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Potentially Inappropriate Prescription and Impact of Physician Training on Usage of Prescribing Screening Tools for the Elderly in a Secondary Healthcare Facility

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ABSTRACT

BACKGROUND: Potentially Inappropriate Prescribing (PIP) for the elderly is widespread and is a risk factor for increased morbidity and mortality among them. The Beers criteria and "Screening Tools of Other Persons' potentially inappropriate Prescriptions (STOPP) and Screening Tools to Alert doctors to Right Treatment (START) criteria" have been validated to reduce PIP prevalence in the elderly when applied. However, many studies attest that a knowledge gap regarding PIP in geriatrics amongst prescribers contributes to the PIP surge. This study aims to assess the prevalence and predictors of PIP and also the impact of physician training on the usage of common prescribing tools for the elderly in a secondary healthcare facility.

METHODS: This study was a retrospective cross-sectional before- and -after study. Case files of 220 ambulatory patients aged 65 years and above were retrieved and screened for Potential Inappropriate Medicines (PIMs) and Potential Prescribing Omissions (PPOs) using the Beers criteria (2019) and STOPP/START criteria (2015). Subsequently a comprehensive training session was held for physicians on the utilization of the Beers and STOPP/START criteria in geriatric pharmacotherapy and the use of screening tools-based smartphone application (app) in reducing PIP among the elderly. The prevalence and pattern of PIM/PPO before and after the intervention were compared on the same case files 2 months later to determine the impact of the training on the pattern and prevalence of PIP.

RESULTS: The mean age was 73.6±6.1years and 54.5% were males. About 76.1% of the population had multi-morbidity and hypertension was the most common affecting 69.1% of participants while diabetes followed at 13.2%. The mean number of medications observed was 5.49±2.35 per patient before and 5.01±2.22 after the intervention. The most prescribed PIMs according to STOPP and Beers criteria before and after the intervention were methyldopa, glimepiride, and glibenclamide. However, amitriptyline also made the list of the most prescribed Beers drug while the most omitted START drug was regular inhaled corticosteroid for frequent exacerbation requiring systemic corticosteroid. The STOPP PIM prevalence was significantly reduced from 37.7% to 29.1% after intervention (*P= 0.045*) while the START Potentially PPOs prevalence of 4.5% (*P=0.5000*) and Beers PIM prevalence of 30% *(P=0.3014*) were not significantly reduced after the intervention. The overall PIP prevalence was reduced considerably from 24 in 100 patients to 18 in 100 patients (*P=0.002*) The binary logistic regression indicated that females, lower education, and multimorbidity, patients receiving more than five drugs, and those with active occupation were significant predictors of PIP in this study.

CONCLUSION: The prevalence of PIP among the elderly was relatively high. Beers and STOPP/START criteria-based educational training coupled with the introduction and installation of a smartphone screening tool application for physicians effectively reduced overall PIP among the elderly. Continuous education in geriatric pharmacotherapy for physicians is necessary to reduce PIP prevalence in the elderly.

INTRODUCTION

The global population of older adults is projected to reach 1.5 billion by 2050.[1] In Nigeria, the 2019 elderly population of 9.1 million is projected to rise to about 11.5 million in 2025 and even further to about 25.5 million by 2050 as stated by the National Bureau of Statistics (NBS 2023)[2]. Globally, the focus on the elderly is essential due to the physiological, psychological, social and economic impact of ageing on the elderly and society at large. For instance, the physiological changes of major organs associated with ageing predispose the elderly to multiple illnesses hence more than half of them suffer from at least two conditions.[3] This outcome could challenge the societal healthcare system with increased resource consumption, especially medicines as the elderly need a collage of medicines to cater for the frequent co-morbidities. Inevitable polypharmacy among the elderly ultimately predisposes them to potentially inappropriate medicines (PIMs).

PIMs could result in increased medical costs, non-adherence to medicines, increased risk of adverse drug reactions, drug-drug interactions (DDIs), lower functional capacity, and multiple geriatric syndromes.[4,5] The main precursor of PIMs is Potentially Inappropriate Prescribing (PIP) which involves either overprescribing, mis-prescribing or underprescribing.[6,7] PIP is common among the elderly and apart from changes in their ageing physiology, other causes include health system factors; poor medical record, low doctor-to-patient ratio, and poor knowledge of geriatric pharmacotherapy(side effects and drug interactions)[8]. The clinical impact of PIP includes increased risk of treatment failure, functional decline, hospitalizations, poor quality of life and even death [9]. PI P prevalence is equally high globally (23-75%) and (15-45%) in Nigeria.[10,11] To aid rational prescribing and reduce the PIP prevalence among the elderly, screening tools like the American Geriatric Society (AGS) Beers criteria and STOPP/START criteria and even screening tools smartphone applications have been developed. The AGS Beers Criteria contains a list of potential medicines to be mostly avoided under certain circumstances among the elderly. The criteria target use by practicing clinicians primarily and it applies to the 65 years and above elderly in all ambulatory or hospital care but not to those in hospice or palliative care. The purpose of the criteria is to improve medication selection and educate physicians and patients to reduce the risk of adverse drug events.[12] The Screening Tools of Older Persons' potentially inappropriate Prescription (STOPP) criteria priority is to highlight preventable drug-drug interactions and or adverse drug events (ADEs) while Screening Tools to Alert doctors to the Right Treatment (START) criteria detect omission of medications well-indicated for the elderly population. Studies have it that screening tools like Beers and STOPP/START Criteria when employed in prescribing could reduce them.[13]

Educational intervention for prescribers is one of the most effective strategies to improve rational prescribing.[14] however many studies attest that a knowledge gap regarding PIP in geriatrics and screening tools amongst prescribers contribute to the PIP surge.[15] This study aims to assess the prevalence, predictors of PIP and the impact of physician training on usage of prescribing tools for the elderly in a secondary healthcare facility.

METHODS

Study Design

A hospital-based retrospective cross-sectional before and after study designed to evaluate Potentially Inappropriate Prescription among the elderly and assess the impact of STOPP/START and Beers criteria-based physician training on prescribing patterns for elderly out-patients who visited Military Hospital Lagos (MHL).

The study population consisted of case files of the elderly aged 65 and above who visited any of the departments of MHL excluding the Eye Clinic and doctors who had treated them during the study period and consented to the study.

Sampling and Sampling Technique

A convenient sampling method was used to enlist the participants from the pool of case files 65 years and above (from the Medical Records department) until the sample size was complete.

Chow *et al* (2017)[16] sample size determination for cross-sectional (before and after study) was used.

A previous study shows that the proportion of PIM before and after the study was 27% and 22% respectively Akkawi *et al* (2020).[17]

Where n=Initial sample size

Zα = Standard normal deviation Probability (α) corresponds to type 1 error=1.64

At a 95% confidence interval

Zβ= Standard deviation corresponding to probability of typeb2verror (β)= 0.842 at a power of 80%

Pc: PIM value in the control group =0.27

Pi- PIM value in the intervention group=0.22

K- Ratio of sample size between the two groups=1

The formula for sample size calculation for a [before and after] cross-sectional study is as shown below:

$$n = \left[\frac{Pc[1-Pc]}{K} + Pi[1-Pi]\right]$$

Correcting sample size with finite population and factoring attrition, the sample size was 220

Data Collection

Data collection instruments were the case files and proforma. The proforma was used to collect information from the case files such as respondents' signs, medications used, number of medications prescribed (with frequency and duration), diagnosis, and test results. This information which was from the most recent prescriptions was screened with STOPP /START (2015) and Beers (2019) criteria to identify and record PIMs pre and post-educational intervention from the same case files. The proforma was pre-tested on 10 case files which were not added to the study.

Intervention

The intervention was aimed at changing the prescribers' behavior regarding prescribing for older adults to reduce PIP. The multi-faceted intervention consisted of one multimedia presentation on the 2019 Beers and 2015 STOPP/START criteria utilization in geriatric pharmacotherapy and the introduction of a new geriatric Beers and STOPP/START criteria smartphone application. The 3-hour presentation was organized as follows: Why PIP prevalence among the elderly, citing their peculiar elderly physiology. Followed by discussions on attributes, components and application of Beers and STOPP/START criteria. Finally, the physicians were introduced to the geriatric Beers and STOPP/START smartphone application, showed how it's used and its advantages. After the presentation, it was ensured that all the physicians had the application installed on their phones and it was test run by the Physicians answering 3 questions on the choice of geriatric pharmacotherapy using the phone application. An additional information brochure on adaptation of the Beers and STOPP/START criteria was also distributed to all the physicians for further reference.

A total of 28 doctors (Consultants, Medical Officers and Interns) from 4 departments of the hospital: Medicines, Surgery, General Outpatients, Obstetrics and Gynecology attended the lecture.

Data Analysis

The collected data from the extraction sheets were sorted, coded, and entered into the USA Statistical Package for Social Sciences (SPSS) statistical software version 21.0 for analysis. Mean, median and standard deviation were used for continuous variables and to summarize categorical variables, percentage was used. The chi-square test was used to assess differences in categorical variables pre and post-intervention. Wilcoxon's test was used to examine differences in continuous variables. Logistic regression was used to test the association between independent and dependent variables. Differences were considered significant if ($p< 0.05$)

ETHICALAPPROVAL

Ethics approval for the study was received from the Health Research Ethics Committee of Military Hospital Lagos (MHL) with approval no; MHLHREC/MAY 2022/APP-004 and as the study was retrospective, participants' consent forms were not required.

RESULTS

Study demographics and clinical characteristics of respondents

Two hundred and twenty case files of participants met the inclusion criteria for this study. Most of the participants 139 (62.7%) belonged to the age group 65-74 years and the median age observed was 72 (IQR,70-72) years. There were more male (55%) respondents. Most of the participants 87.27% were married. The majority (80%) of them had a secondary level of education and (90%) were retirees. The mean number of medicines used was 5.49±2.35before intervention and 5.01±2.2 per patient after the intervention while the range of medicines (2-10) before intervention remained unchanged after the intervention. Three quartiles of the patient had multiple diagnoses168 (76%) while the most prevalent disease recorded was hypertension (69.1%) followed by Diabetes mellitus (13.2%) as shown in Table 1 and Figure 1 below

Table1: Socio-Demographic and Clinical Characteristics of Patients' Records

Variable	Option	Frequency	% .
Patients Age (years)	(65-74)	139	63.18
Mean age ± SD	(75-84)	66	30.00
73.6 ± 6.1	(85-94)	11	5.00
	95+	4	1.82
Gender	Male	121	55.0
	Female	99	45.0
Marital Status	Married	192	87.27
	Widowed	25	11.36
	Divorced	3	1.36
Level of Education	1ry	21	9.55
	2ry	175	79.55
	3ry	24	10.90
Occupation	Retired	198	90.00
	Trader	13	5.91
	Self-employed	9	4.09
	Sum Total	220	100.0
Mean number of drugs prescribed BEFORE 5.49±2.35 (2-10)AFTER INTERVENTION 5.01±2.2			

5.01±2.2

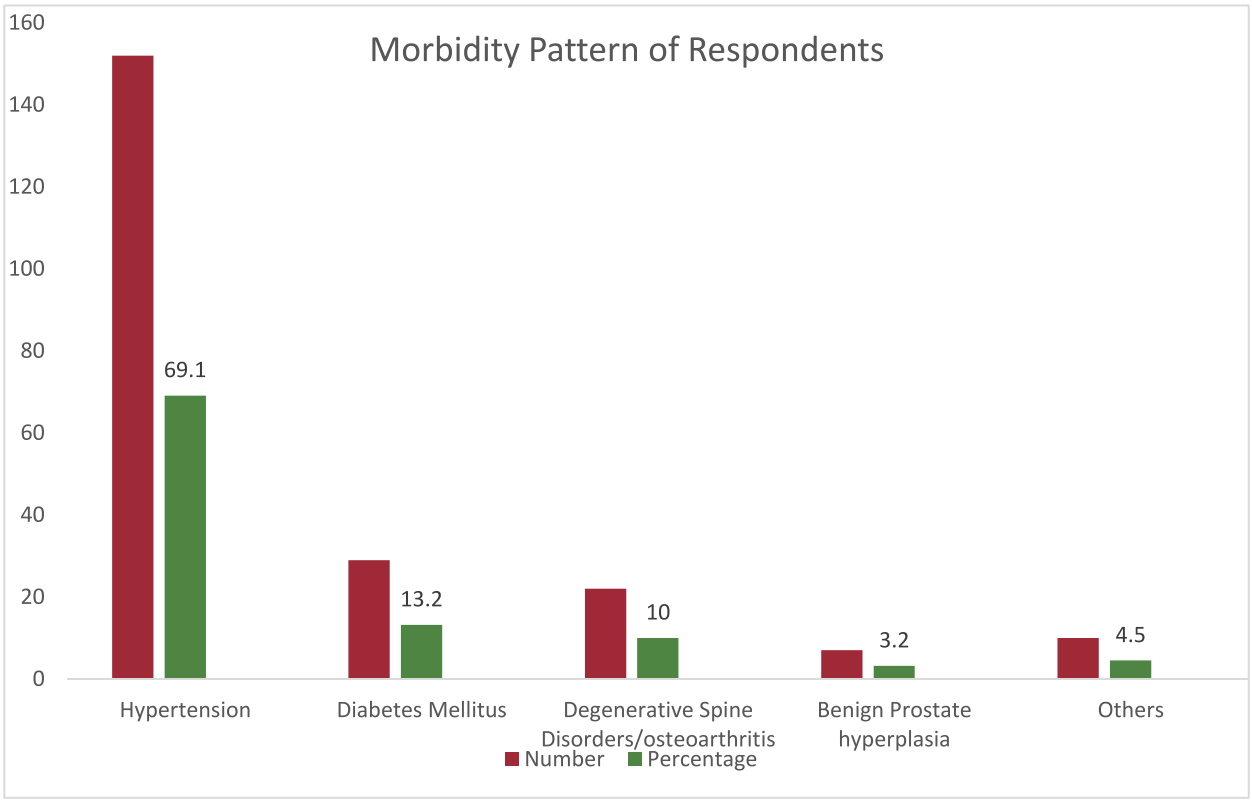

Fig 1: Morbidity pattern of the respondents

Potentially Inappropriate Medications (PIMs) prescribed or omitted before and after Intervention

Beers criteria identified 85 PIMs before the intervention which was reduced to 60 after the educational intervention and 94 STOPP PIMs before which was also reduced to 55 after intervention.10 PPOs were observed according to START criteria before which was not changed at all after the intervention. Methyldopa was the most prescribed PIM before and after educational intervention, accounting for almost a quarter of all the PIMs for both Beers and STOPP criteria. This was followed by glimepiride with glibenclamide. In addition, amitriptyline was also one of the most prescribed Beers PIM after intervention while celecoxib was one of the most prescribed STOPP PIM before the intervention. Regular inhaled corticosteroid for asthma patients with frequent exacerbation was the most omitted START drug before and after the intervention as shown in Tables 2 to 4 below.

Table 2.: Potentially Inappropriate Medicines prescribed before and after educational intervention

	PIM CATEGORY	JUSTIFICATION	BEFORE	AFTER
Variable	**Drug Name**	**Justification**	**N (%)**	**N (%)**
Beers Criteria Drugs	**PIMs to be avoided regardless of diagnosis**			
	Diclofenac	Avoid chronic use due to increased risk of gastrointestinal bleeding/ peptic ulcers in high risk >75group without PPI	4 (4.7)	1(1.7)
	Trihexyphenidyl	Other more potent anti - psychotics available	3(3.5)	3(5.0)
	Promethazine	Highly anticholinergic effects and clearance reduced in the elderly	2(5.8)	1(1.7)
	Glibenclamide	prolonged hypoglycemic effects and increased risk of falls	10(11.8)*	(10.0)*
	Amitriptyline	highly anticholinergic, sedative and orthostatic effect which may increase fall risk	4(4.7)	6(10.0)*
	Glimepiride	prolonged hypoglycemic effects and increased risk of falls	12(14.1)*	9(15.0)*
	Methyldopa	CNS side effects, bradycardia and orthostatic hypotension	21(24.7)*	12(20.0)*
	Hyoscine	Anticholinergic side effect and questionable effect	3(3.5)	2(3.3)
	Drug-disease or drug–syndrome			
	Heart failure	Pioglitazone due to risk of worsening heart failure	3(3.5)	3(5.0)
		Celecoxib due to risk of worsening heart failure	3(3.5)	2(3.3)
	Benign Prostate Hyperplasia	Orphenadrine due to ability to cause urinary retention	5 (5.8)	3(5.0)
	Drugs to be used with caution			
	Aspirin 75mg	for primary prevention of cardiovascular disease due to risk of major bleeding with no evidence of cardiovascular disease	6(7.1)	3(5.0)
	Clinically important drug interactions			
	Warfarin	+Amiodarone due to increased risk of bleeding (monitoring required)	3(3.5)	3(5.0)
	Celecoxib	+ warfarin due to increased risk of Bleeding	3(3.5)	3(5.0)
	Spironolactone	+candesartan due to increased risk of hyperkaliemia	3 (3.5)	3(5.0)
	Total		**85(100)**	**60(100)**

Table 3: Potentially Inappropriate Medicines prescribed before and after educational intervention (Contd)

Drug Name	JUSTIFICATION FOR PIM	BEFORE	AFTER
STOPP Criteria ANTIPLATELET/ Drugs ANTI COAGULANT			
Aspirin in uncontrolled severe hypertension	Due to increased risk of bleeding	3 (3.19)	1(1.81)
Aspirin for primary prevention of stroke without recorded proof cerebral, coronary or peripheral vascular conditions	Due to risk of bleeding	6 (6.38)	3(5.45)
Warfarin +Cox2 Inhibitors celecoxib, tenoxicam	Due to major risk of GI bleeding	3(3.19)	3(5.45)
Clopidogrel in uncontrolled severe hypertension	Due to increased bleeding risk	2(2.13)	1(1.81)
Clopidogrel for primary prevention without documented cardiovascular disease	Due to increased bleeding risk	3 (3.19)	1(1.81)
Clopidogrel + celecoxib without PPI	Due to increased bleeding risk	3 (3.19)	2(3.64)
STOPP MUSCULOSKELETAL			
NSAID+ corticosteroid without PPI	Increased risk of gastro intestinal bleeding	3 (3.19)	0 (0.00)
Cox2 inhibitor (Celecoxib) in any stage of heart failure	Worsens symptoms of heart failure	3(3.19)	2(3.64)
Diclofenac without PPI	Increased risk of gastrointestinal Bleeding	4(4.25)	1 (1.81)
STOPP CVS			
Spironolactone + drugs that increase potassium without monitoring	due to increased risk of hyperkaliemia	3 (3.19)	3(5.45)
ACEIs, ARBs Loop diuretics + Frusemide in dependent ankle edema	no evidence of heart failure, liver disease or nephrotic syndrome due to risk of intravascular volume depletion	3 (3.19)	2 (3.64)
Frusemide + urinary incontinence	Worsens symptoms	4 (4.25)	2(3.64)
Methyldopa	Less tolerated by elderly than younger adults	21(22.34)*	12 (21.81)*
STOPP ENDOCRINE			
Long -acting Sulfonylurea in Type 2 DM (Glimepiride)	Prolonged hypoglycemic effects	12(12.77)*	9(16.36)*
Glibenclamide	Prolonged hypoglycemic effect	10(10.64)	6(10.90)
Pioglitazone in Heart failure	Worsens Heart failure symptoms	3(3.19)	3(5.4)

STOPP CNS			
TCA with prostatism Amitriptyline	Worsens symptoms	1(1.08)	0(0.00)
Phenothiazines for nausea and vomiting Promethazine	Highly antimuscarinic effect	2 (2.13)	1(1.81)
Orphenadrine + chronic Prostatism	Worsens urinary retention	5 (5.32)	3(5.45)
Total		**94(100)**	**55(100)**

Table 4: Potential Prescribing Omissions before and after educational intervention

START	**Drug Name**	**JUSTIFICATION**	**BEFORE**	**AFTER**
Drugs	Bisphosphonate	Bisphosphonate and Vitamin D in patients taking oral corticosteroid to reduce the risk of osteoporosis	3(30%)	3(30%)
Antihypertensives in Diabetic patient		systolic blood pressure were above 140 mmHg or diastolic was above 90mmHg	3(30%)	3(30%)
Inhaled corticosteroid		Regular inhaled corticosteroids for patients with frequent exacerbation requiring oral corticosteroids to reduce hospitalization rates	4(40%)*	4(40%)*
TOTAL			**10(100)**	**10(100)**

Predictors of PIP

Binary logistic regression suggested that gender, level of education, occupation, drugs prescribed and morbidity had a significant influence on PIP at Wald = 6.402, 4.690, 3.469,31.014 and 37.027 since $p<0.05$ respectively. Females were shown to be 2.649 times more likely to experience PIP compared to males [odds ratio (OR) 1.089, confidence interval (CI) 1.0638-1.858 *P=0.011*]. Other predictors of PIP observed were those with active occupation, those receiving greater than 5 medications and those who had multi-morbidity. Conversely, individuals with higher levels of education demonstrated a decreased likelihood of engaging in PIP, with a reduction of 0.029 compared to those with lower educational attainment as shown in Table 5 below.

Table 5: A Predictive Model Applying Logistics Regression

Predictors	**Coefficients**	**S.E.**	**Wald**	**Odds Ratio (95%CI)**	**P-value**
Gender	0.974	0.385	6.402	2.649 (1.246, 5.633	0.011*
AGE	0.085	0.273	0.097	1.089 (0.638, 1.858)	0.755
Marital status	-0.202	0.451	0.201	0.817 (0.338, 1.977	0.654
Level of education	-3.548	1.671	4.507	0.029 (0.001, 0.762)	0.034*
Occupation	1.379	0.740	3.469	3.969 (0.930, 16.933)	0.043*
Drugs prescribed	0.614	0.110	31.014	1.849 (1.489, 2.295)	0.000*
Morbidity	2.153	0.714	37.027	9 (0.078, 2.101)	<0.001*
Constant	-6.454	1.819	12.587	0.002	0.000
Summary: The Nagelkerke R Squared = 0.711, Omnibus test of model coefficients: : Chi-squares value = 69.192 ($p<0.05$)					
Hosmer and Lemeshow Test: Chi-squares value = 15.315, Sig. = 0.018, Overall percentage prediction = 75.8% > 50.0%					
Method of Variable Removal = Backward Stepwise (Likelihood Ratio) *Significant at 5% level.					

Prevalence of PIP and Efficacy of educational intervention

The prevalence of STOPP criteria PIPs was reduced significantly after the educational intervention with installation of the screening tools smartphone application. (37.7% to 29 .1%; *p=0.045*) but the reduction of Beers prevalence from (30% to 22.7%; *p=0.3014*) was not significant neither was the START prevalence (4.5%; *p=0.500*) which was not reduced at all.

The data suggests a noteworthy shift in the overall PIP prevalence as before the intervention, 24 out of 100 patients exhibited PIP, which decreased to 18 out of 100 post-intervention which was statistically significance at P=*0.0002* as shown in Table 6 below.

Table 6: Prevalence of PIP and Impact of educational intervention

	BEFORE		**AFTER**		**t-test**	**p-value**
	Frequency N (%)	Frequency N (%)	Frequency N (%)	Frequency N (%)		
Variable	**No PIP**	**Yes PIP**	**No PIP**	**Yes PIP**		
Beers criteria	154 (70.0)	66 (30.0%)	170 (77.3%)	50 (22.7)	1.257	0.3014
STOPP	137 (62.3%)	83 (37.7)	156 (70.9%)	64 (29.1)	4.546	0.0454*
STARTcriteria	210 (95.5)	10 (4.5%)	210 (95.5)	10 (4.5)	0.005	0.5000
Total	501	159	536	124		
Overall %	75.9	24.1	81.2	18.8	3.757	0.0002

DISCUSSION

The impact of screening tools-based educational intervention for physicians coupled with the introduction and installation of smartphone screening tool applications in physicians' phones on potentially inappropriate prescribing for the elderly was investigated in this study. The most common disease observed was hypertension, and diabetes accounted for greater than 70% of all diseases, Table (1). This may be the reason why the most prescribed PIM for both Beers and STOPP criteria was methyldopa, followed by glimepiride and glibenclamide before and after the educational intervention. This finding is similar to another Nigerian study that evaluated PIP using 2019 Beers and 2015 STOPP that observed methyldopa and Nonsteroidal anti-inflammatory drugs (NSAIDs) as mostly prescribed Beers drugs while mostly prescribed STOPP drugs were NSAIDs together with antiplatelet without proton pump inhibitor, glimepiride and glibenclamide[18]. The clinical implication of this is that with methyldopa side effects of orthostatic hypotension coupled with sulphonylureas (glibenclamide and glimepiride) hypoglycemic effects, the elderly in this study could have a high risk of experiencing falls. More studies would need to be done in Nigeria to estimate drug-induced fall rates among the elderly using methyldopa and long-acting sulfonylureas. Furthermore, this study also observed the lack of documentation in the case files of any fall risk assessment done for these elderly patients. This oversight further reiterates the lack of knowledge of the physician about geriatric medicine in general.[15,19] Amitriptyline (Beers and STOPP drug) was the only PIM that the frequency of use increased after the educational intervention from 4 to 6 prescriptions as shown in Table (2). A possible explanation of this increase despite the educational intervention could be that it was prescribed mainly for insomnia which is said to be prevalent among the elderly.[20]

The high prevalence of Beers and STOPP criteria PIMs; (30% and 37.7%) respectively before the educational intervention are similar to another combined Nigerian and South African study that recorded Beers and STOPP PIM prevalence of (35.2 % versus 29.6%) respectively.[21] However lower than two other Nigerian and Chinese studies which recorded 67.2% and 85.3% respectively for Beers and STOPP PIM prevalence before and (40.2%,59.7%) respectively after intervention.[22,23] All be it that the later, Chinese study was on hospitalized elderly who may have had severe morbidity requiring overt polypharmacy which may account for the very high figures.

START PPO prevalence of (4.5%) pre and post-intervention was low in this study as compared with START PPO(53,2% vs 42%) pre and post-intervention prevalence observed in a similar Malaysian study on strategies to reduce PIP among discharged elderly.[17] This may be because the clinical tests observed in the case folders were by no means exhaustive to warrant START criteria. For example, fall risk assessment or bone mineral density scores are necessary to start the elderly on Vitamin D and calcium supplements. The clinical implication of this is that the elderly in this facility may be unduly exposed to greater morbidity as the prescribers managing them may not be prescribing the tests and consequently additional drugs, they need to help them get better. Hence more training and specialization in geriatric medicine is required for our Nigerian healthcare providers as they lack this training even from the medical schools up until present.[18,24] Notwithstanding, the low START prevalence of 4.5% in this study was similar to another finding from a Western Nigerian study which showed a 4.4% START prevalence as well.[11]

Also, predictors in this study were found to be female sex, those with lower level education, active occupation and polypharmacy, Table (5). These findings differ from a study carried out in India that observed the male gender, education level of 10–12th grade and the age 76-80 years as predictors of PIM[25] but agree with two other studies from Saudi Arabia and a Nigerian study[11,26]. The Saudi Arabian study concluded in their study that a higher number of dispensed medications, an increased number of diagnoses and the female sex were associated with being prescribed PIMs[26] while the Nigerian study showed polypharmacy to be significantly associated with PIP[11]. The above studies taken together suggest that the predictors of PIP are mostly polypharmacy and co-morbidities. The clinical implication of this is that healthcare providers must be knowledgeable enough to screen all prescriptions for the elderly who due to their ageing physiology as stated earlier inevitably have co-morbidities and therefore receive polypharmacy. This study indicates that educational intervention coupled with the introduction and installation of geriatric pharmacotherapy smartphone screening applications for prescribers significantly reduced overall PIP from about 1 in every 4 prescriptions to 1 in every 5 prescriptions *(P=0.002*) Table (6). STOPP PIP was also reduced after intervention (37.7% vs 29.1%, *P=0.045*) Table (6). These findings are similar to a Malaysian study on the 'Impact of a multifaceted intervention to reduce Potentially Inappropriate Prescribing among discharged older adults; a before and after study' which concluded that, "The smartphone app coupled with academic detailing was effective in reducing the prevalence of START PPO at discharge(53.3% Vs 42%); *P = 0.014*. However, it did not significantly affect the prevalence or pattern of PIM".[17]In addition, the results agree with another study on the Effect of Pharmacists intervention on PIP for the elderly in Canada concluded that "Pharmacists led intervention resulted in greater discontinuation of inappropriate prescriptions compared with usual care after 6 months". [28]

Although the PIMs mostly prescribed (Methyldopa, Glimepiride, Glibenclamide and Amitriptyline) increase the risk of falls in the elderly, this study is limited in not considering the actual presence of adverse drug events (ADEs) as a secondary endpoint. This would have enabled us to ascertain the extent to which we can apply these screening tools in our geographic setting. An additional limitation could be not using proper control of elderly prescriptions by doctors who were exempted from education on the usage of the screening tools. Proper randomization and control should be the focus of future studies.

CONTRIBUTION TO THE BODY OF KNOWLEDGE

This Pharmaceutical care intervention study reiterates the role of Pharmacists in bridging the knowledge gap among prescribers to resolve drug therapy problems and improve patient outcomes. Worthy of note is that PIMs mostly prescribed in this study (which can increase fall risk in the elderly) are in the Nigerian National Health Insurance Scheme (NHIS) and Essential Medicines List (EDL). This should promote discussions to promote research in developing our own National Prescribing Criteria for our vulnerable elderly population.

CONCLUSION

This study data suggests that a multifaceted intervention involving Beers and STOPP/START criteria-based educational intervention coupled with the introduction and installation of screening tools criteria smartphone application for physicians may be effective in reducing the PIP prevalence among patients hence enhancing prescription practices and patient care. Methyldopa and sulphonylureas; glimepiride and glibenclamide were the most prescribed PIMs before and after the intervention. Females, polypharmacy, active occupation and multimorbidity were significantly associated with PIP in this study. Continuous education in geriatric pharmacotherapy for physicians is necessary to reduce PIP

prevalence in the elderly. This study's findings should promote further studies that investigate the actual occurrence of adverse drug reactions linked to PIMs according to Beers and STOPP/START criteria in a Nigerian population.

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