                 | –                    | –               | 20%        |

To the best of our knowledge, this is one of the first studies to assess the medications of elderly patients according to 2015 updated BC in Northern Cyprus. The high prevalence of PIMs in elderly patients reported in this study necessitates a nationwide assessment, and responsible bodies should act accordingly to reduce and adopt strategies that may reduce and overcome the reported high prevalence. Furthermore, the sampled population in this study came from different clinics and represented a wide range of pathologies and chronic illness populations.

Further studies should be conducted nationwide using a multicenter approach, and such assessments should also consider the level of awareness and thus assess both pre- and post-awareness continuous medical education (CMEs) activities. Furthermore, other health care facilities and settings should implement such assessments continuously, while it is also important to trace readmission in geriatrics, particularly to follow-up medications that are classified as used with caution and also to be vigilant for new possible candidates to be classified as PIMs.
Yet a major limitation of our study is the fact that it was uni-centered study; hence, limiting the generalizability of its results nationwide. Also incidence of PIM reported could be less than real incidence because we use the 2015 update of Beers Criteria, which contains PIMs’ recommendation as “use with caution” only in specific conditions whereas hospitals in North Cyprus lack proper documentation and daily progress note writing. Another limitation is not assessing providers’ knowledge and awareness of the latest BC, which is significantly different than Beers 2012; also currently a new version Beers 2018 is released, necessitating to be adapted and to create awareness within prescribers and other health care professionals to limit the incidence of PIMs.

**Conclusion**

By evaluating the current patterns of drug use in elderly patients in light of the updated Beers Criteria 2015, a high prevalence of PIMs was observed, significantly more in inpatients than on discharge. Polypharmacy was observed in almost 80% of patients, whereas 76.6% of patients were at least on one PIM during hospitalization. The high prevalence of PIMs in elderly patients reported by this study necessitates a nationwide assessment and responsible bodies to act to reduce and adopt strategies that may reduce or overcome such high prevalence.

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**Conflicts of interest**

There are no conflicts of interest.

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