

Akande-Sholabi W, Adebuseye LA, Olowookere OO. Potentially inappropriate medication use among older patients attending a geriatric centre in south-west Nigeria. *Pharmacy Practice* 2018 Jul-Sep;16(3):1235.

<https://doi.org/10.18549/PharmPract.2018.03.1235>

Original Research

Potentially inappropriate medication use among older patients attending a geriatric centre in south-west Nigeria

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Received (first version): 25-Mar-2018

Accepted: 1-Sep-2018

Published online: 14-Sep-2018

Abstract

Objectives: To determine the prevalence and describe factors associated with the use of potentially inappropriate medication (PIM) among older patients.

Methods: Cross sectional study of 400 older patients selected systematically at the geriatric centre, University College Hospital, Ibadan between July and September 2016. With the aid of semi-structured questionnaires, information on the socio-demographic characteristics, lifestyle habits, healthcare utilisation and morbidities was obtained. The Beer's criteria 2015 update was used to identify the PIMs. Predictors of PIMs were determined using multivariate analyses at alpha 0.05.

Results: Age was 70.2 (SD=5.9) years and 240 (60%) were females. General prescription pattern showed antihypertensives (34.7%) as the commonest medications used. The point prevalence of PIMs use was 31%. In all, 10 PIMs were used by the respondents. The majority (81.5%) were using one PIM, while (17.7%) used two PIMs and (0.8%) 3 PIMs. NSAIDs (72.6%) were the commonest PIMs identified, followed by the benzodiazepines (24.2%). Respondents had an average of 1.9 morbidities, and multimorbidity found in 60.5%. Logistic regression analysis showed self-rated health assessed as better compared with age-mates [OR =1.718 (1.080–2.725)] and being physically active [OR =1.879 (1.026–3.436)] as the most significantly associated with PIMs use.

Conclusions: The use of PIMs among older patients in our setting was high with NSAIDs being the most frequently used medications. An interdisciplinary approach, of medication review by pharmacists', working with physicians may improve prescribing practices among older persons. Therefore, it is necessary to create public health awareness on the use of PIMs among older persons.

Keywords

Inappropriate Prescribing; Professional Practice; Aged; Potentially Inappropriate Medication List; Prevalence; Cross-Sectional Studies; Multivariate Analysis; Nigeria

INTRODUCTION

The older persons represent a majority of the world's population, with approximately two-thirds found in developing countries.¹ Potential inappropriate medications (PIMs), in old age is defined as drugs with higher risk of intolerance related to adverse pharmacodynamics or pharmacokinetics or drug-disease interactions.^{2,3} Inappropriate prescribing in the older population is considered a key public health problem because of its direct relationship to morbidity, mortality and consumption of health resources. Potentially inappropriate medications use was found in 34% older Europeans⁴ 70% in African American⁵ and 15.7 - 45.6% older Nigerians using the Beers criteria.⁶⁻⁸

Prescribing of inappropriate medication is a major cause of morbidity and mortality in Europe and the United States.^{4,9,10} The sum of healthcare consumed by people

above the age of 65 years is, approximately 2.3 times more than that consumed by those below the age of 65 years in Europe.^{11,12} Older patients are more predisposed to significant morbidity and mortality due to inappropriate prescribing than the younger patients for numerous reasons. Contributing factors include changes in pharmacokinetic in older age, drug-drug interactions as a result to multiple prescriptions and mostly poorer health status.¹³⁻¹⁵

Physiological changes that arise with ageing mostly affect the drug distribution, hepatic metabolism, but most significantly renal elimination in old age can potentiate the effects of medications, even at doses considered 'normal' in younger adults.¹³⁻¹⁵ The Beers criteria comprise of medications the older persons should avoid regardless of the patient's diagnosis.

In Nigeria, numerous studies have investigated the common prescription pattern among patients attending the general outpatients' department.⁶⁻⁸ Increasing consideration is being paid to inappropriate medication use in older persons. However, criteria defining the appropriate or inappropriate use of medication in Nigeria are not readily available and are not uniform. Notably, no study has been found on PIMs among the older persons in a geriatric centre in Nigeria, therefore the need for this study.

This study aims to assess the use of potentially inappropriate medications using the Beer's criteria among

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older person patients at the Chief Tony Anenih Geriatric Centre (CTAGC), University College Hospital (UCH), Ibadan, Nigeria.

METHODS

This was a cross-sectional, hospital-based study which was carried out at the Chief Tony Anenih Geriatric Centre (CTAGC), University College Hospital (UCH), Ibadan, Nigeria. The CTAGC is the pioneer geriatric centre in Nigeria which was a purpose-built facility for the care of the older persons. The centre has several specialty units such as ophthalmology, physiotherapy, rheumatology, dietetics, geriatric lifestyle, dentistry, memory, and geriatric psychiatry units. In addition, there are service areas in the CTAGC which include the centre inpatient (ward), outpatient, physiotherapy, dietetics, surgical (theatre), and the medical social work services.

The study population was older persons patients aged 60 years and beyond who attended the CTAGC, UCH outpatient clinic from July 2016 to September 2016. The ages of the respondents were determined by direct recall, for those who could not recall their ages, exploration of their ages was made from the table of historical events by Ajayi-Igun.¹⁶ Older persons who did not consent or were too ill to undergo the study procedure were excluded. The sample size was calculated using the Leslie and Kish formula for single proportion using the assumed prevalence of 50%. In all, 400 older persons were recruited. Systematic random sampling method was employed to recruit every third older patient [Sampling interval $k=NT/NS=2.7$, where NT is the sampling frame (1080) and NS=sample size (400)].

The respondents were interviewed with a semi-structured questionnaire which was pre-tested on 40 patients to ensure the validity of the questionnaire, no changes was made to the questionnaire after the pre-test. However, the participants were not included in the actual study.

Information was obtained on the respondents' demographic characteristics such as their age, sex, ethnicity, marital status and number of children; socio-economic characteristics such as educational level, income, occupation (present and past), living arrangement and lifestyle habits. Past medical history of the respondents including previous outpatients' visits, previous hospitalization, healthcare utilization pattern, past morbidities and pattern of medication use in the past one year prior to this study was similarly obtained.

The International Classification of Primary Care second electronic version (ICPC-2e) was used to categorise the diseases of the respondents into domains. ICPC-2e was developed by the World Organization of Family Doctors.¹⁷ The ICPC-2e assesses diseases related to (i) general and unspecified, (ii) blood and immune mechanism, (iii) digestive system, (iv) eye, (v) ear, (vi) circulatory system, (vii) musculoskeletal system, (viii) psychological system, (ix) neurology, (x) respiratory system, (xi) skin, (xii) endocrine, metabolic and nutritional, (xiii) urinary system, (xiv) female genital, and (xv) male genital system.

The Beer's criteria 2015 update was used to determine the potential inappropriate medications (PIMs). The criteria were developed by the American Geriatric Society (AGS).¹⁸ The medications categorized as PIMs in this study were selected from the list of medications indicated as PIMs by the AGS which include medications that cause interactions with drug and diseases, interactions with drug and syndrome, drugs that may aggravate disease or syndrome and medications to be used with caution in the older persons.¹⁸ Similarly, the medication pattern and intake of the respondents were assessed. The questionnaire was translated to Yoruba language and back translated to English language. The administration of the questionnaire took about 40 minutes.

The study received approval from the University of Ibadan/University College Hospital Institutional Ethical Review Board with IRB No (EC/16/0042) approved on 16th June 2016. Informed consent of each respondent was obtained before examination and administration of questionnaires. All the respondents were treated for their primary complaints before administration of the questionnaire.

At the end of each day, the administered questionnaires were sorted out, crosschecked after each interview and coded serially. SPSS (version 21) was used for data entering, cleansing and analysis. Descriptive statistics was

Drug class	N	%
Antihypertensives	575	34.7
Haematinics	176	11.9
Antiplatelets	154	10.4
Analgesics	151	10.2
Oral Hypoglycaemic agents	117	7.9
Disease modifying anti-rheumatic drugs	113	7.6
Antibiotics	42	2.8
Sedatives	30	2.0
Opioids	28	1.9
Anti-lipids	24	1.6
Proton Pump Inhibitors	17	1.1
Anti-malarials	12	0.8
Anti-depressants	9	0.6
Cholinesterase Inhibitors	8	0.5
Anti-Anginal medications	7	0.5
Bisphosphonates	6	0.4
Antacids	5	0.3
Anti-psychotics	3	0.2
Ophthalmic medications	2	0.1
H2-receptor antagonists	2	0.1
Bronchodilators	2	0.1
Steroids	1	0.1
Total	1484	100

Potential inappropriate medications	N	%
Diclofenac	76	51.3
Bromazepam	30	20.3
Rabeprazole	13	8.8
Amitriptyline	8	5.4
Meloxicam	7	4.7
Ketoprofen	5	3.4
Methyldopa	4	2.7
Ibuprofen	2	1.4
Nitrofurantoin	2	1.4
Prochlorperazine	1	0.6
Total	148	100

Table 3. Association of sociodemographic characteristics with the prevalence of use of potential Inappropriate medications

n (%)	Potential Inappropriate Medications			chi-sq	p-value
	YES = 124	NO = 276	Total = 400		
Age groups (years)				0.48	0.92
60 – 64	24 (34.3)	46 (65.7)	70 (100.0)		
65 – 69	37 (30.3)	85 (69.7)	122 (100.0)		
70 – 74	35 (29.7)	83 (70.3)	83 (100.0)		
≥ 75	28 (31.1)	62 (68.9)	90 (100.0)		
Sex				0.02	0.89
Males	47 (29.4)	113 (70.6)	160 (100.0)		
Females	77 (32.1)	163 (67.9)	240 (100.0)		
Marital status				2.42	0.12
Currently married	102 (29.6)	243 (70.4)	345 (100.0)		
Not currently married	22 (40.0)	33 (60.0)	55 (100.0)		
Educational attainment				2.14	0.14
No formal	16 (23.5)	52 (76.5)	68 (100.0)		
Had formal education	108 (32.5)	224 (67.5)	332 (100.0)		
Occupational status				0.02	0.89
Retired	104 (31.1)	230 (68.9)	334 (100.0)		
Not retired	20 (30.3)	46 (69.7)	66 (100.0)		
Living arrangement				0.06	0.81
Alone	6 (28.6)	15 (71.4)	21 (100.0)		
With others	118 (31.1)	261 (68.9)	379 (100.0)		
Financial support				4.87	0.02
Self	95 (34.4)	181 (65.6)	276 (100.0)		
By others	29 (23.4)	95 (76.6)	124 (100.0)		
Number of children				0.05	0.82
0 – 5	88 (30.7)	199 (69.3)	287 (100.0)		
>5	36 (31.9)	77 (67.9)	113 (100.0)		

used to describe socio-demographic characteristics of the respondents. Appropriate charts were used to illustrate categorical variables. Chi-square statistics was used to assess association between categorical variables and Student's t-test to test association between continuous variables. Logistic regression analysis was carried out to explore independent variables associated with potential inappropriate medications. The dependent variable in logistic regression is binary or dichotomous, containing data coded as Yes or No. The goal of logistic regression is to find the best fitting model to describe the relationship between the binary characteristic of interest. Statistical significance was set at $p < 0.05$.

RESULTS

There were 400 respondents (females=240). The mean age was 70.2 (SD=5.9) years (range 60 – 91 years). The males were significantly older than the females 71.2-(SD 6.1) years vs 69.5 (SD=5.7) years ($t=2.738$, $p=0.01$). In all, 1484 medications were used by the respondents with antihypertensive 575 (34.7%) being the commonest followed by haematinics 176 (11.9%). See Table 1.

Using the Beer's criteria, 124 respondents were on PIMs giving a point prevalence of 31%. The majority of the respondents 101 (81.5%) used one PIM, while 22 (17.7%) respondents used two PIMs and 1 (0.8%) respondent used 3 PIMs. In all, 10 PIMs were used by the respondents. NSAIDs (diclofenac, meloxicam, ketoprofen, ibuprofen) were the commonest (90, 72.6%) PIMs identified, followed by the benzodiazepines (30, 24.2%). The frequency distribution is shown in Table 2.

As shown in Table 3, higher proportion of females (32.1%) was using PIMs compared with the males (29.4%) but not statistically significant proportion. PIMs use was common

among respondents who were not currently married, had formal education, retired from occupation, living with others and had more than 5 children alive. PIMs use was significantly associated with being self-supporting financially ($p=0.02$).

Higher proportion of respondents who rated their health status better than their age-counterparts significantly used PIMs as compared with those who rated their health status same as their age-counterparts (35.9% vs 23.2%, $p=0.01$). Similarly, higher proportions of respondents who were physically active (33.9%) significantly used PIMs compared with those who were not physically active (19.8%, $p < 0.001$), as shown in Table 4.

Table 5 describes the diseases of the respondents classified according to ICPC- 2 domains by the prevalence of PIMs. In all, 748 diseases were identified among the respondents giving an average of 1.9 diseases per respondent. Multi-morbidities defined as having more than 2 diseases was found in 242 (60.5%) of the respondents. Highest proportion of PIMs was used by respondents who had diseases in the neurological domain, while none of the respondents with diseases in the skin, ear and female genital domains used PIMs. There was no statistical association between the diseases classified according to ICPC- 2 domains and PIMs.

Table 6 shows the logistic regression analysis carried out on variables which showed significant association with PIMs. Respondents whose self-rated health was assessed as better than those of their age-counterparts ($OR=1.718$; $95\%CI= 1.080 - 2.725$, $p=0.022$) and as being physically active ($OR=1.879$; $95\%CI= 1.026 - 3.436$, $p=0.041$) were found to be most significantly associated with PIMs.

n (%)	Potential Inappropriate Medications			chi-sq	p-value
	YES = 124	NO = 276	Total = 400		
First Admission				3.09	0.21
Never	73 (34.4)	140 (65.7)	213 (100.0)		
Before 60	30 (25.0)	90 (75.0)	120 (100.0)		
After 60	21 (31.3)	46 (68.7)	67 (100.0)		
Self-rate health				0.01	0.96
Good	118 (31.0)	263 (69.0)	381 (100.0)		
Poor	6 (31.6)	13 (68.4)	19 (100.0)		
Health comparison with age-mate				7.15	0.01
Better	88 (35.9)	157 (64.1)	245 (100.0)		
Same	36 (23.2)	119 (76.8)	155 (100.0)		
Alcohol				0.74	0.69
Yes	1 (20.0)	4 (80.0)	5 (100.0)		
No	123 (31.1)	272 (68.9)	395 (100.0)		
Tobacco				0.02	0.89
Yes	2 (28.6)	5 (71.4)	7 (100.0)		
No	84 (21.4)	309 (78.6)	393 (100.0)		
Physical activities				42.06	<0.001
Active	108 (33.9)	211 (66.1)	319 (100.0)		
Not Active	16 (19.8)	65 (80.2)	81 (100.0)		
Herbal medicine				0.01	0.98
Yes	28 (31.1)	62 (68.9)	90 (100.0)		
No	96 (31.0)	214 (69.0)	310 (100.0)		
Multi-morbidities				0.79	0.37
Yes	71 (29.3)	171 (70.7)	242 (100.0)		
No	53 (33.5)	105 (66.5)	158 (100.0)		
Body mass Index				5.33	0.15
Underweight	2 (13.3)	13 (86.7)	15 (100.0)		
Normal	25 (27.2)	67 (72.8)	92 (100.0)		
Overweight	42 (33.6)	83 (66.4)	125 (100.0)		
Obese	44 (37.9)	72 (62.1)	116 (100.0)		

DISCUSSION

The data revealed high prevalence of PIM in the older persons attending the geriatric centre with NSAIDs as the most frequent PIM identified. Prescribing pattern and ICPC-2 indicates cardiovascular and musculoskeletal diseases as most prevalent among the older people in this study.

Almost 72% of the PIM detected involve NSAIDs (diclofenac, meloxicam, ketoprofen, ibuprofen) followed by benzodiazepines accounting for about 24%. The large-scale use of NSAIDs could be linked to the treatment of musculoskeletal disorders such as osteoarthritis in the older persons, however cardiovascular, gastrointestinal,

central nervous system or renal risks remain a serious concern for patient safety. In contrast, the NSAIDs used in some studies in Europe were described to be lower, as acetaminophen or opioids signified the chosen analgesic pathway.^{19,20} This might be suggestive of the necessity for reevaluation of the implemented pain management strategies. Benzodiazepines use in the older persons has been identified in many studies as a common potential problem.^{21,22} The benzodiazepines are commonly prescribed medications as anxiolytic or as sleep aid among older persons.^{22,23} Long term use of these medications are contraindicated in older persons and considered as potentially inappropriate medications in Beer's criteria

Diseases classified according to ICPC- 2 domains	Potential Inappropriate Medications			p-value
	Yes = 124 n (%)	No = 276 n (%)	Total = 400 N (%)	
Cardiovascular	91 (29.2)	221(70.8)	312 (100.0)	0.14
Musculoskeletal	49 (30.6)	111 (69.4)	160 (100.0)	0.89
Endocrine, Metabolic & Nutrition	16 (26.7)	44 (73.3)	60 (100.0)	0.43
Neurological	19 (40.4)	28 (59.6)	47 (100.0)	0.14
Eye	13 (27.7)	34 (72.3)	47 (100.0)	0.60
Digestive	12 (40.0)	18 (60.0)	30 (100.0)	0.27
Respiratory	8 (28.6)	20 (71.4)	28 (100.0)	0.77
Psychological	5 (20.0)	20 (80.0)	25 (100.0)	0.22
General and Unspecified	3 (23.1)	10 (76.9)	13 (100.0)	0.53†
Urological	2 (15.4)	11 (84.6)	13 (100.0)	0.22†
Blood and Immune mechanism	4 (40.0)	6 (60.0)	10 (100.0)	0.53†
Skin	0 (0.0)	1 (100.0)	1 (100.0)	0.50†
Ear	0 (0.0)	1 (100.0)	1 (100.0)	0.50†
Female genital	0 (0.0)	1 (100.0)	1 (100.0)	0.50†

† Fisher's Exact Test

Variables	beta	p-value	OR	95%CI for OR	
				Lower	Upper
Self-supporting financially	0.127	0.604	1.136	0.702	1.838
Rated health better than age-mates'	0.541	0.022*	1.718	1.080	2.725
Physically active	0.630	0.041*	1.879	1.026	3.436
Constant	0.082	0.810	1.085		

owing to the danger of continued sedation, confusion, psychomotor impairment, falls and physical dependence.²¹ The outcomes of this study correlates with those from Europe and United States of America.^{21,22}

The mean age of the respondents was about 70 years similar to that documented in other studies.^{6,24} The commonest morbidity identified was from cardiovascular system with 34.7% of the patients having hypertension. Comparable studies carried out in different centers in Burkina Faso and Tunisia also stated hypertension as the foremost source of morbidity affecting 82% and 52% of the participants.^{25,26} Not surprisingly antihypertensives were the most frequent medications used by the respondents. This was followed by haematinics (11.9%), antiplatelets (10.4%), analgesics (10.2%), oral hypoglycaemic (7.9%) and Disease modifying anti-rheumatic drugs (7.6%). This reflected the high prevalence of cardiovascular and musculoskeletal conditions among older people in Nigeria. As reported by Fadare *et al.* in Nigeria, 30.6% of the prescribed medications were antihypertensive,⁶ a result similar with other Nigeria findings on medications use in hypertension.²⁷ Similarly, among older persons Indians, 40.3% of the prescribed medications were antihypertensives.²⁸ This finding is suggestive of high prevalence of non-communicable diseases among older persons in developing countries.

Inappropriate medication prescribing is a common, major global health issue in older people. This study indicated that PIM frequency amongst the older persons is 31% and of these patients 81.5% used at least one PIM. The PIM prevalence found was comparable to the range mentioned in various European and Nigerian documentation using Beer's criteria.^{6,21,29} Moreover, comparison of findings may not be appropriate because diverse set of criteria are applied and in different study environments. Many European countries prescriptions, has found deficiencies in Beers criteria, thus, this led to the establishment of other criteria such as the Screening Tool of Older Person's Prescriptions (STOPP) and Screening Tool to Alert Doctors to Right Treatment (START).^{30,31}

Logistic regression analysis showed that older persons who rated their health better than their age-counterparts and those who were physically active had 1.7 times and 1.9 times risk of using PIMs respectively. Given that the most commonly used PIMs were NSAIDs, one could assume that the pain-free effects of the NSAIDs had positive effects on the self-rated health and activities of the older persons. However, further studies are needed to explore this finding.

The strength of this study includes the use of Beer's criteria in detecting the prevalence of PIMs and the findings of the

study will contribute valuable evidence to the literature regarding the prescribing of PIMs to the older persons in this setting. One of the limitations of this study is that it was carried out in the only geriatric centre in Nigeria and this might affect our findings and cannot be generalized to the older patients across Nigeria. The limitation of Beers criteria stands, since this was developed for the USA. It can be noted that some of the medications recorded on the criteria may not have similar antagonistic effects on different population.

Clinical Implications

Our findings indicate that overall prevalence of PIM using Beers criteria was 31%. As PIM is associated with adverse health outcomes, healthcare providers should aim to reduce their prevalence. A systematic review concluded that various interventions including pharmacist interventions, clinical decision support systems and multi-disciplinary approaches can reduce inappropriate prescribing.³² Screening tools such as Beers criteria have demonstrated to be very valuable in identifying PIM and can be used in intervention studies to improve medication appropriateness and reduce the risk of inappropriate prescribing in older persons, which ultimately should improve other relevant patient outcomes.

CONCLUSIONS

This study has shown the prevalence and factors associated with PIMs and patterns of diseases prevalent in geriatric patients, and have also provided useful baseline data. It showed the high prevalence of PIMs use among the older persons with its attendant public health impact. Assuming the older persons population and the possibilities of PIM, it is necessary to establish and endorse simple applicable, evidence-based national criteria which can be applied in an effective way. With regards the older persons "less is more" hence, safer pharmacological alternatives as well as non-pharmacological strategies might be a good substitute. Drug use studies of this type may eventually help in improving the quality of healthcare services given to the geriatric patients.

CONFLICT OF INTEREST

None.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sector.

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