ORIGINAL PAPER

https://dx.doi.org/10.4314/njpr.v15i2.1

Nig. J. Pharm. Res. 2019, 15 (2) pp 127-141
ISSN 0189-8434 e-ISSN 2635-3555 **Available online at http://www.nigjpharmres.com**

Evaluation of Drug Therapy Problems among Outpatient Hypertensive and Type-2-Diabetic Patients at a Tertiary Hospital, South-West Nigeria

R. ADISA*[A-F], D. O. OSOBA[B-F]

Department of Clinical Pharmacy and Pharmacy Administration, Faculty of Pharmacy, University of Ibadan, Ibadan, Nigeria

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of article.

Abstract

Background: Health-related burden and poor outcomes due to drug therapy problems (DTPs) is a major concern in healthcare delivery especially in resource-poor countries.

Objective: To evaluate extent and types of DTPs as well as disease-specific clinical parameters in outpatient hypertensive and type-2-diabetic (T2D) patients attending a tertiary hospital in Nigeria.

Materials and Methods: This entailed questionnaire-guided interaction with 205-adult hypertensive and 198-T2D patients who were purposively enrolled, followed by a retrospective review of their medical records from September - November 2018. Domains of DTP explored included drug and dose selection, drug form, treatment duration, patients' adherence and drug interactions. Data were summarised using descriptive statistics, while categorical variables were evaluated with Chi-square test at $p<0.05$ level of significance.

Results: Overall, 840 DTPs were identified among participants. This comprised 422(50.2 %) DTPs among T2D (average = 2.13 DTPs per patient), and 418(49.8 %) DTPs in the hypertensive (average = 2.04 DTPs per patient). The order of occurrence of DTPs among T2D was non-adherence [intentional, 173 (41.0 %) and unintentional, 69 (16.4 %)]>drug interactions, 155 (36.7 %)>drug selection, 25 (5.9 %); while for hypertensive patients, the order was non-adherence [intentional, 156 (37.3 %); unintentional, 57 (13.6 %)]>drug interactions, 157 (37.6 %)>dose selection, 25 (6.0 %)>drug selection, 23 (5.5 %). A total of 133(65.5 %) hypertensive patients had good blood pressure (≤140/90 mmHg) control, while the mean glycosilated haemoglobin was 7.5 (SD=2.6 %).

Conclusion: Extent of DTPs among participants is high, with non-adherence and drug interactions constituting the highest DTPs burden. There is generally a need for prescribers and pharmacists in particular to be wary of potential or actual DTPs during patient encounters, as this may ensure better therapeutic outcomes.

Keywords: Drug therapy problems, Hypertensive and type-2-diabetic patients, Outpatient, Nigeria.

INTRODUCTION

Drug therapy plays a crucial role in the treatment and improvement of quality of life of patients with chronic diseases including hypertension and diabetes mellitus (Pharmaceutical Care Network Europe (PCNE), 2010; Ganiyu *et al*., 2014; Niriayo *et al*., 2018). However, the benefits of drugs to patients may be compromised with the occurrence of drug therapy problems [DTPs] (PCNE, 2010; Westberg *et al*., 2017; Niriayo *et al*., 2018). Drug therapy problem refers to any undesirable event related to medication therapy that actually or potentially affects the desired goal of treatment (PCNE, 2010). It is common in hospitalised and ambulatory patients (Dahal *et al*., 2013; Nivya *et al*., 2015) and can occur at all steps of the treatment process such as during prescribing, transcribing, dispensing and administration of medication therapy (Redel, 2012; Dahal *et al*., 2013). Drug therapy problem is therefore a major concern in healthcare delivery largely because of its association with prolonged length of hospital stay, increased cost and economic burden, as well as morbidity and mortality with an almost 2-fold increase in the risk of death (Manley *et al*., 2003; Nivya *et al*., 2015). A review of the literature concerning DTPs has shown that 28% of all emergency department visits were medication-related, of which 70%-90% were preventable (Patel and Zed, 2002; Morris and Cantrill, 2003).

Hypertension and type 2 diabetes (T2D) are common chronic non-communicable diseases that pose major challenges for healthcare system in economically developing and developed countries (World Health Organisation [WHO], 2014). World health statistics reported that one-in-three and one-in-ten adults worldwide have an elevated blood pressure and blood glucose, respectively (WHO, 2014). The inevitable problem of multiple drug regimen arising from the instituted care for patients with hypertension and T2DM have been found to be associated with poor therapeutic outcomes, waste of resources and decreased quality of life (Ernst & Grizzle, 2001; Huri and Wee, 2013). Also, the increasing number and complexity of drugs coupled with the higher risk of multi-morbidities and advanced age among these patients could predispose to higher rate of treatment non-adherence, dosing problems, adverse drug reactions and actual/potential drug interactions, which constitutes the core components of DTPs (Gillespie *et al*., 2009; Gastelurrutia *et al*., 2011; Huri and Wee, 2013).

Pharmacists by virtue of their training have a vital role to play in identifying DTPs, thereby resolving the actual DTPs and prevent the potential ones through careful pharmaceutical care practice (ASHP, 2003; Graabaek and Kjeldsen, 2013). Thus, to achieve the best possible outcomes from drug therapy and attaining a quality healthcare service, any act in clinical practice that involve identification and resolution of drug therapy problems need to be embraced (ASHP, 2003; Graabaek and Kjeldsen, 2013). In general, DTPs are typically classified based on the cause of the problem and not on the clinical impact of the problem (Hohmann *et al*., 2012; Basger *et al.*, 2014), thus, the precise classification of DTPs varies across practices and research studies (Basger *et al.*, 2014). In Nigeria and many other resource-poor countries, there is dearth of studies that comprehensively look at the magnitude and burden of DTPs in patients with chronic diseases. This study therefore aimed to evaluate the extent and types of DTPs, as well as disease-specific clinical parameters among hypertensive and/or type-2-diabetic patients attending the medical outpatient clinic of a tertiary hospital in southwestern Nigeria. This is with a view to identifying areas of focus for future intervention to improve therapeutic outcomes.

METHODOLOGY

Study site

Study site was the University College Hospital (UCH), Ibadan. The UCH is a 900-bed teaching hospital affiliated with the University of Ibadan, Ibadan. The hospital comprised specialists in the different fields of medical practice, and is notable for treatment and care of different categories of ambulatory and institutionalised patients within and outside the region. The hospital is also a site for residence training for physicians as well as clinical training for other healthcare professionals including pharmacists and other ancillary health personnel.

Study design

This study was a prospective cross-sectional questionnaire-guided interaction with hypertensive and type-2-diabetic patients attending the medical outpatient clinic of UCH, followed by a retrospective review of their medical records between September and November 2018.

Study population

The study population included adult patients with primary diagnosis of T2D alone, hypertension alone and those with T2D comorbid hypertensive who attended the medical outpatient clinic of UCH within the study period.

Sample size determination

Representative sample size for the study was determined using the Raosoft® sample size calculator (www.raosoft.com/samplesize.html). Information from the medical outpatient record unit of the hospital indicated that an average of 35 patients each were regularly attended to during the weekly endocrinology and cardiology clinics of the hospital. Thus, for the 12-weeks study period, an estimated population of 420 patients was calculated for each disease category. Assuming a 95% confidence level and 5% margin of error, a sample size of 205 each was obtained for the hypertensive and type-2-diabetic patients, respectively. With the incorporation of a 10% attrition rate, a target sample size of approximately 230 patients was obtained for each disease category, to guide purposive enrollment of participants.

Inclusion and exclusion criteria

Patients enrolled into the study were consented adult patients with primary diagnosis of T2D alone, hypertension alone, as well as those with T2D comorbid hypertension. Also, eligible patients must have been on therapies for at least three months prior to the time of the study. Patients who were booked for inpatient admission and those who declined participation or with incomplete data in their case notes were excluded.

Data collection and sampling procedure

Eligible patients were approached for participation while waiting to see the physicians on the respective clinic days. The procedure and objectives of the study were explained to individual patient, after which voluntary verbal informed consent was obtained individually to signify intention for participation. The study protocol and informed consent was translated into Yoruba, the local language, for those who did not understand English Language, while elderly patients who require assistance were assisted by caregivers who accompanied them to the hospital. Translation and back-translation of response was subsequently done to ensure response consistency. Patients were assured of anonymity and confidentiality of responses, and were informed that participation is entirely voluntary. Only consented patients were purposively enrolled and interviewed using the questionnaire, while medical records of participants were subsequently reviewed using the data collection form.

Data collection instruments

The semi-structured questionnaire that guided the prospective interaction with patients consisted of three sections. Section A captured demographic information, section B evaluated the non-adherence behaviours of patients using modified "Show and Tell" questioning approach (Garder *et al*., 1994; Adisa and Fakeye, 2014), while challenges and side effects experienced with medications were also explored among the patients. Retrospective review of patients' case-notes was guided by data collection form which captured profile of prescribed regimen for at least two consecutive clinic visits, as well as laboratory investigations for disease-specific clinical parameters.

Pretest and content validation of instruments

The questionnaire and data collection form were assessed for content validity by a panel of two academic pharmacists and a medical consultant endocrinologist to ascertain the comprehensiveness and relevance of the item-questions *vis-a-vis* the study objectives, as well as ensuring that there are no ambiguous questions or statements. Subsequently, a pretest of the instruments was done among five randomly selected newly diagnosed patients with hypertension and/or T2D to ascertain the appropriateness of study design, as well as sampling and recruitment procedure. Feedback from the pretest and content validation led to minor modifications such as rephrasing of some closed-ended questions in an open-ended format with relevant prompts to ensure easy comprehension, while the data collection form was further expanded to capture specific modification or change in dosage regimen, as well as ensuring extraction of at least two disease-specific clinical parameters within two consecutive clinic visits for every participant.

Data analysis

Data were sorted, coded and entered into the Microsoft Excel for data management. The data were subsequently exported into the Statistical Package for Social Sciences (SPSS) version 23.0 for analysis. Descriptive statistics including frequency, percentage, and mean (standard deviation) were used to summarise the data. Pearson Chi-square ($\chi 2$) was used to evaluate association between relevant patients' characteristics and some disease-specific parameters including presence of comorbidity, number of medication per encounter, as well as clinical outcome, at $p < 0.05$ level of statistical significance. The identification and classification of DTPs was guided by combination of Pharmaceutical Care Network Europe classification tool version 6.2 (European Pharmaceutical Care, 2010) and consensus review by the investigators using the clinical judgement from appropriate standard reference text and disease treatment guidelines Chobanian *et al*., 2003; JNC 8, 2014; BNF, 2017; ADA, 2018). Possible drug-drug interaction was assessed using the Medscape drug interaction checker software (www.medscape.com).

Ethics approval

Ethical clearance and approval of the study protocol was granted by the joint University of Ibadan/UCH Research and Ethics Committee with the approval number of UI/EC/18/0246.

RESULTS

Response rate were 89.1 % and 86.1 % among hypertensive and type-2-diabetic (T2D) patients, respectively. The mean age was 61.8 (SD=14.9 years) in hypertensive, and 62.0 (SD=12.7 years) in T2D patients. Most of the participants were above 60 years of age [Hypertensive: 122 (59.5 %); T2D: 114 (57.6 %)]. Male constituted, 107 (52.2 %) among the hypertensive, while most of the T2D patients were females, 127 (64.4 %). Prescription with greater than four medications per encounter was 137 (69.2 %) among T2D, and 126 (61.4 %) in hypertensive patients (Table 1).

A total of 164 (80.0 %) hypertensive and 137 (69.2 %) T2D patients were in the clinic with prescribed medications to enable clarification of actual use of medication using modified "Show and Tell" questioning approach. Table 2 shows the detail of non-adherence behaviours of patients. Deliberate underuse of medication doses, 51 (21.1 %) constituted the most common intentional non-adherence behaviour in T2D patients, while taken drug holiday due to fear of side effects, 53 (24.5 %) was the most intentional non-adherence components among hypertensive participants. Forgetfulness was the most common unintentional non-adherence behaviour among participants [hypertensive: 23 (10.8 %); T2D: 17 (7.0 %)]. Challenges to medication-taking were cited to include expensive cost of medication [hypertensive: 38 (55.9 %); T2D: 29 (43.9 %)], as well as burden of daily intake of medicine [hypertensive: 13 (19.1 %); T2D: 19 (28.8 %)] Table 2. Thirty-eight (18.5 %) of the hypertensive patients reported to experience some side effects with medication(s), of which a total of 11 (28.9 %) reported frequent urination, dizziness and insomnia but could not identify the drugs responsible for the effects. Thirty-nine (19.7 %) of the T2D cited some side effects experienced with medication(s), of which most, 13 (33.3 %) were reported as hypoglycaemia, while 6 (15.4 %) mentioned erectile dysfunction.

Table 3 shows the summary of DTPs identified from the combined patients' interview and review of medical records. Overall, 840 DTPs were identified among participants in six major domains. This comprised, 418 (49.8 %) DTPs with an average of 2.04 DTPs per patient among the hypertensive, and 422 (50.2 %) DTPs with average of 2.13 DTPs per patient in T2D patients. Specific DTP components were identified in four domains for the hypertensive patients in the order of occurrence as non-adherence [intentional, 156 (37.3 %) and unintentional, 57 (13.6 %)] > potential drug-drug interactions, 157 (37.6 %) > dose selection, 25 (6.0 %) > drug selection, 23 (5.5 %); while for the T2D, DTP components were identified in three domains in the order of incidence as non-adherence [intentional, 173 (41.0 %) and unintentional, 69 (16.4 %)] > potential drug-drug interactions, 155 (36.7 %) > drug selection, 25 (5.9 %) Table 3. Changes/modifications in the patients' prescribed regimen within two consecutive clinic visits were summarised in Table 4. Seventy-four (36.1 %) of the hypertensive patients and 75 (37.9 %) T2D had modifications in the prescribed regimen. Overall dose increase was the most common modification among T2D, 24 (32.0 %); while overall dose decrease was the highest regimen changes that occur among the hypertensive, 20 (27.0 %).

Table 1: Demographic characteristics and relevant disease-specific parameters of participants

Variable	**Type-2-diabetes (n = 198)**	**Hypertension (n = 205)**
Age (years)	**Frequency (%)**	**Frequency (%)**
>30 – 40	11 (5.6)	20 (9.8)
41 – 50	22 (11.1)	26 (12.7)
51 - 60	51 (25.8)	37 (18.0)
>60	114 (57.6)	122 (59.5)
Gender		
Male	71 (35.9)	107 (52.2)
Female	127 (64.1)	98 (47.8)
Marital status		
Single	3 (1.5)	5 (2.4)
Married	165 (83.3)	165 (80.5)
Widowed	29 (14.6)	32 (15.6)
Divorced	1 (0.5)	3 (1.5)
Level of education		
None	35 (17.7)	56 (27.3)
Primary	46 (23.2)	42 (20.5)
Secondary	56 (28.3)	35 (17.1)
Tertiary	61 (30.8)	72 (35.1)
Occupation		
Business	114 (57.6)	101 (49.3)
Retired	69 (34.8)	69 (33.7)
Civil servant	15 (7.6)	34 (16.6)
Student	0 (0.0)	1(0.5)
Religion		
Christian	136 (68.7)	141 (68.8)
Islam	62 (31.3)	63 (30.7)
Traditional	0 (0.0)	1 (0.5)
Family history		
Yes	95 (48.0)	160 (78.0)
No	60 (30.3)	24 (11.7)
Don't know	43 (21.7)	21 (10.2)
Time since diagnosis of illness (years)		
< 1	11 (5.6)	37 18.1)
1-5	8 (4.0)	74 (36.1)
6 -10	51 (25.8)	36 (17.6)
>10	53 (26.8)	58 (28.3)
Duration of treatment (years)		
>3 months - < 1	31 (15.7)	58 (28.3)
1-5	13 (6.6)	91 (44.4)
6-10	55 (27.8)	26 (12.7)
>10	53 (26.8)	30 (14.6)
Number of medication per encounter		
< 4	61 (30.8)	79 (38.5)
≥4	137 (69.2)	126 (61.5)

n = number.

Table 2: Non-adherence behaviours and challenges to medication-taking among participants

Variables	T2D, n (%)	Hypertension, n (%)
Specific non-adherence behaviour	**n = 242**	**n = 213**
Intentional		
Deliberate underuse of medication doses	51 (21.1)	44 (20.7)
Skip some of the prescribed medications when symptom is controlled	50 (20.7)	14 (6.6)
Take drug holiday because of fear of side effect(s)	22 (9.1)	53 (24.9)
Self-medication with unprescribed medication(s)	16 (6.6)	5 (2.3)
Sometimes boredom/tired of daily intake of medicine(s)	14 (5.8)	12 (5.6)
Dissatisfaction with therapy	9 (3.7)	5 (2.3)
Defaults in clinic attendance	4 (1.7)	5 (2.3)
Medication stoppage on account of belief that symptom(s) is/are under control/feel healthy	7 (2.9)	2 (0.9)
Not regular on adjunct prescribed medication	0 (0.0)	16 (7.5)
Unintentional		
Forgetfulness	17 (7.0)	23 (10.8)
Exhausted medication before refill	10 (4.1)	16 (7.5)
Financial constraints	9 (3.7)	2 (0.9)
Duplication of medication using different brands of the same drug	9 (3.7)	0 (0.0)
Uncomfortable with insulin's route of administration	9 (3.7)	NA
Unintentional underuse of doses	9 (3.7)	10 (4.7)
Lack of understanding of drug usage	1 (0.4)	5 (2.3)
Discontinuation of medications on account of advice from someone else	1 (0.4)	0 (0.0)
Doubling of dose when previous dose is missed	1 (0.4)	0 (0.0)
Caregiver does not administer right dose of the prescribed medications	1 (0.4)	1 (0.5)
Claims of not given prescription to buy medications	1 (0.4)	0 (0.0)
Poor insulin administration technique	1 (0.4)	NA
Challenges to medication-taking		
Yes	66 (33.3)	68 (32.2)
If yes, specific challenge(s)		
Expensive cost of medication	29 (43.9)	38 (55.9)
Daily intake of medicine(s)	19 (28.8)	13 (19.1)
Lack of access to medicine(s)	8 (12.1)	10 (14.7)
Pain at injection site	4 (6.1)	NA
Need to receive care from multiple healthcare facilities	2 (3.0)	0 (0.0)
Inadequate understanding of most of the medicine information by the caregiver	1 (1.5)	2 (2.9)
Visual impairment	1 (1.5)	0 (0.0)
Inability to properly administer insulin	1 (1.5)	NA
Dissatisfaction/lack of belief in therapy	1 (1.5)	5 (7.4)
Brought prescribed medication(s) to the clinic		
Yes	137 (69.2)	164 (80.0)
No	61 (30.8)	41 (20.0)
Reason(s) for not bringing medications to the clinic		
In the clinic with the prescription sheet	16 (26.2)	12 (29.3)
I didn't know I am to bring the medication(s) to the clinic	14 (23.0)	9 (22.0)
I forgot it	12 (19.7)	7 (17.1)
I know the names of my medicines	12 (19.7)	9 (22.0)
I didn't buy my medications	3 (4.9)	3 (7.3)
My doctor didn't say i should bring it	2 (3.3)	1 (2.4)
My medicines are finished	1 (1.6)	0 (0.0)
Patient claimed not to be given prescription to buy medication(s)	1 (1.6)	0 (0.0)

n = number, T2D = Type-2-diabetes, NA = Not applicable

Table 3: Drug therapy problems identified among type-2-diabetes and hypertensive participants

Primary domain of drug therapy problems	T2D, n (%) n = 422	Hypertension, n (%) n = 418
1.Problem related to drug selection	25 (5.9)	23 (5.5)
Specific drug selection problem		
Synergistic drug required and not prescribed	21 (84.0)	9 (39.1)
No indication for drugs	3 (12.0)	0 (0.0)
New indication for drug treatment presented	1 (4.0)	4 (17.4)
Too many drugs prescribed for the indication	0 (0.0)	1 (4.3)
Inappropriate combination of drugs	0 (0.0)	0 (0.0)
More cost effective drugs available	0 (0.0)	0 (0.0)
Indication for drug treatment not noticed	0 (0.0)	0 (0.0)
2. Dosage/Drug form		
Inappropriate dosage form	0 (0.0)	0 (0.0)
3. Problem related to dose/dosage regimen	0 (0.0)	25 (6.0)
Specific dose selection problem		
Dose too high	0 (0.0)	0 (0.0)
Drug dose too low	0 (0.0)	0 (0.0)
Dosage regimen not frequent enough	0 (0.0)	0 (0.0)
Dosage regimen too frequent.	0 (0.0)	0 (0.0)
Inappropriate dosing frequency	0 (0.0)	0 (0.0)
Deterioration of blood glucose/blood pressure control requiring dose adjustment	0 (0.0)	15 (60.0)
Improvement of blood glucose/blood pressure control requiring dose adjustment	0 (0.0)	10 (40.0)
4. Duration of treatment		
Duration of treatment too long	0 (0.0)	0 (0.0)
Duration of treatment too short	0 (0.0)	0 (0.0)
5. Problem related to patients' adherence/drug use process		
Intentional non-adherence behaviour	173 (41.0)	156 (37.3)
Unintentional non-adherence behaviour	69 (16.4)	57 (13.6)
6. Others		
Potential drug-drug interactions	155 (36.7)	157 (37.6)
Side effects not attended to	0 (0.0)	9 (39.1)
Average drug therapy problem per patient	**2.13**	**2.04**

n = number, T2D = Type-2-diabetes

Table 4: Summary of changes and modifications in patients' medication regimen within two consecutive clinic visits

Variables	T2D (n = 198)	Hypertension (n = 205)
Change/modification in regimen from previous to recent visit	**n (%)**	**n (%)**
Yes	75 (37.9)	74 (36.1)
No	123 (62.1)	131 (63.9)
If yes, specific change(s)	**n = 75**	**n = 74**
Overall dose increase	24 (32.0)	14 (18.9)
Addition of synergistic drug	14 (18.7)	10 (13.5)
Switching to another class of drug	9 (12.0)	0 (0.0)
Overall dose decrease	7 (9.3)	20 (27.0)
Discontinuation of one of the medications	5 (6.7)	7 (9.5)
Addition of synergistic drug and switching to another drug in the same class	3 (4.0)	0 (0.0)
Dose increase and addition of a synergistic drug	2 (2.7)	4 (5.4)
Dose increase and discontinuation of one of the medications	2 (2.7)	2 (2.7)
Addition of synergistic drug and switching to another class of drug	2 (2.7)	0 (0.0)
Addition of a new drug for a new indication	1 (1.3)	0 (0.0)
Switching to another drug in the same class	1 (1.3)	2 (2.7)
Dose increase and dose decrease for some medications	1 (1.3)	1 (1,4)
Dose decrease and addition of a synergistic drug	1 (1.3)	3 (4.1)
Dose increase and addition of synergistic drug and one of the medication discontinued	0 (0.0)	2 (2.7)
Dose increase and switching to another class of drug	1 (1.3)	2 (2.7)
Dose increase, dose decrease, switching to another class of drug	1 (1.3)	0 (0.0)
Dose decrease and switching to another class of drug	1 (1.3)	0 (0.0)
Addition of a synergistic drug and discontinuation of one of the medication	0 (0.0	1 (1.4)
Dose decrease and discontinuation of one of the medications	0 (0.0)	6 (8.1)

n = number, T2D =Type-2- diabetes

Tables 5 and 6 show details of assessment of potential drug-drug interactions from the comprehensive review of prescribed regimen for hypertensive and T2D patients, respectively. Among the hypertensive participants, a total of 532 potential drug-drug interactions in different combination was noted, out of this, 515 (96.8 %) were classified as interactions that need to be closely monitored, 14 (2.6 %) were regarded as serious drug interactions, while 3 (0.6 %) were categorised as drug interactions of minor significance. Beta-blockers, 222 (41.7 %) and angiotensin converting enzyme inhibitors, 142 (26.7 %) were the antihypertensive medications mostly involved in drug-drug interactions (Table 5). For the T2DM, a total of 372 potential drug-drug interactions was noted in different combination; of this, 285 (76.6 %) were classified as interactions requiring close monitoring, 87 (23.4 %) as minor non-clinically significant interactions and none as serious drug interaction (Table 6).

The mean systolic blood pressure (BP) among hypertensive patients for the first and second consecutive clinic visits were 127.1 ± 22.7 and 130 ± 24.3 mmHg, while the diastolic BP were 78.8 ± 13.3 and 79 ± 14.4 mmHg, respectively. Overall, 133 (65.5%) hypertensive patients had blood pressure ≤ 140/90 mmHg indicating good control, while 70 (34.5%) had suboptimal BP > 140/90 mmHg. One hundred and forty-seven (74.2 %) T2D patients had fasting blood glucose (FBG) documented in the case notes with the overall mean FBG of 120.6 (SD=47.8) mg/dL; of this, 100 (68.0 %) had FBG < 126 mg/dL indicating good blood glucose control, while 47 (32.0%) had FBG ≥ 126 mg/dL signifying suboptimal control. Of the 84 (42.2 %) T2D who had glycosilated haemoglobin (HbA1c) documented in the case notes, 48 (57.1 %) had HbA1c ≤7 % indicating good long-term glycaemic control, while 36 (42.9 %) had HbA1c > 7 % suggesting poor glycaemic control. The overall mean HbA1c was 7.5 (SD=2.6 %).

Table 5: Possible drug-drug interactions identified in the prescribed medication regimen for hypertension patients within two consecutive visits

Drug-drug interaction		**Frequency (%)**
Yes		157 (76.6)
No		48 (23.4)
Specific drug-drug interaction	**Possible effects**	**N = 532**
A.Serious drug interaction		
β-blocker + Digoxin	Either increases the toxicity of other	9 (1.7)
ACEI + Pregabalin	Either increases the toxicity of other, increased risk of angioedema	3 (0.6)
CCB + Statin	Increase in effect of Nifedipine by Statins	1 (0.2)
Amiloride + Spironolactone	Increase in serum potassium	1(0.2)
B. Minor drug interaction		
Thiazide diuretics + Clopidogrel	Increase in level of Clopidogrel	2 (0.4)
CCB + Prednisolone	Prednisolone decreases effects of CCB	1 (0.2)
C. Interaction to monitor closely		
β-blocker + Potassium sparing diuretics	Both increase serum potassium	52 (9.8)
β-blocker + Loop diuretics	β blocker increases and loop diuretics decreases serum potassium	48 (9.0)
β blocker + CCB	Both increase anti-hypertensive channel blocking	32 (6.0)
β-blocker + ARBs	Risk of hyperkalemia by pharmacodynamics synergism	30 (5.6)
β-blocker + (Amiloride + Hydrochlorothiazide)	β-blocker increases and diuretics decreases serum potassium	20 (3.8)
β- blocker + Digoxin	Effects of digoxin is increase by pharmacodynamics synergism	17 (3.2)
β-blocker + Aspirin	Both increase in serum potassium	13 (2.4)
β-blocker + Dabigatrin	Increase in effects of dabigatrin by p-glycoprotein efflux transporter	1 (0.2)
ACEI + Potassium sparing diuretics	Risk of hyperkalemia	43 (8.1)
ACEI + Loop diuretics	Risk of hypotension and renal insufficiency	38 (7.1)
ACEI + Aspirin	Either increase toxicity of other which may result in renal function deterioration with high dose Aspirin in elderly	23 (4.3)
ACEI + Digoxin	Effects of digoxin is increase by unspecified mechanism	15 (2.8)
ACEI + Amiloride	Risk of hyperkalemia by pharmacodynamics synergism.	10 (1.9)
ACEI + Metformin	Toxicity of metformin is increases by unspecified mechanism	7 (1.3)
ACEI + Sulphonylureas	Increase in effects of sulphonylurea by pharmacodynamics synergism	3 (0.6)
ARBs + Thiazide diuretics	ARBs increases and diuretics decreases serum potassium	41 (7.7)
ARBs + Potassium sparing diuretics	Both increase serum potassium	18 (3.4)
ARBs + Aspirin	Both increase serum potassium	6 (1.1)
ARBs + Statin	Increase toxicity of statins (Increased risk of myopathy)	5 (0.9)
ARBs + Digoxin	Increase in level of s digoxin by unknown mechanism and increase serum potassium	4 (0.8)
Loop diuretics + Digoxin	Effects of digoxin is increase by pharmacodynamics synergism	18 (3.4)
Potassium sparing diuretics + Digoxin	Effects of digoxin is increase by P-glycoprotein efflux transporter	18 (3.4)
Loop diuretics/hydrochlorothiazide + Aspirin	Aspirin increases and diuretics decreases serum potassium	27 (5.1)
Potassium sparing diuretics + Aspirin	Both increases serum potassium	13 (2.4)
Thiazide diuretics + Statin	Increase in level of statins by p-glycoprotein efflux transporter	5 (0.9)
Thiazide diuretics + Warfarin	Decrease in effects of warfarin by unknown mechanism	3 (0.6)
Spironolactone + Risperidone	Increase in level of risperidone by p-glycoprotein efflux transporter	2 (0.4)
Loop diuretics + Metolazone	Decrease in the effects of statins by p-glycoprotein efflux transporter	1 (0.2)
Thiazide diuretics + Tadalafil	Increase in effects of diuretics by pharmacodynamics synergism	1 (0.2)
CCB + Statins	Decrease in the effects of statins by p-glycoprotein efflux transporter	1 (0.2)

Classification of significance of the interaction	
Monitor closely	515 (96.8)
Serious	14 (2.6)
Minor	3 (0.6)

Source: *Medscape drug interaction checker****. Definitions: Serious drug interaction****- Use of alternatives is advised****, Monitor closely*** *– Drug interaction involving close monitoring****, Minor drug interaction*** *- Not clinically significant. CCB = Calcium channel blockers, ACEI = Angiotensin converting enzyme inhibitor, ARBs = Angiotensin II receptor blocker, N = number in different combinations*

Table 6: Possible drug-drug interactions identified in the prescribed medication regimen for type-2-diabetic patients within two consecutive visits

Drug-drug interactions		**Frequency (%)**
Yes		155 (78.3)
No		43 (21.7)
Specific drug-drug interaction	**Possible effects**	**N = 372**
Minor drug interaction		
Biguanide + CCB	Increase in effect of metformin, risk of hypoglycaemia	33 (8.9)
Biguanide + Thiazide diuretics	Decrease in effect of biguanide	31 (8.3)
Insulin + Thiazide diuretics	Decrease in the effect of insulin	10 (2.7)
Sulphonylurea+Thiazide diuretics	Decrease in the effect of sulphonylurea	9 (2.4)
Sulphonylurea + Aspirin	Aspirin increases the effect of glimepiride by plasma protein binding competition	4 (1.1)
Interactions to monitor closely		
Biguanide + Insulin	Either increase the effect of others	96 (25.8)
Biguanide + ACEI	Increased risk of lactic acidosis and hypoglycemia	72 (19.4)
Biguanide + Olanzepine	Olanzepine is associated with hyperglycemia	3 (0.8)
Biguanide + Amiodarone	Increase in the effect of metformin	2 (0.5)
Insulin + ACEI	Increase in effect of insulin by pharmacodynamic synergism	30 (8.1)
Insulin + Aspirin	Increase in effect of insulin by pharmacodynamic synergism	19 (5.1)
Insulin + ARBs	Increase in effect of insulin	13 (3.5)
Insulin + DPP4	Either increase the effect of others	12 (3.2)
Insulin + Sulfonylurea	Either increase the effect of others	4 (1.1)
Insulin + Olanzepine	Alteration in glucose level, thus the possibility of hyperglycaemia	1 (0.3)
Sulfonylurea + ACEI	Increase in effects of sulphonylurea by pharmacodynamics synergism	29 (7.8)
Sulphonylurea + Statins	Increase in toxicity of statins, may increase risk of myopathy	1 (0.3)
Thiazolidinedione + Statins	Increase in toxicity of statins, may increase risk of myopathy	3 (0.8)
Classification od significance of the interaction		
Monitor closely	285 (76.6)	
Minor	87 (23.4)	
Serious	0 (0.0)	

Source: Medscape drug interaction checker**. Definitions: Serious drug interaction**- Use of alternatives is advised**, Monitor closely** – Drug interaction involving close monitoring**, Minor drug interaction** - Not clinically significant. CCB = Calcium channel blockers, ACEI = Angiotensin converting enzyme inhibitor, ARBs = Angiotensin II receptor blocker, **DPP4** = Dipeptidyl peptidase 4 inhibitor, N = number in different combination

Table 7 shows the relationship between relevant patients' characteristics and disease-specific parameters. Educational level significantly influenced glycaemic outcome among the T2D patients, with those who had at least secondary education largely had good glycaemic control ($\chi 2 = 5.997$, df = 3, p = 0.01). Also, number of medications per encounter ($\chi 2 =$ 4.936, df =1, p = 0.03) significantly influenced medication adherence among hypertensive patients. Patients who were placed on ≥ 4 medications were found to be better adherent compared to those on < 4 medications per encounter.

Table 7: Association between relevant patients' characteristics and disease-specific parameters

Variables	Type-2-diabetes Comorbidity		BP assessment (mmHg)		Glycaemic assessment	
Age (years)	**Yes**	**No**	**Good BP ≤ 140/90**	**Poor BP> 140/90**	**Good HbA1c<7 %**	**Poor HbA1c ≥ 7%**
<40	4 (2.5)	7 (18.9)	7 (5.4)	3 (5.1)	5 (10.4)	2 (5.6)
40-50	15 (9.3)	7 (18.9)	15 (11.5)	5 (8.5)	5 (10.4)	6 (16.7)
51-60	45 (28.0)	6 (16.2)	31 (23.8)	17 (28.8)	11 (22.9)	15 (41.9)
>60	97 (60.2)	17 (45.9)	77 (59.2)	34 (57.6)	27 (56.2)	13 (36.1)
	$\chi2$ = 19.800	p < 0.001*	$\chi2$ = 0.779	p = 0.854	$\chi2$= 5.286	p = 0.152
Level of education						
None	27 (16.8)	8 (21.6)	26 (20.0)	8 (13.6)	6 (12.5)	4 (11.1)
Primary	43 (26.7)	3 (8.1)	25 (19.2)	19 (32.2)	9 (18.8)	12 (33.3)
Secondary	46 (28.6)	10 (27.0)	42 (32.3)	12 (2-.3)	19 (39.6)	6 (16.7)
Tertiary	45 (28.0)	16 (43.2)	37 (28.5)	20 (33.9)	14 (29.2)	14 (38.9)
	$\chi2$ =7.190	p = 0.066	$\chi2$ = 6 302	p = 0.098	$\chi2$ = 5.997	p = 0.011*
Medication per encounter						
< 4	26 (16.1)	35 (94.6)	50 (38.5)	7 (11.9)	18 (37.5)	9 (25.0)
≥ 4	135 (83.9)	2 (5.4)	80 (61.5)	52 (88.1)	30 (62.5)	27 (75.0)
	$\chi2$ = 86.850	p < 0.001*	$\chi2$ =13.630	p < 0.001*	$\chi2$ =1.47	p = 0.225
Family history						
Yes	75 (46.6)	20 (54.1)	67 (51.5)	26 (44.7)	20 (41.7)	18 (50.0)
No	51 (31.7)	9 (24.3)	38 (29.2)	18 (30.5)	15 (31.2)	13 (36.1)
Not known	35 (21.7)	8 (21.6)	25 (19.2)	15 (25.4)	13 (27.1)	5 (13.9)
	$\chi2$= 0.867	p = 0.642	$\chi2$ =1.218	p = 0.544	$\chi2$ =2.133	p = 0.344
	Hypertensive patients Comorbidity		**BP assessment (mmHg)**			
Age (years)	**Yes**	**No**	**BP ≤140/90**	**BP >140/90**		
<40	5 (4.9)	15 (14.7)	14 (10.5)	5 (7.1)		
40-50	16 (15.5)	10 (9.8)	16 (12.0)	10 (14.3)		
51-60	20 (19.4)	17 (16.7)	24 (18.0)	13 (18.6)		
>61	62 (60.2)	60 (58.8)	79 (59.4)	42 (60.0)		
	$\chi2$ = 6.656	p = 0.084	$\chi2$ = 0.753	p = 0.861		
Level of education						
None	24 (23.3)	32 (57.1)	34 (25.6)	21 (30.0)		
Primary	18 (17.5)	24 (23.5)	32 (24.1)	10 (4.3)		
Secondary	20 (19.4)	15 (14.7)	19 (14.3)	16 (22.9)		
Tertiary	41 (39.8)	31 (30.4)	48 (36.1)	23 (32.9)		
	$\chi2$ = 4.098	p = 0.251	$\chi2$ = 4.542	p = 0.209		
Medication per encounter						
< 4	30 (29.1)	49 (48.0)	55 (41.3)	23 (32.9)		
≥ 4	73 (70.9)	53 (52.0)	78 (58.6)	47 (67.1)		
	$\chi2$ = 7.740	p < 0.005*	$\chi2$=1.399	p = 237		
Family history						
Yes	82 (79.6)	78 (76.5)	102 (76.7)	56 (80.0)		
No	12 (11.7)	12 (11.8)	17 (12.8)	7 (10.0)		
Not known	9 (8.7)	12 (11.8)	14 (10.5)	7 (10.0)		
	$\chi2$ = 0.524	p = 0.770	$\chi2$ = 0.377	p = 0.828		

*n = number, HbA1c = Glycosilated haemoglobin, *significant difference with Pearson Chi-square (X^2) test. Level of significance p <0.05. BP = Blood pressure, BP classification is based on the Eight Joint (JNC 8) National Committee for Diagnosis, Classification, Detection and Management of High Blood Pressure, Glycaemic assessment is based on American Diabetes Association criteria for HbA1c goal.*

DISCUSSION

In this study, close to three-quarters each of hypertensive and T2D patients demonstrate arrays of intentional non-adherence behaviours as the most common DTP. Notably, more than one-fifth of participants in each disease category engage in deliberate underuse of medication dose(s). Overall, non-adherence problems followed by potential drug-drug interactions, as well as dose and drug selection problems were identified among hypertensive patients in varying proportions, while all except dose selection problem was observed in T2D participants.

The preponderance of intentional non-adherence behaviours demonstrated by patients in our study is worrisome considering the fact that, this type of attitudinal deficit or behaviour is the most intractable form of non-adherence behaviour to resolve in clinical practice (Gardner *et al*., 1991). Healthcare providers especially physicians and pharmacists may therefore need to take cognizance of these medication-taking attitudes of patients during the patient-provider interaction. Specifically, they should be more conscious of intentional and unintentional non-adherence behaviours which may compromise the achievement of optimal therapeutic outcome. Therapy adherence has been identified as a core component of drug therapy problems that is often overlooked in clinical practice (Costa *et al*., 2015; Pellicer *et al*., 2015). Thus, the necessity to continually reinforce the importance of consistent adherence to prescribed pharmacologic and non-pharmacologic therapies at every encounter with hypertensive and T2DM patients, while emphasizing its benefits in achieving better blood pressure and blood glucose control. The modified "Show and Tell" questioning approach employed in our study largely assisted in unfolding the necessary gaps in medication-taking behaviour of patients, hence, the approach can be regarded as a practicable patient-centred questioning skills that may be encouraged among pharmacists in resolving adherence-related issues in clinical practice. In general, an average of 2.04 and 2.13 DTPs per patient was obtained among the hypertensive and T2D, respectively. Hsu *et al* (2015), Westberg *et al* (2017) and Niriayo *et al* (2018) reported a higher value with an average of 5.9, 2.5 and 2.6 DTPs per patient in their respective studies, while a lower value of 1.5, 1.54 and 0.84 DTPs per patient was reported by Gastelurrutia *et al* (2011), Ganiyu *et al* (2014) and Adibe *et al* (2017) respectively. Other studies reported varying patterns of occurrence of individual DTPs in diabetes and/or hypertensive groups (Odili *et al*., 2011; Huri *et al*., 2013). The possible reason for the variation in DTP occurrence across different diseases and care settings may be due to the differences in the methods of DTP identification and classification, practitioner's expertise and experiences as well as disease distribution and population demographics (Westberg *et al*., 2017). Drug therapy problems have been recognised as a problem that can arise during the management of different diseases and can occur at all steps of the treatment process regardless of the clinical settings (Dahal *et al*., 2013; Al Hamid *et al*., 2014). The inevitable problem of multiple drug regimen arising from the standard care and management of patients with chronic diseases may typically increase the possibility of exposing patients to a higher incidence of DTPs (Gillespie *et al*., 2009; Gastelurrutia *et al*., 2011; Huri *et al*., 2013).

It is noted that hypertensive and T2D participants contribute approximately 50% each to the overall magnitude of DTPs, though there are differences in the specific DTP components demonstrated by patients in each disease category. In our study, a large number of participants were above 60 years of age, while more than three-quarters of T2D and approximately half of hypertensive patients had comorbid illness. Also, more than two-thirds of T2D and nearly 62% of the hypertensive were on ≥ 4 medications. All these, might have possibly contributed to the greater likelihood of varying display of non-adherence behaviours, dosing problems and potential drug-drug interactions which are major components of DTPs (Gillespie *et al*., 2009; Rahmawati *et al*., 2009; Gastelurrutia *et al*., 2011; Huri *et al*., 2013). However, presence of unresolved DTPs in patients may results into avoidable upward or downward adjustments of medication doses by prescribers, as largely noted in the medication regimen for nearly 40% each of the hypertensive and T2D participants in our study. Nascimento *et al* (2009) and Westberg *et al* (2017) reported the highest severity DTP classes as adherence and adverse drug reaction, while Odili *et al* (2011) and Adibe *et al* (2017) identified inappropriate drug selection/dosing problem and drug interaction as the major source of DTPs in their respective studies.

In our study, we found out that potential drug-drug interactions were abound in the prescribed regimen for patients, with more than three-quarters each among the hypertensive and T2D participants. Previous studies

also reported drug interactions as a common DTPs in patients, especially those on multiple chronic regimen (Odili *et al*., 2011; Zaal *et al.*, 2013; Westberg *et al*., 2017; Adibe *et al*., 2017), while antidiabetes and cardiovascular-related medications have been identified as drug classes with a higher risk of severity of adverse drug reactions (Westberg *et al*., 2017). This perhaps further underscores the need for prescribers to be more vigilant and be wary of the possible medication interaction potentials whenever a prescription of multiple regimen for patients with chronic diseases is being envisaged. Also, the pharmacist whose role in patient care is directly focus on identifying and resolving DTPs (ASHP, 2003) should always make proactive efforts in unravelling any area of deficit in patients' medication-use process, thereby averting the adverse consequence(s) that may arise from medication non-adherence and drug interactions.

Though, in our study, we did not directly evaluate the severity of drug interactions, however, based on Medscape drug interaction checker and classification of significance (www.medscape.com), nearly 97% and more than three-quarters of the identified drug interactions in hypertensive and T2D participants, respectively, were those that requires close monitoring. It may therefore be highly essential for the prescribers and pharmacists in particular to take cognizance of potential drug-drug interactions whenever a fixed or co-administered combination of antihypertensive and antidiabetes medications is being anticipated for patients. Pharmacists by virtue of their training have a pivotal role to play in identifying and resolving DTPs more than any other healthcare professionals (ASHP, 2003; Graabaek and Kjeldsen, 2013; Richardson *et al*., 2014), and there is increasing evidence that indicate a positive influence in clinical practice with participation and intervention by clinical pharmacists in healthcare (Viktil and Blix, 2008; Christensen *et al*., 2011; Richardson *et al*., 2014; Ojeh *et al*., 2015).

Interestingly in our study, approximately 65 % of the hypertensive and more than two-thirds of T2D patients had good blood pressure (BP) control. However, nearly 57 % of T2D patients had HbA1C <7 % and more than two-thirds had fasting blood glucose below 126 mg/dL indicating good glycaemic control (ADA, 2018). The moderately good clinical outcome recorded among participants may in part corroborates the greater proportion (>60 %) of patients in each disease category who were without any dosage modification within two consecutive clinic visits. Primary care providers may therefore need to intensify efforts in ensuring zero tolerance to treatment non-adherence among patients, as well as ensuring pragmatic approach to avert possible adverse consequences of potential drug-drug interactions, thereby allowing for more patients to achieve the desired goals of therapy.

In this study, educational level of patients seem to have significant influence on the glycaemic control of T2D. Studies have identified a positive correlation between educational qualification of patients and the clinical outcomes (Onotai, 2008; Adisa and Fakeye, 2014). Thus, there may be a need for hypertensive and diabetes primary care provider to closely pay attention to patient's educational status during patient-provider interaction, in order to ensure better therapeutic outcomes. Majority of the hypertensive and T2D participants were above 60 years, which may possibly corroborate the fact that the two chronic diseases typically becomes more evident during the 5^{th} to 6^{th} decade of life (Colosia *et al*., 2013; WHO, 2014; Asresahegn *et al*., 2017). However, this does not rule out the likelihood of occurrence of hypertension and T2D in younger adults, especially when there is a first-degree family history and genetic predisposition (Yekeen *et al*., 2003; WHO, 2014). Also, nearly 80% of the hypertensive and almost 50% of T2D participants had a family history of the disease. This seems consistent with the report that indicate patient's family history as a strong risk factor for the development of most chronic diseases including hypertension and T2D (Chineye *et al*., 2012; Asresahegn *et al*., 2017).

Despite the comprehensiveness and useful information provided in our study, its limitation may include the possibility of recall and documentation bias which may make the detection and substantiating claims for the occurrence of DTPs to be subjective. Studies have shown that DTPs related research may be cofounded by a number of inherent factors (Haley *et al*., 2009; Ganiyu *et al*., 2014). Nevertheless, the approach of combining prospective patients' interview with concurrent review of case notes in the identification and classification of DTPs, coupled with the clinical judgement from supporting standard reference text and disease treatment guidelines (Chobanian *et al*., 2003; JNC 8, 2014; BNF, 2017; ADA, 2018) may constitutes a useful strength of our study. However, the non-inclusion of intervention component to resolve the identified DTPs may be a gap that need to be addressed in future study, in order to ensure a far-reaching conclusion on DTPs burden and the clinical outcomes.

CONCLUSION

It can be concluded from this study that the extent of DTPs among participants is high, with non-adherence and drug interactions constituting the highest DTPs burden. There is generally a need for prescribers and pharmacists in particular to be wary of potential or actual DTPs during patient encounters, as this may ensure better therapeutic outcomes .

REFERENCES

Adibe, M.O., Igboeli, N.U and Ukwe, C.V. (2017). Evaluation of drug therapy problems among renal patients receiving care in some tertiary hospitals in Nigeria. Trop. J. Pharm. Res. 16 (3): 697-704.

Adisa, R and Fakeye, T.O. (2014). Treatment non-adherence among patients with poorly controlled type 2 diabetes in ambulatory care settings in southwestern Nigeria Afr. Health Sci. 14(1):1-10.

Al Hamid, A., Ghaleb, M., Aljadhey, H., Aslanpour, Z. (2014). A systematic review of hospitalization resulting from medicine-related problems in adult patients. Br. J. Clin. Pharmacol. 78: 202–217.

American Diabetes Association (2018). Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes. Diabet. Care 41(Suppl 1): S13-S27.

American Society of Hospital Pharmacists (2003). ASHP statement on the pharmacist's role in the care of patients with HIV infection. Am. J. Health Syst. Pharm. 60(19): 1998-2003.

Asresahegn, H., Tadesse, F and Beyene, E. (2017). Prevalence and associated factors of hypertension among adults in Ethiopia: a community based cross-sectional study. BMC Res. Notes 10: 629.doi.10.1186/s13104-017-2966-1.

Basger. B.J., Moles, R.J and Chen, T.F. (2014). Application of drug-related problem (DRP) classification systems: a review of the literature. Eur. J. Clin. Pharmacol. 70: 799-815.

British National Formulary 2017 Edition. British Medical Association and Royal Pharmaceutical Society.

Chineye, S., Uloko, A.E., Ogbera, A.O., Ofoegbu, E.N., Fasanmade, O.A., Fasanmade, A.A and Ogbu, O.O. (2012). Profile of Nigerians with diabetes mellitus – Diabetes Nigeria study group (2008): Results of a multicenter study. Indian J. Endocrinol. Metab. 18(4):558-564.

Chobanian, A.V., Bakris, G.L, Black, H.R, Cushman, W.C, Green, L.A, Izzo, J.L Jr., Jones, D.W., Materson, B.J., Oparil, S., Wright, J.T Jr and Rocella, E. J. (2003). "The seventh report of the joint national report on prevention, detection, evaluation, and treatment if high blood pressure: the JNC 7 report". JAMA 289: 2560-2572.

Christensen, A.B., Holmbjer, L., Midlöv, P., Höglund, P., Larsson, L., Bondesson, A.A and Eriksson, T. (2011). The process of identifying, solving and preventing drug related problems in the LIMM-study. Int. J. Clin. Pharm. 33: 1010–1018.

Colosia, A.D., Palencia, R and Khan, S. (2013). Prevalence of hypertension and obesity in patients with type 2 diabetes mellitus in observational studies: a systematic literature review. Diabetes Metab. Syndr. Obes. Targets Ther. 6: 327-338.

Costa, E., Giardini, A., Savin, M., Menditto, E., Lehane, E., Laosa, O., Pecorelli, S., Monaco, A and Marengoni A. (2015). Interventional tools to improve medication adherence: review of literature. Patient Prefer. Adher. 9: 1303–1311.

Dahal, P., Kumar, S.B., Venkataraman, R and Fuloria, P.C. (2013). Assessment of clinical pharmacist intervention in tertiary care teaching hospital of southern India. Asian J Pharm. Clin. Res. 6(2): 258–261.

Eight Joint National Committee (JNC 8) Guidelines for the Management of Hypertension in Adults. (2014). Am. Fam. Physician 90(7): 503-504.

Ernst, F.R and Grizzle, A.J. (2001). Drug-Related Morbidity and Mortality: Updating the Cost of Illness Model. J. Am. Pharm. Assoc. 41: 192–199.

Ganiyu, K.A., Suleiman, I.A and Erah, P.O. (2014). Drug therapy problems in patients on antihypertensives and antidiabetic drugs in two tertiary health institutions in Niger Delta region, Nigeria. J. Pharm. Allied Sci. 11(1): 1986 – 1995.

Gardner, M., Boyce, R.W., Herrier, R.N. (1994). Pharmacist-patient Consultation Program (PPCP- Unit 3): Counseling to Enhance Compliance. National Healthcare Operations, New York; Pfizer Incorporated: pp 4-87.

Gastelurrutia, P., Benrimoj, S.I and Jos, E. (2011). Negative clinical outcomes associated with drug-related problems in heart failure (HF) outpatients: Impact of a pharmacist in a multidisciplinary HF Clinic. J. Cardiac Fail.. 17(3): 217–223.

Gillespie, U and Henrohn. A.A. (2009). A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: A randomized controlled trial, Arch. Intern. Med. 169(9): 894-900.

Graabaek, T and Kjeldsen, L.J. (2013). Medication reviews by clinical pharmacists at hospitals lead to improved patient outcomes: A systematic review. Basic Clin. Pharmacol. Toxicol. 112: 359–373.

Haley, M., Raymond, C., Nishi, C and Bohm, E. (2009). Drug-related problems in patients undergoing elective total joint arthroplasty of the hip or knee. Can. J. Hosp. Pharm. 62(5): 360-366.

Hohmann C, Eickhoff C, Klotz JM, Schulz M, Radziwill R. Development of a classification system for drug-related problems in the hospital setting (APS-Doc) and assessment of inter-rater reliability. J. Clin. Pharm. Ther. 2012;37:276-281.

Hsu, W., Shen, L and Lee, C. (2015). Drug-related problems vary with medication category and treatment duration in Taiwanese heart failure outpatients receiving case management. J.Formos Med. Assoc. 7 :1–8.

Huri, H.Z and Wee, H.F. (2013). Drug related problems in type 2 diabetes patients with hypertension: a cross-sectional retrospective study. BMC Endocr. Disord. 13:2.doi.10.1186/1472-6823-13-2.

Manley, H.J., McClaran, M.L., Overbay, D.K., Wright, M.A., Reid, G.M., Bender, W.L., Neufeld, T.K., Hebbar, S and Muther, R.S. (2003). Factors associated with medication-related problems in ambulatory hemodialysis patients. Am. J. Kidney Dis. 41(2): 386- 393.

Morris, C.J and Cantrill, J.A. (2003). Preventing drug-related morbidity: the development of quality indicators. J. Clin. Pharm. Ther. 28: 295-305.

Nascimento, Y.A., Carvalho, W.S and Acurcio, F.A. (2009). Drug-related problems observed in a pharmaceutical care service, Belo Horizonte, Brazil. Braz. J. Pharm. Sci. 45(2):321-330.

Niriayo, Y.L., Kumela, K., Kassa, T.D and Angamo, M.T. (2018). Drug therapy problems and contributing factors in the management of heart failure patients in Jimma University Specialized Hospital, Southwest Ethiopia. PLoS ONE 13(10): e0206120.

Nivya, K., Sri, V., Kiran, S., Ragoo, N., Jayaprakash, B and Sekhar, M.S. (2015). Systemic review on drug related hospital admissions–A pubmed based search. Saud. Pharm. J. 23(1): 1–8.

Odili, V.U., Egiebor, B.O and Oparah, A.C. (2011). Identification of Drug Therapy Problems in Patients with Diabetes Treated in a Secondary Care Facility in Benin City. Nig. J. Pharm. Res. 9(1):72-81.

Ojeh, V.B., Naima, N., Abah, I.O., Falang, K.D., Lucy, O., London, I., Dady, C., Agaba, P and Agbaji, O. (2015). Pattern of drug therapy problems and interventions in ambulatory patients receiving antiretroviral therapy in Nigeria. Pharm. Pract. 13(2): 566.doi: 10.18549/PharmPract.2015.02.566.

Onotai, L.O. (2008). A review of the impact of the health literacy status of patients on health outcomes. Nig. Health J. 8:32–38.

Patel, P and Zed, P.J. (2002). Drug-related visits to the emergency department; how big is the problem? Pharmacotherapy 22(7): 915-923.

Pellicer, R., Riu, M and Salas, E. (2015). Patient risk factors for developing a drug-related problem in a cardiology ward. Ther. Clin. Risk Manag. 11: 9–15.

Pharmaceutical Care Network Europe Foundation. PCNE Classification for Drug Related problems (revised 14-0110 vm) V6.2 2010. Available at: http://www.pcne.org/workinggroups/2/drug-related-problems. Accessed 25 July, 2019.

Rahmawati, F., Pramantara, D.P., Rohmah, W and Sulaiman, S.A.S. (2009). Polypharmacy and unnecessary drug therapy on geriatric hospitalized patients in yogyakarta hospitals, Indonesia. Int. J. Pharm. Pharm. Sci. 1(1):6-11.

Reddel, H. (2012). Rational prescribing for ongoing management of asthma in adults. Aust. Prescr. 35: 43-46.

Richardson, T.E., O'Reilly, C.L and Chen, T.F. (2014). Drug-related problems and the clinical role of pharmacists in inpatient mental health: An insight into practice in Australia. Int. J. Clin. Pharm. 36: 1077-1086.

Viktil, K.K and Blix, H.S (2008). The impact of clinical pharmacists on drug-related problems and clinical outcomes. Basic Clin. Pharmacol. Toxicol. 102(3): 275–280.

Westberg, S.M., Derr, S.K, Weinhandl, E.D., Adam, T.J., Brummel, A.R., Lahti, J., Reidt, S. L, Sick, B.T., Skiermont, K.F and St. Peter, W.L. (2017). Drug therapy problems identified by pharmacists through comprehensive medication management following hospital discharge. J. Pharm. Tech. 33(3): 96 –107.

World Health Organization. Non-communicable Diseases, Country Profiles 2014. Available at: http://www.who.it/nmh/publications/ncdprofiles-2014/en/. Accessed 25 July, 2019.

Yekeen. L.A., Sanusi, R.A and Ketiku, A.O. (2003). Prevalence of obesity and high level of cholesterol in hypertension: Analysis of Data from the University College Hospital, Ibadan. Afr. J. Biomed. Res. 6: 129–132

Zaal, R.J., Jansen, M.M., Duisenberg-van Essenberg, M., Tijssen, C.C., Roukema, J.A and van den Bemt, P.M. (2013). Identification of drug-related problems by a clinical pharmacist in addition to computerized alerts. Int. J. Clin. Pharm. 35: 753–762.

*Address for correspondence: Rasaq Adisa

Department of Clinical Pharmacy and Pharmacy Administration,
Faculty of Pharmacy,
University of Ibadan,
Ibadan, Nigeria
Telephone: +2348034226199
E-mail: adisaras73@yahoo.co.uk

Conflict of Interest: None declared

Received: August 29, 2019

Accepted: December 2, 2019