RESEARCH

Assessment of potentially inappropriate medications among long-stay older adult patients with serious mental illnesses: findings from a low-resource setting

Ghinwa Abilmona[1], Feten Fekih-Romdhane[2,3†] and Souheil Hallit[4,5*†]

Abstract

Background Potentially inappropriate medications (PIMs) are defined as drugs whose adverse effects outweigh the benefits or when more efficacious alternatives are present. This study aims to assess the overall prevalence of PIMs according to Beers 2019 and 2023 among older adult patients with serious mental illnesses (such as schizophrenia), and factors associated with PIMs while examining the difference between the two versions.

Method This cross-sectional study included chronic patients aged 65 years and above, hospitalized at the Psychiatric Hospital of the Cross (Lebanon), and taking at least one medication daily. Sociodemographic characteristics, medications, and clinical information were obtained from patients' medical records. SPSS version 26 was used for data analysis. Descriptive statistics were used to describe independent variables, while bivariate analysis was used to assess associations between PIM use and different factors. A two-tailed p value < 0.05 was considered statistically significant.

Results Ninety-seven patients were included with a mean age of 71.21 (± 4.63) years. 52.6% were female. 44.3% were on polypharmacy (5–9 medications). 97.9% had at least one PIM according to both versions with the majority being anticholinergics (84.5%). Polypharmacy was significantly correlated to PIM use. Hospital stay length and the presence of comorbid neurological disorders were negatively associated with PIM use.

Conclusion PIMs were extremely prevalent among hospitalized psychiatric older adult patients. Raising awareness among physicians on the Beers criteria or making them mandatory could help diminish PIM use among this vulnerable population.

Keywords Polypharmacy, Potentially inappropriate medications (PIMs), Older adults, Psychiatric disorders, Beers criteria

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Introduction

Mental health has emerged as an exceedingly prominent subject in our present day. Serious mental illnesses (SMIs) refer to long-term mental disorders that substantially interfere with or limit major life activities and lead to serious functional impairment [1]. According to the World Health Organization, one individual in six will be aged 60 years or over by 2030 worldwide [2]. An estimated 14% of this age range group currently live with a mental disorder [2]. The 2019 Global Health Estimates reported that mental illness accounts for 10.6% of the total disability (in disability-adjusted life years, DALYs) among older adults [3]. In the USA, the proportion of older adults with SMI has risen to reach 3.4 million (an estimated 2.9% of the US population) [4]. In Lebanon, older adults portray 9.7% of the population and have an estimated prevalence of mental disorders of 23.2% [5, 6].

As a person ages, they are more likely to experience polypharmacy. Polypharmacy is the daily use of five or more medications [7, 8], and hyperpolypharmacy refers to taking of 10 or more medications [9, 10]. They often result from multi-morbidity that is common with older age [9–11]. The concomitant use of medications predisposes the patient to adverse drug reactions (ADRs) that reflect 6.5% of hospital admissions, 70% of which could have been avoided [12]. Polypharmacy has been found to be a predictor for potentially inappropriate medication (PIMs) use [13, 14]. PIMs can be defined as medications having their adverse effects outweigh the benefits and if safer and more efficacious alternatives are present [15]. Patients suffering from psychiatric disorders were shown to be more exposed to PIMs [16]. Patients with PIMs tend to report more adverse drug events (ADEs), increased hospital admissions, increased health-related costs, economic burden, as well as impaired quality of life [17–20]. Additionally, PIMs can decrease a patient's satisfaction with their treatment [21] that may already be compromised among patients with psychiatric disorders such as schizophrenics with depression [22]. Pharmacodynamics, pharmacokinetics, and body composition and physiology become altered with older age [23, 24], making it more challenging for physicians to prescribe medications.

The American Geriatrics Society (AGS) Beers criteria are guidelines targeting practicing clinicians used to assess PIMs in older adults (defined as aged 65 years and above [25]) and are applicable in all settings except palliative and hospice care [26]. The AGS issued the most recent update of the criteria in this current year 2023 [26], with some modifications made since the last version of 2019. These modifications entailed the removal of certain medications that were no longer on the US market, changes in wording, recommendation and rationale statement of some criteria for optimal clarity, the incorporation of new criteria, and the shifting of criteria to different tables (such as moving aspirin from Table 4 of the Beers 2019 (drugs to be used with caution) to Table 2 of the Beers 2023 (PIMs to be avoided)). One of the main targets of these criteria is to decrease the exposure to PIMs among older adult patients [26, 27].

Several studies in different countries were conducted to assess the prevalence of PIMs by using different tools. The prevalence varied worldwide from 25 to 95% [28–30] depending on the study settings, participants' profile and different tools that assessed PIMs. Research has shown that 40% of clinicians and clinical pharmacists are knowledgeable of the Beers criteria, whereas only 7.3% report actually using such guidelines to prescribe medications [31]. Therefore, more light should be shed on the importance of educating physicians on these guidelines and on making sure that they adhere to them while prescribing. This may ensure safer prescribing for the aging population.

Studies carried out on this topic in the Middle East, and low-resource settings more particularly, are scarce [32] pointing to a need to execute further ones. There are no studies done using the 2023 version of the criteria in Lebanon or any other country yet. Therefore, the primary aim of this study was twofold: (1) to assess PIMs using the Beers 2023 and Beers 2019 among older adult patients with SMIs; (2) to compare the results obtained from the two versions.

Methods

Study design

A cross-sectional study was found a fit design for our study. This single-centered study was carried out from September to October 2023 at the Psychiatric Hospital of the Cross (Lebanon). Recruited participants had to meet the eligibility criteria of our target population that included patients aged 65 years and above; diagnosed with a serious mental illness (such as schizophrenia, schizoaffective disorder, bipolar disorder [33]); and taking prescribed medication on a daily basis. On the other hand, patients were excluded if they did not meet our inclusion criteria, if they were no longer hospitalized, or decided to quit the study. The sample size included all inpatients who fit in our inclusion criteria; hence, a priori sample size calculation was not needed. The study protocol was approved by the hospital's institutional review board (IRB) and was in compliance with the Declaration of Helsinki. The collection and analysis of the data adhered to and respected the privacy and data protection. A digital consent was taken from patients who agreed on participating in this study.

Data collection

The patients' medical records (hard copies) were accessed by one of the study's researchers to collect data (sociodemographic characteristics and clinical information) and integrate them into a digital data collection sheet.

Sociodemographic characteristics

They ranged from age, gender, marital status, and educational level and were extracted from each patient's medical record.

Clinical information

Data on somatic comorbidities (neurological disorders, hypertension, diabetes, cardiovascular disease (CVD), COPD/asthma, dyslipidemia, kidney problems, or other) were collected to assess whether they are associated with PIM use in this study. Alongside the patients' history of falls and fractures, and whether they have dementia, delirium, or cognitive impairment (like mental retardation) that are found in Table 3 of the Beers 2019 and 2023 (medications potentially inappropriate in patients with certain diseases or syndromes) under the title "central nervous system," to allow a more thorough assessment of PIMs. In addition to their primary psychiatric diagnosis, their prescribed medications: generic and brand name, dose frequency, route of administration, and date of initiation to assess the PIMs according to the Beers criteria, weight and height used to calculate the body mass index. Patients' medications like psychotropics were supervised by a psychiatrist, while other medication classes were handled by a family physician. A clinical pharmacist was included in this study to help and contribute expertise in the identification of PIMs based on the Beers criteria.

The AGS Beers criteria versions 2019 and 2023

Following a thorough examination of the list of the patients' daily prescribed medications and collected data, the PIMs were determined, with the help of a clinical pharmacist, according to the AGS Beers criteria versions 2019 and 2023 in the means of detecting whether a discernible disparity will be noticed in the results obtained from each version of the Beers. Each medication in the list was assessed and identified as a PIM if it fell under one or more of the 5 AGS Beers criteria tables as follows [26, 27]: medications considered as potentially inappropriate (Table 2) that are independent of diagnosis; medications potentially inappropriate in patients with certain diseases or syndromes (Table 3); medications to be used with caution (Table 4); potentially inappropriate drug-drug interactions; and medications whose dosages should be adjusted based on renal function [26, 27]. These five categories of the Beers criteria include medications that

should be avoided in older adults based on a rationale and recommendation from the panel. The strength of recommendation depends on the quality of evidence, frequency, and severity of potential adverse events in relation to potential benefits, and clinical judgement [26]. The PIM use was the dependent variable. Furthermore, we considered polypharmacy to be the concomitant use of 5 or more drugs [7] and divided the patients into 3 categories accordingly: 1–4 (no polypharmacy), 5–9 (polypharmacy), and ≥ 10 (hyperpolypharmacy) [34].

Statistical analysis

IBM® SPSS® Statistics software version 26 was used for all data analyses. Descriptive statistics were used to describe the sociodemographic characteristics and clinical information of the older adult inpatients with psychiatric disorders. Continuous variables were displayed using mean (M) and standard deviations (SD), while categorical variables were presented using numbers and percentages. For the association of PIMs with the sample's characteristics, Student's t-test was used for continuous variables and χ^2 test or Fisher's exact test for categorical variables. $p < 0.05$ was considered significant.

Results

Ninety-seven older adult patients with psychiatric disorders met our inclusion criteria after having excluded 319 patients for being less than 65 years old and 17 for refusing to participate. Table 1 summarizes the sociodemographic and clinical information of the study's sample. The mean age was 71.21 (± 4.63) years, and 52.6% of the patients were female. The mean hospital stay length was 19.87 (± 13.57) years, and 44.3% of the patients were on polypharmacy (5–9 medications). Around half of the patients (49.5%) were prescribed at least five medications concomitantly. The most prevalent mental disorder was schizophrenia (75.3%), and the most common somatic comorbidities were hypertension (27.8%) and dyslipidemia (25.8%).

Table 2 shows that 95 patients were found to have at least 1 PIM according to both versions of the Beers criteria, portraying a 97.9% prevalence. In the present study, no patients encountered any kidney problems rendering 0% of prescribed PIMs related to kidney function. The predominant PIM category was PIMs avoided[1] (92.8%) according to Beers 2019 and 2023. PIM caution[2] also recorded a 92.8% according to Beers 2019, but a slightly lower prevalence of 91.8% was recorded in Beers 2023.

The identified PIMs in the above PIM categories were equal in both versions of the Beers (2019 and 2023).

The new update moved aspirin from Table 4 of the Beers 2019 for drugs to be used with caution to Table 2

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Table 1 Sociodemographic and clinical characteristics of the older adult inpatients with psychiatric disorders

Characteristic	*N* (%)	Number of patients with PIMs	
		2019 Beers criteria	2023 Beers criteria
Gender			
Males	46 (47.4%)	45 (97.8%)	45 (97.8%)
Females	51 (52.6%)	50 (98.0%)	50 (98.0%)
Age (years)	71.21 ± 4.63	71.17 ± 4.67	71.17 ± 4.67
Body mass index (kg/m^2)	23.20 ± 3.84	23.09 ± 3.81	23.09 ± 3.81
Education			
Illiterate/primary	29 (31.5%)	27 (93.1%)	27 (93.1%)
Complementary	25 (27.2%)	25 (100%)	25 (100%)
Secondary	23 (25.0%)	23 (100%)	23 (100%)
University	15 (16.3%)	15 (100%)	15 (100%)
Length of stay (years)	19.87 ± 13.57	19.40 ± 13.32	19.40 ± 13.32
Marital status			
Single/divorced/widowed	93 (95.9%)	91 (97.8%)	91 (97.8%)
Married	4 (4.1%)	4 (100%)	4 (100%)
Diagnosis			
Schizophrenia	73 (75.3%)	71 (97.3%)	71 (97.3%)
Other [b]	24 (24.7%)	24 (100%)	24 (100%)
Number of prescribed medications			
1–4	49 (50.5%)	47 (95.9%)	47 (95.9%)
5–9	43 (44.3%)	43 (100%)	43 (100%)
≥ 10	5 (5.2%)	5 (100%)	5 (100%)
Somatic comorbidities			
Diabetes	9 (9.3%)	9 (100%)	9 (100%)
Cardiovascular disease	9 (9.3%)	9 (100%)	9 (100%)
Hypertension	27 (27.8%)	26 (96.3%)	26 (96.3%)
Dyslipidemia	25 (25.8%)	24 (96.0%)	24 (96.0%)
Kidney problems	0 (0%)	0 (0%)	0 (0%)
Neurological disorders	2 (2.1%)	1 (50.0%)	1 (50.0%)
COPD/asthma	11 (11.3%)	11 (100.0%)	11 (100.0%)
Other comorbidities[a]	14 (14.4%)	14 (100.0%)	14 (100.0%)

[a] Thyroid disease, benign prostatic hyperplasia

[b] Major depression disorder, bipolar disorder, schizoaffective disorder, alcoholism, personality pathology, NOS (not otherwise specified)

of the Beers 2023 for medications that are potentially inappropriate for most older adults. So, a 14.4% of aspirin prescribed as a PIM to be avoided was only recorded in Beers 2023 PIMs avoided[1] category and a 10.3% of aspirin prescribed as a PIM to be used with caution among elderly aged 70 years and above was only recorded in Beers 2019 PIMs caution[2] category (Table 3).

Of the overall PIMs, according to Beers 2019 and 2023, Anticholinergics comprised the highest proportion (84.5%), primarily trihexyphenidyl (73.2%). Benzodiazepines constituted 22.7% of the overall PIMs (Beers 2019 and 2023) with a predominance of clonazepam (10.3%). Furthermore, proton-pump inhibitors (PPIs) constituted a 20.6% of overall PIMs according to both versions of the

Beers, mainly omeprazole (11.3%). Lastly, antipsychotics constituted the least of overall PIMs (13.4%) according to both versions, mainly haloperidol (10.3%).

Bivariate analysis

A higher percentage of patients with PIMs was significantly found in those without neurological disorders (epilepsy/head injury or trauma [35]) compared to not. Furthermore, a lower mean length of hospital stay was found in patients who had PIMs vs not (Table 4).

Length of hospital stay was significantly associated with less total PIMs in 2019 ($r = 0.03$; $p < 0.001$) and in 2023 ($r = .03$; $p < 0.001$). A higher total number of medications was significantly associated with more total PIMs in 2019

Table 2 Description of older adult inpatients with psychiatric disorders according to their potentially inappropriate medications prescribed

	PIMs identified using Beers list 2019, n (%)	PIMs identified using Beers list 2023, n (%)
PIMs total dichotomous		
0	2 (2.1%)	2 (2.1%)
≥1	95 (97.9%)	95 (97.9%)
PIMs avoided[1]	90 (92.8%)	90 (92.8%)
PIMs caution[2]	90 (92.8%)	89 (91.8%)
PIMs drug-drug[3]	61 (62.9%)	61 (62.9%)
PIMs drug-disease[4]	48 (49.5%)	48 (49.5%)
PIMs kidney[5]	0 (0%)	0 (0%)
PIMs total[6]	95 (97.9%)	95 (97.9%)

[1] Medications that are potentially inappropriate in most older adults

[2] Drugs to use with caution

[3] Drug-drug interactions

[4] Those that should typically be avoided in older adults with certain conditions

[5] Drug dose adjustment based on kidney function

[6] Summation of the above PIM categories

($r = 0.47$; $p < 0.001$) and in 2023 ($r = 0.48$; $p < 0.001$). Furthermore, older age was not significantly associated with total PIMs in 2019 ($r = -.09$; $p = 0.388$) and total PIMs in 2023 ($r = -0.09$; $p = 0.363$); same for BMI ($r = -0.16$; $p = 0.121$ and $r = -0.17$; $p = 0.112$), respectively.

Discussion

To our best knowledge, this study is the first to assess PIMs and evaluate their prevalence using the most updated version of the AGS Beers criteria 2023 among older adult patients with SMIs and compare it to the previous list of 2019.

In the present study, according to both versions of the Beers criteria, the overall prevalence of PIMs among chronic older adult inpatients with SMIs was 97.9%. This prevalence estimate is similar to those reported in a previous study conducted among psychiatric inpatients in Lebanon (90.5%) [36] and India (91.2%) [37] using the Beers 2019 criteria. However, the prevalence of PIMs found in the present sample was much higher than the range of 20.6 to 82.6% found in other studies assessing PIMs by using the Beers criteria [38–42]. The differences observed can be explained by the fact that the former Lebanese study [36] and ours assessed all PIM categories from all medications with no exception, instead of only assessing specific PIM categories in the other previous studies. Another recent study reported a lower overall prevalence of PIMs than ours, 60.1% and 61.9%

Table 3 The most prescribed drugs as PIMs according to the Beers 2019 and 2023 among older adult inpatients with psychiatric disorders

	Drugs	As per Beers 2019 (%)	As per Beers 2023 (%)
PIMS avoided[1]	Trihexyphenidyl	73.2%	73.2%
	Promethazine	32%	32%
	Omeprazole	11.3%	11.3%
	Aspirin	0%	14.4%
PIMs caution[2]	Haloperidol	64.9%	64.9%
	Chlorpromazine	23.7%	23.7%
	Olanzapine	14.4%	14.4%
	Aspirin	10.3%	0%
PIMs DDI[3] (≥ 2 anticholinergics)	Trihexyphenidyl-chlorpromazine	11.3%	11.3%
	Trihexyphenidyl-promethazine	11.3%	11.3%
PIMs drug-disease[4]			
Dementia	Trihexyphenidyl	6.2%	6.2%
	Haloperidol	6.2%	6.2%
Delirium	Trihexyphenidyl	23.7%	23.7%
	haloperidol	19.6%	19.6%
History of falls and fractures	Trihexyphenidyl	7.2%	7.2%
	Haloperidol	11.3%	11.3%

[1] Medications that are potentially inappropriate in most older adults

[2] Drugs to use with caution

[3] Drug-drug interactions

[4] Those that should typically be avoided in older adults with certain conditions

Table 4 Bivariate analysis of factors associated with total PIMs according to the Beer's list 2019 and 2023

	Total PIMs according to the Beers list 2019			Total PIMs according to the Beers list 2023		
	Absence of PIMs	Presence of PIMs	*p*	Absence of PIMs	Presence of PIMs	*p*
Gender			0.941			0.941
Male	1 (2.2%)	45 (97.8%)		1 (2.2%)	45 (97.8%)	
Female	1 (2.0%)	50 (98.0%)		1 (2.0%)	50 (98.0%)	
Neurological disorders			**0.041**			**0.041**
No	1 (1.1%)	94 (98.9%)		1 (1.1%)	94 (98.9%)	
Yes	1 (50.0%)	1 (50.0%)		1 (50.0%)	1 (50.0%)	
Age	73.0 ± 1.4	71.2 ± 4.7	0.583	73.0 ± 1.4	71.2 ± 4.7	0.583
BMI	27.9 ± 3.0	23.1 ± 3.8	0.079	27.9 ± 3.0	23.1 ± 3.8	0.079
Length of hospital stay	42.0 ± 1.4	19.4 ± 13.3	**< 0.001**	42.0 ± 1.4	19.4 ± 13.3	**< 0.001**

Numbers in bold indicate significant *p* values

using Beers 2015 and Beers 2019, respectively [43]; however, this prevalence was among older adult inpatients in general and not those having psychiatric disorders specifically.

In the current study, the predominant PIM category was PIMs to be avoided in older adults with an equal prevalence of 92.8% in both versions of the Beers. This was consistent with Sharma et al.'s [43] study in older adult inpatients, which recorded a PIMs to be avoided prevalence of 82.3% and 83% based on Beers 2015 and Beers 2019, respectively. Nevertheless, a rather lower prevalence (19.5%) was reported in the study using Beers 2019 among older adult inpatients with psychiatric disorders in Lebanon [36], yet it was one of their major categories that recorded PIMs. Additionally, and similar to our results (Table 2 of the Beers 2019 and 2023), the latter study found that anticholinergics were the most occurring PIMs in the PIMs to be avoided category [36]. This high prevalence of PIMs indicates a failure in abiding by these guidelines. This is in line with previous literature indicating that the estimated number of medication errors occurring during patient management in the Arab region is unusually high [44] that Arab clinicians have a low tendency to prescribe atypical antipsychotics as first-line treatment because of their high cost, are more likely to add anticholinergics from the start with antipsychotics, and to maintain prescribing of anticholinergics for as long as patients were receiving antipsychotics [45]. These assumptions are also supported by previous findings among Lebanese patients showing that first-generation antipsychotics and anticholinergics were prescribed in 76.7% and 70.8% of cases, subsequently recommending that pharmacological treatment plan should avoid the add-on of anticholinergics [46].

A total of 49.5% of our patients were prescribed at least five medications. In conformity with other studies [32, 37], the concomitant use of five or more medications was found to be an independent risk factor for PIM use that enhances the chances of drug-drug interactions [36, 47, 48] which can lead to ADE that is likely to result in prescribing cascades [49]. Meanwhile, in controversy to most studies [43, 50–52], the length of hospital stay was negatively associated with PIM use where a lower mean length of hospital stay was found in patients with a higher PIM use. This suggests the possibility that a longer hospital stay results in a more stable psychiatric condition, leading to the deprescribing of some of the prescribed medications. Additionally, chronic patients tend to have their medication regimen assessed on a regular basis by their physician who becomes more aware of what medications best suit these patients. Similarly, neurological disorders (epilepsy/head injury) were also found to have a negative association with PIM use. Patients with neurological disorders, mainly, tend to be prescribed medications like antiepileptics. A study [53] showed that 45% of the patients taking antiepileptics presented DDI with CNS active drugs. So, patients taking antiepileptics may be prescribed less medications to avoid any unpleasant medication-related inconveniences; this might decrease the likelihood of PIMs There were variations among studies regarding the medication classes comprising the highest proportion of PIMs, likely stemming from differences in settings, profile of the older adults and using different versions of the criteria [36, 39, 43]. In the current study, anticholinergics comprised the highest proportion (84.5%) of total PIMs (primarily trihexyphenidyl) according to both versions of Beers, which was higher than the 16% recorded in the recent Lebanese study using Beers 2019 on inpatients with psychiatric disorder [36]. This can be explained by the fact that the major antipsychotic prescribed in our study was haloperidol. It is known to

be the most commonly associated with extrapyramidal syndrome (EPS), justifying the high proportion of anticholinergics prescriptions, specifically trihexyphenidyl (73.2%) [54]. Owing to the persistent decline in the economic circumstances in Lebanon, over 80% of the population was led into poverty [55]. So, the predominance of haloperidol in our sample may be attributable to its low and affordable price compared to second-generation antipsychotics (SGAs). In addition, mental health care in Lebanon, as in many other Arab countries, is still based on an authoritative approach characterized by limited information sharing, participation and involvement of patients in decision-making. The AGS panel of experts advocates for health plans to ensure affordable safer alternatives to PIMs so that a safe and appropriate treatment is easily accessed by patients [26].

Benzodiazepines, according to both versions of the Beers, were the second most prescribed PIMs (22.7%), mainly clonazepam (10.3%). Similar to our study, it was stated as the second most prescribed PIM among hospitalized older adult patients according to Beers 2015 (29.8%) in a study [10]. In contrast, benzodiazepines prescribed as PIMs in our study were around two times more than in Yaghi and Chahine's study (10%) [36]. Older adults have increased sensitivity to benzodiazepines and the continued use of it can cause clinical dependence in addition to increasing the risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes [26]. PPIs comprised the third most prescribed class as PIMs (20.6%) in our study according to Beers 2019 and 2023, mainly omeprazole (11.3%) which was similar to a study that had omeprazole as the most prescribed PPI and recorded 13.8% and 14.6% respectively according to Beers 2019 [36]. Most of the PPI prescriptions in this study were given for gastrointestinal protection from the long-term use of multiple medications. In Sharma et. al's study done on hospitalized older adults, PPI recorded the highest percentage (51.3%) of PIMs according to both Beers 2015 and 2019 [43]. PPI use has been linked to the risk of Clostridium difficile infections and enhanced likelihood of bone loss and fractures [56–58]. So, older adult patients are predisposed to the risks of PPIs when prescribed for more than 8 weeks as recommended by the AGS panel [26]. Lastly, antipsychotics constituted the least of PIMs (13.4%), primarily haloperidol (10.3%) according to both versions of Beers. A study done on psychotropic medications in France using Beers 2003 reported a similar proportion of antipsychotics prescribed as PIMs (18.6%) [13]. However, a higher prevalence of 40.2% of antipsychotics prescribed as PIMs was reported in another study [36]. The latter study [36] reported a high number (81.6%) of older adults having cognitive impairment. The Beers criteria recommends avoiding prescribing antipsychotics for older adults with cognitive impairment; explaining the higher number of antipsychotics prescribed as PIMs in their study [36].

In the current study, there was no difference between the two versions of the Beers criteria except at the level of PIMs to be avoided and drugs to be used with caution. This might be due to aspirin that was moved from drugs to be used with caution in Table 4 of the Beers 2019 to those to be avoided in Table 2 of the Beers 2023 because it significantly increases the risk of bleeding in older patients [26]. However, this difference did not affect the prevalence of PIMs to be avoided between the versions, while there was only a 1% difference between the drugs to be used with caution category where the prevalence was 92.8% and 91.8% according to Beers 2019 and 2023, respectively. In our case, the new update of the Beers does not quite affect the pharmacotherapy of the patients; given that the only difference is slight and at the level of Aspirin. However, the AGS panel recommends avoiding aspirin for primary prevention of CVD and considering deprescribing in older adults already taking aspirin for primary prevention of CVD in Beers 2023 [26]; which should be taken into consideration when prescribing.

Clinical implications

The remarkably high prevalence of PIMs among psychiatric older adult inpatients within this study, as identified by Beers 2019 and 2023, indicates inadequate adherence to the Beers criteria in the context of geriatric healthcare. The results of the present study may allow physicians to grasp the graveness of the expanding PIMs use. Knowing what medication classes constitute the highest PIM proportions, geriatricians can work on ensuring an optimal treatment plan that decreases the probability of adverse drug events usually caused by PIMs, hence declining the cost of hospitalizations due to ADE or medication-related inconveniences. The high number of anticholinergics prescribed for EPS in this study indicates a need for physicians to consider prescribing antipsychotics that exhibit lower EPS side effects. In some cases, physicians tend to have no other option than prescribing a medication considered a PIM, but this issue can be handled by the close monitoring of the patient to prevent and avoid any adverse drug event.

However, abiding by these criteria in Lebanon may not always be feasible or possible. The ongoing economic crisis since 2019 has led to severe inflation causing a drastic increase in medication prices and shortages in most drug classes [55]. Physicians sometimes prescribe a medication despite them knowing that other options exhibit lower ADRs. However, unfortunately, most of the patients can only afford cheaper medications in these

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sorrowful circumstances. The geriatric health may still be compromised as long as this crisis lasts.

Study limitations

This study is the first to assess PIMs based on Beers 2023 and compare the differences to Beers 2019; however, it is bound to some limitations. It is a cross-sectional study, so a causative or temporal relationship cannot be drawn. Moreover, it is single-centered with a small sample size rendering it not very representative and predisposing us to a selection bias. The results of the study assessed PIMs among hospitalized chronic inpatients; therefore, results cannot be generalized to older adults from the community. Finally, Beers criteria did not assess the over/under-use of prescribed drugs.

Conclusion

No discernible disparities have been noticed in the results obtained from Beers 2019 and 2023 in this study, except at the level of aspirin. A high prevalence of PIMs suggests the essential requirement to raise awareness among physicians and clinical pharmacists about the significance of guidelines like the Beers criteria. Perhaps, make it mandatory to abide by the Beers to ensure that a vulnerable population like older adults enduring a psychiatric disorder maintain optimal physical and mental health. These findings will hopefully grant physicians, especially those in Lebanon, a perspective on the prevalence and widespread of PIMs among such a vulnerable population. Considering the economic crisis in Lebanon, physicians will not always be able to abide by such guidelines. This is a serious challenge facing the healthcare professionals in Lebanon as they do their utmost to improve the geriatric healthcare. Finally, further studies on this issue may allow keeping track on whether any change is being made to diminish the prevalence of PIMs among the older population, and whether the geriatric healthcare system is making use of the results and suggestions that the ongoing research is providing.

Abbreviations
PIMs Potentially inappropriate medications
AGS American Geriatrics Society
ADE Adverse drug event
PPI Proton pump inhibitor
EPS Extrapyramidal syndrome
CVD Cardiovascular disease

Declarations

Ethics approval and consent to participate
The Ethics and Research Committee of the Psychiatric Hospital of the Cross approved this study protocol. Submitting the form online was considered equivalent to obtaining a written informed consent. All methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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