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Potentially inappropriate prescribing including under-use amongst older patients with cognitive or psychiatric co-morbidities

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Abstract

Objective: the study aimed to determine the prevalence of and risk factors for inappropriate prescribing (IP) and prescribing omission (PO) in elderly with mental co-morbidities.

Participants: one hundred fifty consecutive inpatients with mental co-morbidities hospitalised for acute medical illness (mean age 80 ± 9, 70% of women) were considered for the study.
Measurements: IP and PO were prospectively indentified according to STOPP/START criteria at hospital admission.
Results: over 95% were taking ≥1 medication (median = 7) which amounted to 1,137 prescriptions. The prevalence of IP was 77% and PO was 65%. The most frequent encountered IP concerned drugs adversely affecting fallers (25%) and anti-aggregants therapy without atherosclerosis (14%). PO concerned antidepressants with moderate/severe depression (20%) and calcium-vitamin D supplementation (18%). Independent predictors for IP were increased number of concomitant drugs (odds ratio [OR] 1.54, 95% confidence interval [CI] 1.13–1.89), being cognitively impaired (OR 1.83, 95% CI 1.55–2.24), and having fallen in the preceding 3 months (OR 2.03, 95% CI 1.52–2.61) or hospitalised in the preceding year (OR 1.09, 95% CI 1.02–1.23). Concerning PO, psychiatric disorder (OR 1.64, 95% CI 1.42–2.01) and increase level of co-morbidities (OR 1.79, 95% CI 1.48–1.99) were identified. Living in an institutional setting was a predictive maker for both IP (OR 1.45, 95% CI 1.27–1.74) and PO (OR 1.67, 95% CI 1.32–1.91).
Conclusion: IP and PO were highly prevalent raising the need of a greater health literacy concerning geriatric conditions in non-geriatrician practitioners who care elderly as well as in the community, in hospital and institutional settings for improving quality and safety in prescribing medication.

Keywords: *inappropriate prescription, omission of prescription, STOPP START, health literacy, older adults*

Introduction

In the current increasingly fragmented health care systems, older patients suffering from different chronic conditions consume a large range of medicines. Given by one or several providers applying evidence-based medicine (EBM) without coordination, it leads to potential adverse drug events (ADE) [1]. Within this context, special attention must be given to potentially inappropriate medication (PIM). A prescribing medication is potentially inappropriate if the risk of ADE outweighs the clinical benefit, particularly when a safer or more effective alternative therapy is available for the same condition. The use of a medication that is known to induce harmful effects through drug–drug or drug–disease interactions is also inappropriate, as is the prescription of a medication at a too high dose or for excessive duration [2]. Drug-related errors are the most common type of medical error, occurring at the time of prescribing through to the monitoring of patients' responses. The percentage of hospital admissions due to ADE varies from around 4% in young people to 16% and more among older persons whose drug vulnerability is linked to changes in pharmacokinetics and pharmacodynamics and by impairments in health status [3, 4]. ADE rank between the fourth and the sixth cause of death in hospitalised patients, concerning mainly patients in long-term care or institutional settings. Therefore, ADE represents a clinical and economic burden to patients and society, and in elderly people PIM has therefore become an important public health issue worldwide [1].

Another and frequently understated aspect of potentially inappropriate prescribing (IP) in older people is the omission of indicated medications with proven efficacy in patients with a significant life expectancy [5, 6]. Among the numerous factors influencing the appropriateness of prescribing, people with cognitive and psychiatric disorders are often described as the higher risk population [1, 3, 5, 7–9]. A recent prospective multicentre study of 1,176 hospitalised patients aged over 75 years (510 with depression and 543 with dementia) showed that half of the studied population was treated with psychotropics; a multivariate analysis proved that the prescription of psychotropics was significantly linked to dementia (odds ratio [OR] 1.4, 95% confidence interval [CI] 1.1–1.9) and to depression syndrome (OR 1.7, 95% CI 1.3–2.1) [9]. Conversely and interestingly, Chan *et al.* have observed in a university hospital-based geronto-psychiatry that between admission and discharge, reducing the mean number of inappropriate prescription according to the revised Beers' criteria, in demented inpatient, was significantly correlated with the improvement in functional performance [8].

Whether the literature is abundant concerning PIM among the elderly with cognitive and/or psychiatric disorders, it mainly focuses on psychotropic drugs [7–9]. Currently, at our knowledge, very few studies concern PIMs of other medications than psychotropic drugs in this population. Above all, very rare are studies having focused the prescribing omission (PO). This lack could be easily explained by the lack of appropriate assessment tool. While explicit and implicit criteria for IP in older people have been developed (the most commonly cited being Beers' criteria [10–12], the Improved Prescribing in the Elderly Tool [13], the Medication Appropriateness Index [14] and the Assessing Care of Vulnerable Elders—ACOVE [15]),

(i) the suitability of these criteria for day-to-day clinical use is uncertain,
(ii) many of composing criteria are controversial (up to 50% of the proscribed drugs in the Beers' criteria are not listed in European formularies) and
(iii) the criteria do not explicitly refer to specific drugs that are problematic in older people nor do they capture problems of under-use of beneficial medicines [16].

Thus, the recently developed and validated set of explicit criteria for PIM use in older adults called Screening Tool of Older Persons' Prescriptions (STOPP)/Screening Tool to Alert doctors to Right Treatment (START) gives us the opportunity for exploring and analysing more fully PIMs including PO [2, 5]. It is a reliable and comprehensive screening tool that enables prescribing physician to appraise an older patient's prescription drugs in the context of his/her concurrent diagnoses [17]. Therefore, the main objectives of the present study were, in a population of old patients with cognitive and/or psychiatric co-morbidities hospitalised for acute medical conditions to geriatric medicine units, to (i) prospectively determine the prevalence of and risk factors for potentially IP according to STOPP criteria and (ii) to determine the prevalence of and risk factors for potentially PO according to START criteria in the same population.

Materials and methods

Study population

Data were prospectively collected from consecutive acutely ill older patients admitted for any acute somatic condition within a year period (1 January to 31 December 2008) to two specialised units of the Department of Rehabilitation and Geriatrics of Geneva University hospitals (Switzerland). These units are dedicated to old patients known to present either behavioural or psychological symptoms related to dementia (18 acute geriatric beds, i.e. Unit A) or any co-morbid psychiatric disorders, mainly depression (eight acute geriatric beds, i.e. Unit B). All patients were admitted from the community directly or via the emergency ward. Patients who were transferred from other medical or surgical wards for comprehensive geriatric assessment or rehabilitation were not considered. The study protocol has been approved by the local research committee.

IP assessment

For identifying IP, the French adaptation of STOPP/START criteria was performed at the patient's admission by two trained physicians (P.O.L. and Y.H.) [2]. STOPP/START criteria are arranged according to the relevant physiological systems for ease of use by clinicians (cardiovascular system, central nervous system and psychotropic drugs, gastrointestinal system, respiratory system, musculoskeletal system, urogenital system and endocrine system). The content validity of STOPP/START has been established using a Delphi consensus technique in accordance with the EBM [5]. In addition, STOPP includes specific criteria pertaining to analgesic drugs, drugs that adversely affect older people who fall, and duplicate drug class prescriptions. STOPP comprises 65 indicators for potentially IP including drug–drug and drug–disease interactions. Each STOPP criterion is accompanied by a concise explanation as to why the prescribing practice may be inappropriate in an older person. START assesses the under-use of medicines for several common conditions simultaneously and incorporates 22 evidence-based indicators for PO in older people (when no contraindication to prescription exists).

Complementary data collection

At the time of admission, demographic information (patient's age, gender, living condition), number of prescribed medications, specific diagnoses and cumulative morbidity, functional status, number of falls in the preceding 3 months and number of hospital admissions in the preceding year were recorded by senior residents in Geriatric Medicine. Moreover, patients' functional abilities were assessed using Katz's activities of daily living (ADL) scale [18]. Only five of the six ADL in the Katz scale were taken into consideration (continence was not included in accordance with the classical literature recommendations) [19, 20]. A disabled patient was defined as functionally dependent for at least one item. The number of co-morbidity for each patient has been measured using the cumulative co-morbidity Charlson index (CCI) applicable to pathologies coded in ICD-10 [21]. For patients with dementia, both aetiology and severity according to the Clinical Dementia Rating scale were determined [22].

Statistical analysis

Statistical analysis was performed using the SAS, version 9.1 (SAS Institute, Inc., Cary, NC). Descriptive results pertaining to numerical variables are presented in the form of mean, standard deviation (SD) and median. For medication prescriptions (total and potentially inappropriate prescriptions), the interquartile range (IQR) is also presented. For categorical variables, sample sizes and percentages are presented. Patient characteristics were compared with respect to whether their medication prescriptions were potentially inappropriate or not according to STOPP/START criteria. The tests used were chosen according to the type of variables and the sample size under consideration. Categorical outcomes were tested using chi-square (χ^2) or Fisher's exact tests; Student's *t*-test or Mann and Whitney's *U*-test were used for numerical outcomes. The single factor analysis results identified the variables associated with PIM use. The selection threshold for the useful variables in multivariable analysis was set at $P = 0.20$. All the variables thus selected were introduced into a logistic regression model. The effects of the other variables were systematically adjusted for age and gender. This multifactorial analysis was computed using a backward elimination procedure (exit threshold $P = 0.10$) with authorised re-entry. The results of these analyses were presented as OR and their 95% CI. The level of significance was set at $P = 0.05$.

Results

The main characteristics of the study population are presented in Table 1. Of the 150 patients considered, 70% were women. The mean age was 80.0 ± 9.1 years. One third of the population lived in an institutional setting prior to their hospital admission. Most prevalent co-morbidities in the population studied were vascular diseases (cerebrovascular disease 31%, ischaemic heart disease 10%); diabetes mellitus (14%); chronic pulmonary disease (13%); chronic

Table 1. Characteristics of the study population and description of prescription drugs and potentially inappropriate medications (PIM) according to STOPP/START criteria

Patients' characteristics	Total *n* = 150	Unit A *n* = 83	Unit B *n* = 67
Age (years)			
mean ± SD	80.0 ± 8.1	80.8 ± 6.6	76.2 ± 7.6
median	81	83	76
Female % (*n*)	69.3 (104)	57.8 (48)	83.6 (56)
Living in institution % (*n*)	32.0 (48)	33.7 (28)	29.9 (20)
Disabled for at least one ADL	68.7 (103)	85.5 (71)	47.8 (32)
CCI			
Mean ± SD	2.4 ± 2.0	2.6 ± 1.9[a]	2.0 ± 2.1
Median	2	2	1
Cognitive disorder *n* (%)	60.6 (91)	100.0 (83)[b]	11.9 (8)
Clinical Dementia Rating (CDR) scale			
Mild cognitive impairment (CDR 0.5)	7.7 (7)	8.5 (7)	0.0 (0)
Mild dementia (CDR 1)	28.5 (26)	25.3 (21)	62.5 (5)
Moderate dementia (CDR 2)	34.1 (31)	33.7 (28)	37.5 (3)
Severe dementia (CDR 3)	29.7 (27)	32.5 (27)	0.0 (0)
Cognitive disorder aetiology			
Alzheimer's disease	50.6 (46)	48.2 (40)	75.0 (6)
Vascular disease	6.6 (6)	4.8 (4)	25.5 (2)
Mixed dementia	27.5 (25)	30.1 (25)	0.0 (0)
Other	15.3 (14)	16.9 (14)	0.0 (0)
Psychiatric disorders *n* (%)	60.6 (91)	28.9 (24)	100.0 (67)[c]
Depression	61.5 (56)	83.4 (20)	52.3 (35)
Anxiety	8.8 (8)	4.1 (1)	10.4 (7)
Personality disorders	17.6 (16)	12.5 (3)	19.4 (13)
Other	12.1 (11)	0.0 (0)	17.9 (12)
Prescription drugs and PIM			
Total number of prescription	1,137	614	523
Mean ± SD	7.58 ± 4.1	7.4 ± 3.7	7.8 ± 4.4
Median	7	7	8
IQR	5–10	5–10	4–11
0 medications % (*n*)	5.3 (8)	6.0 (5)	4.5 (3)
1–5 medications % (*n*)	27.3 (41)	26.5 (22)	28.3 (19)
6–9 medications % (*n*)	40.0 (60)	42.2 (35)	37.3 (25)
≥10 medications % (*n*)	27.3 (41)	25.3 (21)	29.9 (20)
Potentially inappropriate medication			
According to STOPP criteria % (*n*)	77.3 (116)	77.1 (64)	77.6 (52)
Mean ± SD	1.8 ± 1.7	1.8 ± 1.7	2.2 ± 1.9
Median	1	1	2
IQR	1–2	1–2	1–3
0 PIM % (*n*)	22.7 (34)	22.9 (19)	22.4 (15)
1–2 PIM % (*n*)	48.7 (73)	54.2 (45)	41.8 (28)
3–5 PIM % (*n*)	24.0 (36)	21.7 (18)	26.9 (18)
≥6 PIM % (*n*)	4.6 (7)	1.2 (1)	8.9 (6)
According to START criteria % (*n*)	64.7 (97)	63.9 (53)	65.7 (44)
Mean ± SD	1.3 ± 1.3	1.1 ± 1.1	1.4 ± 1.5
Median	1	1	1
IQR	0–2	0–2	0–2
0 PIM % (*n*)	35.3 (53)	36.1 (30)	34.3 (23)
1–2 PIM % (*n*)	50.6 (76)	51.8 (43)	49.2 (33)
3–5 PIM % (*n*)	12.6 (19)	12.0 (10)	13.4 (9)
≥6 PIM % (*n*)	1.3 (2)	0.0 (0)	3.0 (2)

Unit A = 18 acute geriatric beds dedicated to patients with behavioural and psychological symptoms related to dementia; Unit B = eight acute geriatric beds dedicated to patients with co-morbid psychiatric disorders.SD, standard deviation; IQR, interquartile range; ADL, activities of daily living; CCI, Charlson co-morbidity index.

[a]Indicates a significant difference between Unit A and Unit B means ($P < 0.05$).

[b]Indicates a significant difference between Unit A and Unit B percentages ($P < 0.05$).

[c]Chronic kidney disease = serum creatinine > 150 μmol/l or estimated GFR < 50 ml/min according to Cockcroft and Gault.

Table 2. Most frequently encountered inappropriate prescribing (IP) and prescribing omission (PO) according to STOPP/START criteria

IP according to STOPP criteria % (*n*)	Total *n* = 150
Cardiovascular system	
Aspirin or clopidogrel with no history of coronary, cerebral or peripheral arterial symptoms or occlusive events	14.0 (21)
Loop diuretic as first-line monotherapy for hypertension	8.0 (12)
Loop diuretic for dependent ankle oedema only, i.e. no clinical signs of heart failure	4.0 (6)
Central nervous system and psychotropic drugs	
Long-term neuroleptics (>1 month) in those with parkinsonism	14.6 (7)
Long-term (i.e. >1 month), long acting BZD	6.7 (10)
Long-term (i.e. >1 month) neuroleptics as long-term hypnotics	4.7 (7)
Gastrointestinal system	
PPI for peptic ulcer disease at full therapeutic dosage for >8 weeks	14.7 (22)
Musculoskeletal system	
Long-term use of NSAID (>3 months) for symptom relief of mild osteoarthritis	3.3 (5)
Urogenital system	
Bladder antimuscarinic drugs with dementia	3.3 (5)
Drugs that adversely affect fallers	
BZD	26.7 (40)
Neuroleptic drugs	24.7 (37)
Vasodilator drugs with persistent postural hypotension, i.e. recurrent >20 mm Hg drop systolic blood pressure	3.3 (5)
Analgesic drugs	
Long-term use of powerful opiates, e.g. morphine or fentanyl as first-line therapy for mild to moderate pain	4.0 (6)
Long-term opiates in those with dementia unless indicated for palliative care or management of moderate/severe chronic pain syndrome	4.0 (6)
Duplicate drug classes	
Any regular duplicate drug class prescription, e.g. two concurrent opiates, NSAIDs, SSRIs, loop diuretics, ACE inhibitors	16.0 (24)
PO according to START criteria % (*n*)	
Cardiovascular system	
Warfarin the presence of chronic atrial fibrillation	6.7 (10)
Aspirin or clopidogrel with a documented history of atherosclerotic coronary, cerebral or peripheral vascular disease in patients with sinus rhythm	14.7 (22)
Statin with a documented history of coronary, cerebral or peripheral vascular disease, where the patient's functional status remains independent for ADLs and life expectancy is >5 years	8.0 (12)
ACE inhibitor with chronic heart failure	3.3 (5)
Respiratory system	
Regular inhaled β_2-agonist or anticholinergic agent for mild to moderate asthma or COPD	8.0 (12)
Regular inhaled corticosteroid for moderate/severe asthma or COPD, where predictive $FEV_1 < 50\%$	4.0 (6)
Central nervous system	
Antidepressant drug with moderate to severe depressive symptoms lasting ≥ 3 months	20.0 (30)
Gastrointestinal system	
Fibre supplement with chronic symptomatic diverticular disease with constipation	9.3 (14)
Musculoskeletal system	
Calcium and vitamin D supplement in patients with known osteoporosis (previous fragility fracture, acquired dorsal kyphosis)	18.0 (27)
Endocrine system	
Metformin with type 2 DM ± metabolic syndrome	8.0 (12)
Statin therapy in DM if coexisting one major cardiovascular risk factor present	8.0 (12)

BZD, benzodiazepine; PPI, proton pump inhibitor; NSAID, non-steroidal anti-inflammatory drug; SSRI, serotonin selective re-uptake inhibitor; ACE, angiotensin-converting enzyme; ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; FEV, forced expiratory volume; DM, diabetes mellitus.

kidney disease (13%), defined as serum creatinine > 150 μmol/l or estimated GFR < 50 ml/min according to Cockcroft and Gault; and congestive heart failure (12%). Nearly 70% of the population had been hospitalised at least once in the previous year, and 60% had experienced one or more falls in the 3 months before admission. A comparative analysis between the patients of units A and B has been computed. Excepted for presence of a cognitive disorder (Unit A: 100%; Unit B: 12%, $P < 0.05$), presence of a psychiatric co-morbidity (Unit A: 29%; Unit B: 100%, $P < 0.05$) and the co-morbidity index (Unit A: 2.6 ± 1.9; Unit B: 2.0 ± 2.1, $P < 0.05$), no other significant differences were found between the two groups of patients.

These 150 analysed patients amounted to 1,137 prescriptions. The description of medication prescriptions and PIMs according to STOPP/START criteria are presented in Tables 1 and 2. The prevalence of IP and PO according to STOPP/START criteria are 77% and 65%, concerning, respectively, 116 and 97 patients. No other statistical difference was found between the two groups of patients according to the unit of hospitalisation. Among the 65 STOPP criteria, 25 were never encountered. They mainly

Table 3. Results of the unifactorial analysis identifying variables associated with potentially inappropriate medication (PIM) used according to STOPP/START criteria (results given in form of mean ± SD for numerical variables and percentage calculated and sample sizes for categorical ones—n = 150)

Characteristics	PIM-STOPP			PIM-START		
	No	Yes	P[a]	No	Yes	P[a]
Number of medications	4.1 ± 3.5	8.4 ± 3.8	<0.01	7.4 ± 3.3	7.6 ± 4.4	0.9
Age (year)	80.4 ± 9.4	79.9 ± 7.8	0.6	79.9 ± 7.9	80.0 ± 8.3	0.8
Female	73.5 (25)	75.9 (79)	0.6	67.9 (36)	70.1 (68)	0.8
Living in institution	26.5 (9)	33.6 (39)	0.02	18.9 (10)	39.2 (38)	<0.01
Disabled for at least one ADL	55.9 (19)	72.4 (84)	0.09	66.0 (34)	70.1 (68)	0.7
Charlson co-morbidity index	2.1 ± 2.1	2.4 ± 2.0	0.4	1.8 ± 1.8	2.7 ± 2.0	<0.01
Cognitive disorder	28.9 (19)	79.1 (72)	0.02	60.4 (32)	60.8 (59)	0.9
Psychiatric disorders			0.2			<0.01
Depression	68.4 (13)	59.7 (43)		53.1 (17)	66.1 (39)	
Anxiety	21.0 (4)	5.6 (4)		12.5 (4)	6.8 (4)	
Personality disorders	5.3 (1)	20.8 (15)		12.5 (4)	20.3 (4)	
Other	5.3 (1)	13. 9 (10)		21.9 (7)	6.8 (4)	
Co-morbidity						
Ischaemic heart disease	11.8 (4)	9.5 (11)	0.8	7.6 (4)	11.3 (11)	0.6
Congestive cardiac failure	11.8 (4)	12.9 (15)	0.9	7.6 (4)	15.5 (15)	0.2
Cerebrovascular disease	29.4 (10)	31.0 (36)	0.9	20.7 (11)	36.1 (35)	0.06
Diabetes mellitus	11.8 (4)	14.7 (17)	0.8	7.5 (4)	17.5 (17)	0.1
Chronic kidney disease[b]	11.8 (4)	12.9 (15)	0.9	11.3 (6)	13.4 (13)	0.8
Chronic pulmonary disease	14.7 (5)	12.9 (15)	0.8	1.9 (1)	19.6 (19)	0.002
≥1 Fall in the preceding 3 months	41.2 (14)	65.5 (76)	0.02	60.4 (32)	59.8 (58)	0.9
≥1 Hospitalisation in the preceding year	50.0 (17)	75.0 (87)	0.01	66.0 (35)	71.1 (69)	0.6

SD, standard deviation; PIM-STOPP, PIM according to STOPP criteria; PIM-START, PIM according to START criteria; CDR, Clinical Dementia Rating scale.
[a]$P < 0.05$ indicates a significant difference between the two groups (PIM yes–PIM no).
[b]Chronic kidney disease = serum creatinine > 150 μmol/l or estimated GFR < 50 ml/min according to Cockcroft and Gault.

concerned (i) the central nervous system and psychotropic drugs section (six items): five concerning tricyclic antidepressants and one phenothiazines in patients with epilepsy; (ii) the cardiovascular system section (five items): digoxin at a long-term dose > 125 μg/day with impaired renal function, non-cardioselective β-blockers with chronic obstructive pulmonary disease, diltiazem or verapamil with NYHA class III or IV heart failure, dipyridamole as monotherapy for cardiovascular secondary prevention and aspirin to treat dizziness not clearly attributable to cerebrovascular disease; and (iii) the musculoskeletal system section (five items): essentially in regards to non-steroidal anti-inflammatory drugs. Among the 22 START criteria, two were not encountered including (i) home continuation oxygen with documented chronic type 1 or type 2 respiratory failure and (ii) L-DOPA in idiopathic Parkinson's disease with definite functional impairment and resultant disability (Table 1). The most frequently encountered STOPP and START criteria are detailed in Table 2.

The unifactorial analysis for factors significantly associated with at least one instance of STOPP and START inappropriate medication prescribing is presented in Table 3. According to the selection threshold, all variables with a P-value ≤ 0.20 were selected to be introduced into the logistic regression multifactorial model.

The multivariate analysis demonstrates that demographic data (age and gender) have no predictive value. Independent predictors of receiving an IP were the increased number of medications (OR 1.54, 95% CI 1.13–1.89), being cognitively impaired (OR 1.83, 95% CI 1.55–2.24) whatever the severity and aetiology, having fallen at least once in the preceding 3 months (OR 2.03, 95% CI 1.52–2.61) and hospitalised at least once in the preceding year (OR 1.09, 95% CI 1.02–1.23). Independent predictors of PO according to START criteria were the presence of a psychiatric disorder (OR 1.64, 1.42–2.01) and the number of co-morbidity accord the Charlson co-morbidity index (OR 1.79, 95% CI 1.48–1.99). Living in an institutional setting appeared as an independent predictive maker for both IP and PO according to STOPP/START criteria (with respectively, OR 1.45, 95% CI 1.27–1.74 and OR 1.67, 95% CI 1.32–1.91).

Discussion

This prospective study, concerning acutely ill patients with cognitive or psychiatric disorders, demonstrated the high rate of PIM in this population.

PIM has been defined using STOPP/START criteria which were recently developed and validated [2, 5, 16, 17], following the numerous comments and remarks of the existing and most cited PIM criteria [5]. At our knowledge, clinical studies which have used this screening tool, which appears valid, reliable and comprehensive [17], are still rare. STOPP/START presents itself as (i) a comprehensive and

valid list of potentially inappropriate prescriptions for common conditions in older adults; (ii) as being based on current clinical evidence; (iii) as reflecting the consensus opinion of a panel of experts in geriatric medicine, clinical pharmacology, psychiatry of old age, pharmacy and general practice; and (iv) including commonly encountered errors of commission (drug–drug and drug–disease interactions) as well as instances of PO [5]. A recently published inter-rater reliability study has shown that a median kappa coefficient between raters was 0.93 for STOPP criteria and 0.85 for START criteria, tested between multiple physicians across six European centres [17]. In addition to this sufficiently high inter-rater reliability, the average time for deployment is sufficiently low (mean (± SD) time 90 ± 35 s) to make STOPP/START appropriate to clinical practice [5].

Concerning STOPP criteria, the most frequent drugs prescribed inappropriately are obviously benzodiazepines and antipsychotic drugs [1, 7–9]. However, in this population of mentally ill patients, medications from cardiovascular, gastrointestinal, urogenital and musculoskeletal systems have been also identified as being inappropriately prescribed as showed in details in Table 3. In addition, this table also shows PO of antidepressants, whilst 30% of the study population are at need because of the presence of moderate to severe depressive symptoms lasting more than 3 months. PIMs by omission also concerned the cardiovascular, respiratory, gastrointestinal, musculoskeletal and endocrine systems. All these data demonstrate the lack of health literacy concerning geriatric conditions in those in charge of caring for patients presenting acute medical conditions and medium/long-term mental disorders simultaneously. The multifactorial analysis reinforces this point. More than the factors associated with STOPP criteria (i.e. number of medications: OR 2.54, cognitive disorder: OR 1.83 and hospitalisation during the preceding year: OR 1.09), the factors associated with the presence of START criteria (PO in case of psychiatric disorders and increasing with the level of co-morbidity (OR 1.8)) reinforce the notion of lack of health literacy. They give some evidence of the hurdles one encounters when managing multiple co-morbidities in old patients. Health literacy, broadly defined as the ability of individuals to access and use health information to make appropriate health decisions and maintain basic health [23], is increasingly becoming an issue for health promotion [24]. Lack of knowledge can lead the prescriber(s) to either simply add medications according to existing guidelines for a specific disease, disregarding the presence of other drugs (as proven by the high prevalence of STOPP criteria in the present study), or to omit treating essential co-morbidities (similarly with START criteria). These results suggest that more in-depth training for medical professionals caring for old adults is imperatively needed. This need is reinforced by the results obtained in a study conducted by Arora *et al.* [25]. Its specific aims were to adapt the ACOVE [26] and quality indicators [27] to evaluate processes of hospital care of 600 patients, for a broad set of medical conditions, including general medical conditions (e.g. diabetes mellitus and heart failure) and conditions prevalent in geriatric medicine (e.g. dementia and delirium, pressure ulcers and urinary incontinence). The results showed substantial variation in quality-of-care processes across several domains of care for hospitalised vulnerable elders, with the lowest quality of care for conditions found in geriatric patients compared with general medicine patients [25]. Therefore, greater health literacy can help health care professionals, other than geriatricians, to better manage mixed chronic conditions by combining EBM and existing health care systems to improve both old adult health and their quality of life.

Moreover, living in an institutional setting was associated with an increased risk of IP and PO according to STOPP and START with OR 1.45 and OR 1.67, respectively. Multiple drug use is common among old, frail nursing home residents who are susceptible to adverse effects and drug–drug and/or drug–disease interactions. An institutionalised population-based study (1,987, mean age 83.7 ± 7.7) with a mean number of drugs given per resident reaching 7.9 (SD 3.6) discovered IP in 35% of surveyed records [28]. Prescribing omissions were not studied, although they undoubtedly also adversely affect health and quality of life of institutionalised residents. Such data reinforce the need of a mandatory, specific and specialised training for practitioners in charge of nursing homes, which is as yet not organised in many European countries.

Despite providing important and interesting data, this study has limitations. Firstly, it was not designed to measure outcomes such as ADE. Previously published Irish data showed that the use of STOPP criteria to identify potential inappropriate prescriptions at hospital admission was twice more efficient in determining ADE than using Beers' criteria [16]. Clearly, the association between STOPP/START criteria, PIMs and tangible clinical outcomes such as hospitalisation, morbidity and mortality needs to be further investigated by a large-scale and multicentre study. In the present study, the increased number of medications, that is polypharmacy, has been identified as a significant predictor of whether a STOPP criterion will be found (OR 2.54). Though not a new finding, the presence of polypharmacy should prompt a thorough medication review for identifying potentially inappropriate prescriptions and related ADE. The systematic clinical application of STOPP criteria to any new prescription may be very effective in this regard. Secondly, factors influencing PO have not been evaluated. Therefore, nothing is known concerning patient's therapeutic observance or/and willingness. Nothing is known concerning specific reasons leading patients or practitioners to continue or discontinue certain medications (i.e. patients not willing to stop certain medication or not willing to initiate another one; previous ADE experience…). Thirdly, as this study was performed in older patients admitted to acute geriatric units and in a population with specific co-morbidities (acute medical event in cognitively impaired or psychiatric co-morbid patients), our results cannot be generalised to the entire elderly population.

Conclusion

This study clearly demonstrates that PIM as determined by STOPP/START criteria in a sample of acutely ill hospitalised patients with mental co-morbidities is highly prevalent. These results concern not only IP but also PO. With increasing proportions of older patients worldwide, quality and safety of prescribing have become global health care issues. We believe that physicians prescribing to polymorbid and polymedicated old patients will do this safely only if they develop in-depth knowledge of common geriatric conditions and learn how to apply clinical pharmacology principles and EBM tools to their daily practice as well as in the community, in hospital and institutional settings. Only then the necessary individualisation of therapy can be provided for complex geriatric cases, without undue approximation and oversimplification.

Key points

- In the current increasingly fragmented health care systems, special attention must be given to PIM in older population suffering from chronic conditions and consuming a large range of medicines.
- Whether the literature is abundant concerning PIM among the elderly with cognitive and/or psychiatric disorders, it mainly focuses on psychotropic drugs and very rare are studies having focused the PO.
- Using the STOPP-START criteria, the present study demonstrates the high prevalence of PIM, including PO, which concerns a large panel of drugs.
- The identified independent predictors for PIM raise the need of a greater health literacy concerning geriatric conditions in non-geriatrician practitioners who care elderly as well as in the community, in hospital and institutional setting.

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Conflicts of interest

None declared.

Author contributions

P.O.L. and J.P.M. conceived the study and participated in its design. P.O.L. and Y.H. contributed to the acquisition of subjects and data. P.O.L. and M.D. contributed to the statistical analysis of data. P.O.L., N.V.F., J.P.M. and G.G. contributed to the interpretation of data. P.O.L., Y.H., M.D., M.P., N.V.F., G.G. and J.P.M. contributed to draft the manuscript. All authors read and approved the final manuscript.

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