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Outlook

Invitation to review a manuscript for Discover Endocrinology and Metabolism from Dr Trivedi

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To Abraham Simatupang <abraham.simatupang@uki.ac.id>

Invitation to review "Impact of disease knowledge and attitude, health literacy and medication adherence on disease control for patients with diabetes and/or hypertension – an interventional study"

Dear Dr Simatupang,

We have received a manuscript for Discover Endocrinology and Metabolism that we think falls within your area of expertise. Our reviewers are integral to ensuring we have the highest-quality publication.

We would greatly appreciate it if you could let us know if you are available to review by accepting or declining the invitation link below.

Title: Impact of disease knowledge and attitude, health literacy and medication adherence on disease control for patients with diabetes and/or hypertension – an interventional study

Abstract: Background: Disease control is a multifactorial health concern, especially in patients with chronic diseases. Factors like health literacy, medication adherence, disease knowledge and attitude could influence disease control among patients with diabetes and/or hypertension. It is important to evaluate such factors and find out the impact on disease control.
Methods: A clinical trial involving pre and postinterventional study was conducted among patients with diabetes and/or hypertension in selected community pharmacies. Sequel to baseline assessment of patients' fasting blood glucose (FBG), diastolic and systolic blood pressure (DBP and SBP), educational intervention and 3-month postintervention assessment were conducted. Data were analysed with descriptive and inferential statistics with level of significance set at $p<0.05$.
Results: Two hundred and forty-one (diabetes-48, hypertension-193) patients with an average age of 56.50 + 12.6 years completed the study. Mean values (preintervention vs postintervention, p value) for point-of-care testing and the objective scales used are as follows: SBD (145.43 ± 80.23 vs 128.77 ± 12.72 mmHg, p=0.001), DBP (89.82 ± 38.32 vs 81.44 ± 8.20 mmHg, p=0.001), FBG (110.89 ± 42.39 vs 94.51 ± 9.95 mg/dL, p<0.001), diabetes knowledge (12.35 ± 2.48 vs 17.91 ± 0.35, p<0.001), diabetes attitude (57.33 ± 7.09 vs 59.93 ± 4.33, p=0.002), hypertension knowledge (9.95 ± 1.76 vs 12.75 ± 0.49, p<0.001), hypertension attitude (48.51 ± 6.91 vs 51.56 ± 5.44, p<0.001) and medication adherence (1.50 ± 0.10 vs 0.40 ± 0.04, p<0.001). Diastolic blood pressure control was observed in 135 (56.0%) patients preintervention, which increased to 207 (85.9%) postintervention. Systolic blood pressure was controlled in 128 (53.1%) preintervention and 208 (86.3%) postintervention. Fasting blood pressure control was observed among 205 (85.1%) preintervention and 241 (100.0%) postintervention. While no significant differences were observed between patients' health literacy, diabetes knowledge and disease duration when compared with disease control; diabetes attitude, hypertension knowledge, hypertension attitude,

medication adherence, and age were significantly different with disease control.
Conclusions: Educational intervention offered improved disease control among patients. Disease control was influenced by patients' diabetes attitude, hypertension knowledge, hypertension attitude, medication adherence, and age.

Authors: Akinniyi Akinbiyi Aje, Modupe Olubukola Aroyewun

We hope to hear from you soon.

Kind regards,

Devanshi Trivedi
Editorial Board Member
Discover Endocrinology and Metabolism

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Title Page

Impact of disease knowledge and attitude, health literacy and medication adherence on disease control for patients with diabetes and/or hypertension – an interventional study

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Abstract

Background: Disease control is a multifactorial health concern, especially in patients with chronic diseases. Factors like health literacy, medication adherence, disease knowledge and attitude could influence disease control among patients with diabetes and/or hypertension. It is important to evaluate such factors and find out the impact on disease control.

Methods: A clinical trial involving pre and postinterventional study was conducted among patients with diabetes and/or hypertension in selected community pharmacies. Sequel to baseline assessment of patients' fasting blood glucose (FBG), diastolic and systolic blood pressure (DBP and SBP), educational intervention and 3-month postintervention assessment were conducted. Data were analysed with descriptive and inferential statistics with level of significance set at $p<0.05$.

Results: Two hundred and forty-one (diabetes-48, hypertension-193) patients with an average age of 56.50 + 12.6 years completed the study. Mean values (preintervention vs postintervention, p value) for point-of-care testing and the objective scales used are as follows: SBD (145.43 ± 80.23 vs 128.77 ± 12.72 mmHg, p=0.001), DBP (89.82 ± 38.32 vs 81.44 ± 8.20 mmHg, p=0.001), FBG (110.89 ± 42.39 vs 94.51 ± 9.95 mg/dL, p<0.001), diabetes knowledge (12.35 ± 2.48 vs 17.91 ± 0.35, p<0.001), diabetes attitude (57.33 ± 7.09 vs 59.93 ± 4.33, p=0.002), hypertension knowledge (9.95 ± 1.76 vs 12.75 ± 0.49, p<0.001), hypertension attitude (48.51 ± 6.91 vs 51.56 ± 5.44, p<0.001) and medication adherence (1.50 ± 0.10 vs 0.40 ± 0.04, p<0.001). Diastolic blood pressure control was observed in 135 (56.0%) patients preintervention, which increased to 207 (85.9%) postintervention. Systolic blood pressure was controlled in 128 (53.1%) preintervention and 208 (86.3%) postintervention. Fasting blood pressure control was observed among 205 (85.1%) preintervention and 241 (100.0%) postintervention. While no significant differences were observed between patients' health literacy, diabetes knowledge and disease duration when compared with disease control; diabetes attitude, hypertension knowledge, hypertension attitude, medication adherence, and age were significantly different with disease control.

Conclusions: Educational intervention offered improved disease control among patients. Disease control was influenced by patients' diabetes attitude, hypertension knowledge, hypertension attitude, medication adherence, and age.

Keywords: Point-of-care testing, health literacy, medication adherence, diabetes, hypertension, community pharmacy.

INTRODUCTION

Medication therapy management is an all-encompassing service rendered by pharmacists to adequately monitor patients to optimize patient health outcomes [1]. This becomes vital to offer adequate guidance to patients through education and counselling. It also entails point-of-care testing to monitor disease progression, especially with patients with chronic diseases. Community pharmacists' provision of medication therapy management helps to improve the quality of healthcare received by patients and it eventually culminates in better disease control.

Several factors such as patients' disease knowledge, disease attitude, medication adherence, health literacy could interplay with disease control [2 – 4]. Patients will benefit from consistent education on the chronic nature of the disease, the need to embrace lifestyle management changes and medication adherence. Patients require a great deal of guidance on disease knowledge. There are many myths around that patients may have picked up along the way, and these must be addressed. Also, there may be a need for clarification on disease-related issues. Community pharmacists occupy a vantage position to consolidate whatever patients may have been taught by healthcare professionals in the hospitals [5]. Also, patients' attitudes to disease require attention. The display of negative attitude to their disease may lead to poor self-care practices that could eventually worsen their disease state [6]. Patients should be regularly engaged by community pharmacists during their medication refill to assess their attitude with a view to counselling them to develop positive attitudes.

Health literacy, which refers to how much patients obtain, appraise, and grasp basic health information and required skills for adequate health decisions [7], is also a factor that could affect patients' disease control. It has been shown to impact self-care among patients [8] and could thereby pose a risk to disease control and adversely alter health outcomes [9 – 10]. Patients' level of health literacy should inform the manner of information dissemination by healthcare professionals such that irrespective of their health literacy level, they are able to understand the message. Medication adherence is another factor worth considering as

regards disease control. The chronic nature of diabetes and hypertension calls for special focus on patient medication adherence.

There are insufficient studies on the impact of community pharmacists' intervention among patients with diabetes and hypertension, particularly in developing nations. An interventional study was carried out to assess health literacy, medication adherence, disease knowledge and attitude among patients with diabetes and/or hypertension assessing care in selected community pharmacies.

METHODS

Study design and site

A clinical trial which utilized a pre postinterventional study design was carried out among consented patients with diabetes and/or hypertension accessing care at selected community pharmacies in Ibadan, Nigeria. Ibadan is a large city with 11 Local Government areas. The study took place between August 2023 and March 2024.

Sample size determination, inclusion and exclusion criteria

A community pharmacy was chosen from each of the 11 local government areas in Ibadan. At least 20 patients were recruited from each of the pharmacies selected for this study. This calculation was on account of the preliminary fact that approximately 10 patients with diabetes or hypertension would access the community pharmacies for prescription refill or point-of-care testing during the acceptable window period for fasting blood glucose test (based on the recommendation of the American Diabetes Association, it is about 10:00am). Each pharmacy was therefore visited at least twice to recruit a minimum of 20 patients for the preintervention data collection to arrive at a minimum sample size of 220 patients. The procedure was repeated three-month postintervention for data collection. Inclusion criteria were patients with type 2 diabetes and/or hypertensive patients who were 18 years or older, and on at least one medication. Pregnant women were excluded from the study.

Data collection procedure and instruments

Eligible patients who came for either prescription refill or point-of-care testing at the designated pharmacies were approached to obtain informed consent to participate in the study. The point-of-care testing carried out (blood pressure and fasting blood glucose measurement) was documented in a data collection form. Blood pressure was measured after resting for at least 5 minutes using Omron M3 Comfort automatic blood pressure monitor. Fasting blood sugar was determined using Fine Test glucometer after an overnight fast but not beyond 10.00 am. A semi-structured questionnaire was utilized for data collection on patients' sociodemographic characteristics which included gender, age and duration of disease, and the following

validated assessment scales –Morisky, Green, Levine medication adherence scale [11], Diabetes Knowledge Assessment Scale, Diabetes Attitude Assessment Scale [12], Hypertension Knowledge Assessment Scale and Hypertension Attitude Assessment Scale [13], Short Assessment for health literacy in English (SAHLE) [14]. Responses to the 4-item medication adherence assessment scale was coded as follows: “yes” was assigned “1” and “no” assigned “0”. High, medium and low adherence was defined as a total score of 0, 1 and >1, respectively. The SAHLE scale comprises 18 questions and patients with 0 – 14 correct responses are considered to have low health literacy, while those with 15 – 18 were considered to have high health literacy.

Blood pressure reading less than 140 mmHg and less than 90 mmHg of systolic and diastolic blood pressure, respectively indicated controlled blood pressure [15]. Glycemic control was defined as fasting blood glucose within 70 - 130mg/dL [16].

Intervention

In addition to educational material provided, each patient was counselled on self-care techniques, disease knowledge and attitude, medication adherence and lifestyle changes (diet and exercise). Each patient was given educational material with information on the intervention points. Follow up was done with online communication (phone calls, text messages, and WhatsApp messages, with each patient contacted at least six times within three months) to emphasize positive adherence behaviors and address any question the patients raised, to achieve better therapeutic outcomes.

Data analysis

Data analysis was done using SPSS for Windows Version 20.0 (IBM Corp, New York, USA). Data was described using descriptive statistics - frequency count, percentage, and mean ± standard deviation. Inferential statistics utilized were independent-samples t-test (to compare continuous variables e.g., disease knowledge, disease attitude, medication adherence, disease duration, age with disease control), paired-samples t-test (to compare the continuous variables e.g., fasting blood glucose, disease knowledge and attitude, pre and postintervention). Significance level was set at $p<0.05$.

Ethics approval

The research work protocol was submitted to the Oyo State Ministry of Health Research Ethics Committee, Ibadan and approval was granted with approval number NHREC/OYOSHRIEC/10/11/22. The research was registered with ClinicalTrials.gov with identification number NCT05996601.

RESULTS

Out of the 312 patients recruited for the study, 241 completed the study (Figure 1); out of whom 164 (68.0%) were female patients. The average age of patients was 56.50 + 12.6 years with 144 (59.8%) and 97 (40.2%) within 18 - 59 years and ≥ 60 years, respectively. The Marital status of the patients showed that 15 (6.2%) were single, 186 (77.2%) married. 3 (1.2%) divorced and 37 (15.4%) widowed. Eleven (4.6%) patients were civil servants, 37 (15.4%) self-employed, 155 (64.3%) worked in the private sector and 38 (15.8%) were retired. The level of education of the patients revealed that 12 (5.0%) had no formal education, 41 (17.0%) primary, 71 (29.5%) and 117 (48.5%) tertiary education. Disease duration of the patients revealed that 25 (52.1%) were within 1-5 years, 16 (33.3%) 6-10 years and 7 (14.6%) greater than 10 years for patients with diabetes, and 114 (59.1%) 1-5 years, 54 (28.0%) 6-10 years and 25 (13.0) greater than 10 years for patients with hypertension.

Patients' health literacy assessment showed that 153 (63.5%) had low health literacy while 88 (30.3%) had high health literacy (Table 1). Table 2 shows the medication adherence status of the patients, with 89 (36.9%) having low adherence preintervention but only 10 (4.1%) with low adherence postintervention. While majority of the patients (22, 46.8%) had fair diabetes knowledge at the preintervention phase, the majority (46, 97.9%) had excellent diabetes knowledge postintervention as presented in Table 3. For patients with diabetes, patients who had excellent disease attitude increased from 9 (19.1%) preintervention to 15 (31.9%) postintervention. (Table 4). Mean diastolic blood pressure (in mmHg) decreased from 89.82 ± 38.32 to 81.44 ± 8.20 with diastolic blood pressure controlled among 135 (56.0%) patients, which increased to 207 (85.9%) postintervention. Likewise, mean systolic blood pressure decreased from 145.43 ± 80.23 to 128.77 ± 12.72, with systolic blood pressure control observed among 128 (53.1%) preintervention and 208 (86.3%) postintervention. Fasting blood pressure control was observed among 205 (85.1%) preintervention and 241 (100.0%) postintervention, with the mean fasting blood pressure reducing from 110.89 ± 42.39 to 94.51 ± 9.95 mg/dL.

Tables 5 and 6 provides a detailed report on patients' hypertension knowledge and attitude, respectively. While most of the patients (88, 45.5%) had good hypertension knowledge preintervention, 187 (96.4%) had excellent knowledge postintervention. Patients with excellent hypertension attitudes increased from 55 (28.4%) preintervention to 69 (35.6%) postintervention. While no significant differences were observed between patients' health literacy, diabetes knowledge and disease duration when compared with disease control; diabetes attitude, hypertension knowledge (with systolic blood pressure control), hypertension attitude (with diastolic and systolic blood pressure), medication adherence, and age (with fasting blood glucose control, diastolic and systolic blood pressure control) as shown in Table 7. Table 8 shows the significant difference observed between preintervention and postintervention measurements of fasting blood glucose, diastolic and systolic blood pressure, and assessment of the scales utilized in this study.

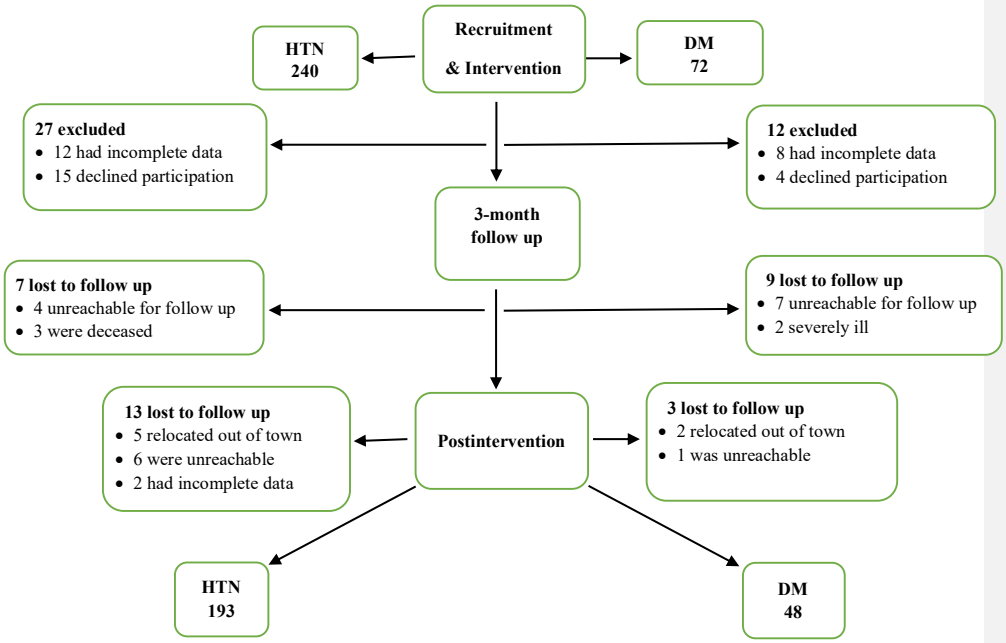

Figure 1 CONSORT flowchart for study participants
CONSORT = Consolidated Standards of Reporting Trial DM = Diabetes HTN = Hypertension

Table 1. Patient's Short Assessment of Health Literacy–English pre and postintervention

				Frequency (%) of correct response	
Stem	**Key or Distractor**			**Preintervention**	**Post-intervention**
Kidney	Urine	Fever	Don't know	184 (76.3)	210 (87.1)
Occupation	Work	Education	Don't know	154 (63.9)	153 (63.5)
Medication	Instrument	Treatment	Don't know	231 (95.9)	232 (96.3)
Nutrition	Healthy	Soda	Don't know	214 (88.8)	214 (88.8)
Miscarriage	Loss	Marriage	Don't know	146 (60.6)	147 (61.0)
Infection	Plant	Virus	Don't know	215 (89.2)	218 (90.5)
Alcoholism	Addiction	Recreation	Don't know	129 (53.5)	128 (53.1)
Pregnancy	Birth	Childhood	Don't know	202 (83.8)	199 (82.6)
Seizure	Dizzy	Calm	Don't know	148 (61.4)	153 (63.5)
Dose	Sleep	Amount	Don't know	172 (71.4)	171 (71.0)
Hormones	Growth	Harmony	Don't know	130 (53.9)	140 (58.1)
Abnormal	Different	Similar	Don't know	185 (76.8)	185 (76.8)
Directed	Instruction	Decision	Don't know	162 (67.2)	165 (69.5)
Nerves	Bored	Anxiety	Don't know	165 (68.5)	174 (72.2)
Constipation	Blocked	Loose	Don't know	204 (84.6)	207 (85.9)
Diagnosis	Evaluation	Recovery	Don't know	106 (44.0)	111 (46.1)
Hemorrhoids	Veins	Heart	Don't know	147 (61.0)	147 (61.0)
Syphilis	Contraception	Condom	Don't know	141 (58.8)	145 (60.2)
Health literacy category		**Low health literacy**		153 (63.5)	154 (63.9)
		High health literacy		88 (30.3)	87 (36.1)

Table 2. Patients' Medication Adherence Assessment pre and postintervention

Questions asked	Frequency (%) of correct response	
	Preintervention	Postintervention
Do you ever forget to take your medicine?	147 (61.0)	225 (93.4)
Are you careless at times about taking your medicine?	157 (65.1)	233 (96.7)
When you feel better, do you sometimes stop taking your medicine?	119 (49.4)	174 (72.2)
Sometimes, if you feel worse when you take the medicine, do you stop taking it?	179 (74.3)	234 (97.1)
Medication adherence category		
Low adherence	89 (36.9)	10 (4.1)
Medium adherence	48 (19.9)	73 (30.3)
High adherence	104 (43.2)	158 (65.6)

Table 3. Patient's Diabetes Knowledge Assessment pre and postintervention

Questions	Frequency (%) of correct response	
	Preintervention	Postintervention
Diabetes is contagious by touch	43 (91.5)	47 (100.0)
Being obese can predispose to diabetes	22 (46.8)	47 (100.0)
Taking alcohol regularly decrease blood sugar	35 (74.5)	47 (100.0)
Diabetes is curable (i.e., after a while taking medication won't be needed)	16 (34.0)	44 (93.6)
Irregular use of medication can worsen diabetes	44 (93.6)	47 (100.0)
A person with diabetes should refrain from eating foods rich in carbohydrates (e.g., rice, potatoes, bread, yam, cassava flakes)	33 (70.2)	47 (100.0)
A person with diabetes is to eat **only** protein rich foods (e.g., beans, meat, egg, milk)	29 (61.7)	47 (100.0)
People who are fat are the only ones who develop diabetes	45 (95.7)	47 (100.0)
Diabetes is hereditary	35 (74.5)	47 (100.0)
Partaking in consistent physical activity helps a diabetic patient improve their health status	41 (87.2)	47 (100.0)
Individuals who consume sugar a lot will develop diabetes	33 (70.2)	47 (100.0)
individuals who consume fizzy (soft) drinks (e.g., Coca cola®, Fanta®, Mountain dew®, Pepsi®) are the ones who develop diabetes	29 (61.7)	47 (100.0)
Untreated diabetes can lead to blindness	39 (83.0)	47 (100.0)
Untreated diabetes can lead to kidney failure	37 (78.7)	47 (100.0)
Untreated diabetes can lead to typhoid fever	47 (100.0)	47 (100.0)
Consuming "herbals" (e.g., Yoyo bitters® Alomo bitters®, FIJK®, Ruzu bitters®, Swedish bitters®) can help decrease blood sugar	26 (55.3)	47 (100.0)
Herbal medicines work better than conventional drugs in lowering blood sugar	31 (66.0)	47 (100.0)
Discontinuing the use of medication on occasion is beneficial since it enables the body to clear itself of the detrimental effect of drugs	31 (66.0)	46 (97.9)
Diabetes knowledge category		
Poor (0-49.9%)	2 (4.3)	0 (0)
Fair (50-69.9%)	22 (46.8)	0 (0)
Good (70-89.9%)	21 (44.6)	1 (2.1)
Excellent (90-100%)	2 (4.3)	46 (97.9)

Table 4. Patient's Diabetes Attitude Assessment pre and postintervention

Questions asked	Frequency (%)					Frequency (%)				
	SA	A	DK	D	SD	SA	A	DK	D	SD
	Preintervention					Postintervention				
Taking my drugs regularly will help me live long	40 (85.1)	6 (12.8)	1 (2.1)	-	-	40 (85.1)	7 (14.9)	-	-	-
A personal glucometer is not necessary as I measure my blood sugar on hospital checkup days	7 (14.9)	16 (34.0)	1 (2.1)	18 (38.3)	5 (10.6)	7 (14.9)	18 (38.3)	-	18 (38.3)	5 (10.6)
I diligently record my sugar measurements	23 (48.9)	23 (48.9)	1 (2.1)	-	-	22 (46.8)	21 (44.7)	-	4 (8.5)	-
My dignity (what I think of myself) has been reduced by this diabetes; I am not who I once was	-	4 (8.5)	-	16 (34.0)	27 (57.4)	-	-	-	22 (46.8)	25 (53.2)
The medicines for my illness are not easy to take everyday	-	5 (10.6)	-	21 (44.7)	21 (44.7)	-	1(2.1)	-	25 (53.2)	21 (44.7)
I am ashamed of this diabetes	1 (2.1)	6 (12.8)	-	14 (29.8)	25 (53.2)	1 (2.1)	-	-	22 (46.8)	24 (51.1)
Whenever I get tired of taking my drugs, I stop them	1 (2.1)	10 (21.3)	-	19 (40.4)	17 (36.2)	2 (4.3)	-	-	30 (63.8)	15 (31.9)
I'm not sure that taking my drugs consistently will improve my health	5 (10.6)	-	3 (6.4)	24 (51.1)	15 (31.9)	-	-	-	32 (68.1)	15 (31.9)
The inevitable will happen, regardless of how much I follow health practitioners' advice about diabetes	1 (2.1)	3 (6.4)	-	22 (46.8)	21 (44.7)	-	-	-	27 (57.4)	20 (42.6)
I don't need to trouble myself with regular physical activity to improve my health	2 (4.3)	6 (12.8)	2 (4.3)	24 (51.1)	13 (27.7)	-	-	-	33 (70.2)	15 (31.9)
I'd rather use herbal medicines than the conventional medication for diabetes	-	5 (10.6)	3 (6.4)	22 (46.8)	17 (36.2)	-	-	-	30 (63.8)	18 (38.3)
I consume "herbals" (e.g., Swedish bitters®, Ruzu bitters®, FIJK®) to help decrease my blood sugar	-	2 (4.3)	1 (2.1)	29 (61.7)	15 (31.9)	-	-	-	31 (66.0)	16 (34.0)
I consume "herbals" (e.g., Swedish bitters®, Ruzu bitters®, FIJK®) alongside my diabetes medication	-	3 (6.4)	1 (2.1)	27 (57.4)	16 (34.0)	-	-	-	31 (66.0)	16 (34.0)
I feel water therapy works better than medicines to treat the disease	2 (4.3)	6 (12.8)	7 (14.9)	17 (36.2)	15 (31.9)	-	2 (4.3)	-	30 (63.8)	15 (31.9)

Diabetes attitude category	Preintervention	Postintervention
Fair (50-69.9%)	7 (14.9)	0 (0)
Good (70-89.9%)	31 (66.0)	32 (68.1)
Excellent (90-100%)	9 (19.1)	15 (31.9)

SA = Strongly agree, A = Agree, DK = Don't know, D = Disagree, SD = Strongly disagree

Table 5. Patient's hypertension knowledge assessment pre and postintervention

Questions asked	Frequency (%) of correct response	
	Preintervention	Postintervention
Hypertension is contagious by touch	182 (93.8)	193 (99.5)
Being obese can make a person develop hypertension (predisposition)	126 (64.9)	191 (98.5)
Regular alcohol intake can decrease blood pressure	170 (87.6)	193 (99.5)
Hypertension is curable (i.e., after a while, taking medication won't be needed)	56 (28.9)	156 (80.4)
Irregular use of medication can worsen hypertension	189 (97.4)	193 (99.5)
Only people who are fat develop hypertension	184 (94.8)	156 (80.4)
Hypertension can be hereditary	154 (79.4)	193 (99.5)
Partaking in consistent physical exercise helps a hypertensive patient improve their health status	163 (84.0)	193 (99.5)
Herbal medicines work better than the prescribed drugs in lowering blood pressure	105 (54.1)	193 (99.5)
Untreated hypertension can lead to stroke	192 (99.0)	193 (99.5)
Untreated hypertension can lead to typhoid fever	103 (53.1)	193 (99.5)
It's important that hypertensive patients regularly check their blood pressure	189 (97.4)	193 (99.5)
Discontinuing the use of medication on occasion is beneficial as it enables the body to clear itself of the detrimental effect of drugs	120 (61.9)	184 (94.8)
Hypertension knowledge category		
Poor (0-49.9%)	7 (3.6)	0 (0)
Fair (50-69.9%)	65 (33.5)	0 (0)
Good (70-89.9%)	88 (45.4)	7 (3.6)
Excellent (90-100%)	34 (17.5)	187 (96.4)

Table 6. Patient's Hypertension attitude assessment pre and postintervention

	Frequency (%)					Frequency (%)				
	SA	A	DK	D	SD	SA	A	DK	D	SD
Questions asked	**Preintervention**					**Postintervention**				
Taking my drugs regularly will help me live long	175 (26.7)	19 (9.8)	-	-	-	168 (86.6)	23 (11.9)	2 (1.0)	1 (0.5)	-
A personal blood pressure measuring machine is not necessary as I can check my blood pressure on hospital checkup days	28 (14.4)	81 (49.4)	-	79 (48.2)	6 (3.1)	26 (13.4)	84 (43.3)	1 (0.5)	77 (39.7)	6 (3.1)
I diligently keep my own record of my blood pressure measurements	67 (34.5)	102 (52.6)	-	23 (11.9)	2 (1.0)	64 (33.0)	99 (51.0)	4 (2.0)	26 (13.4)	1 (0.5)
My dignity (self-worth) has been reduced due to hypertension; I am not who I once was	2 (1.0)	-	-	102 (52.6)	90 (46.4)	3 (1.5)	21 (10.8)	-	69 (35.6)	102 (52.6)
The medicines for my illness are overwhelming; it is difficult to take them everyday	1 (0.5)	2 (1.0)	-	112 (57.7)	80 (41.2)	3 (1.5)	23 (11.9)	-	88 (45.4)	80 (41.2)
I am ashamed of this hypertension	1 (0.5)	-	-	97 (50.0)	96 (49.5)	4 (2.0)	24 (12.4)	-	64 (33.0)	101 (51.1)
Whenever I get tired of taking my drugs, I stop them	1 (0.5)	8 (4.1)	-	113 (58.2)	72 (37.1)	7 (3.6)	58 (29.9)	1 (0.5)	58 (29.9)	70 (36.1)
I'm not sure taking my drugs regularly will help my health improve	1 (0.5)	-	-	116 (59.8)	77 (39.7)	10 (5.2)	15 (7.7)	8 (4.1)	91 (46.9)	70 (36.1)
What will be will be, regardless of how much I follow health practitioners' advice about hypertension	1 (0.5)	1 (0.5)	-	111 (57.2)	81 (41.8)	2 (0.1)	13 (6.7)	5 (2.6)	86 (44.3)	88 (45.4)
I don't need to trouble myself with regular exercise to improve my health	1 (0.5)	1 (0.5)	-	118 (60.8)	73 (37.6)	5 (2.6)	13 (6.7)	17 (8.8)	89 (45.9)	70 (36.1)
I'd rather use herbal medicines instead of the conventional drugs for hypertension	1 (0.5)	1 (0.5)	-	103 (53.1)	89 (45.9)	2 (0.1)	15 (7.7)	4 (2.0)	83 (42.8)	89 (45.9)
I take herbal preparations alongside my drugs for hypertension	1 (0.5)	1 (0.5)	-	93 (47.9)	96 (49.5)	3 (1.5)	30 (15.5)	1 (0.5)	66 (34.0)	94 (48.6)

Hypertension attitude category	**Preintervention**	**Postintervention**
Fair (50-69.9%)	30 (15.5)	1 (0.5)
Good (70-89.9%)	109 (56.2)	124 (63.9)
Excellent (90-100%)	55 (28.4)	69 (35.6)

SA = Strongly agree, A = Agree, DK = Don't know, D = Disagree, SD = Strongly disagree

Table 7. Comparison between selected variables and disease control

Variables		Mean ± SD	p value	Mean ± SD	p value	Mean ± SD	p value	Mean ± SD	p value	Mean ± SD	p value	Mean ± SD	p value
	Disease control	Fasting blood glucose				Diastolic blood pressure				Systolic blood pressure			
		Diabetes		Hypertension		Diabetes		Hypertension		Diabetes		Hypertension	
SAHLE	Controlled	12.37±3.32	0.407	12.90±3.29	0.052	11.84±3.68	0.723		0.791	11.11±3.75	0.243	13.03±3.31	0.280
	Uncontrolled	11.45±4.22		11.13±4.14		12.25±3.89				12.88±3.56		12.43±3.71	
DKAS	Controlled	13.00±3.01	0.079			12.50±2.78	1.000			12.07±2.67	0.419		
	Uncontrolled	11.65±1.69				12.50±2.34				12.88±2.30			
DAAS	Controlled	59.35±4.87	0.036*			58.97±6.11	0.023*			58.67±6.00	0.003*		
	Uncontrolled					54.06±7.82				50.25±8.17			
HKAS	Controlled			9.97±1.81	0.834			12.83±3.57	0.606			10.29±1.71	0.003*
	Uncontrolled			9.87±0.99				12.70±3.17				9.45±1.85	
HAAS	Controlled			48.60±6.81	0.641			10.02±1.81	<0.001			50.84±5.96	<0.001*
	Uncontrolled			47.73±8.13				9.89±1.70				44.89±7.08	
MGL	Controlled	0.74±0.06	0.001*	1.47±0.45	0.030*	1.06±0.32	0.037*	1.03±0.27	<0.001	1.14±0.43	0.015*	0.88±0.14	<0.001*
	Uncontrolled	2.10±0.18		2.33±0.60		2.00±0.59		2.13±0.49		2.63±1.51		0.24±0.45	
Disease duration	Controlled	7.44±1.27	0.128	5.98±1.25	0.470	5.74±1.75	0.710	6.37±1.23	0.490	6.39±1.35	0.851	5.31±1.94	0.107
	Uncontrolled	4.75±1.06		7.20±1.21		5.25±1.13		5.74±4.81		5.88±1.26		6.88±1.24	
Age in years	Controlled	65.59±11.21	0.003*	54.99±12.66	0.171	63.97±10.74	0.006*	54.84±14.03	0.541	60.04±12.25	0.865	52.89±13.38	0.004*
	Uncontrolled	55.25±10.81		59.60±9.93		54.38±11.09		55.94±10.51		59.25±10.96		58.20±9.73	

SAHLE: Short assessment of health literacy in English, DKAS: Diabetes knowledge assessment scale, DAAS: Diabetes attitude assessment scale, HKAS: Hypertension knowledge assessment scale, HAAS: Hypertension attitude assessment scale, MGL: Morisky-Green-Levine medication adherence measurement scale, SD: Standard deviation, Test statistics: Independent-samples t-test, * Statistically significant ($p<0.005$)

Table 8. Pre and postintervention comparison of point-of-care tests results and assessment scales

Variables	Mean ± SD		p value
	Preintervention	Postintervention	
Diastolic blood pressure (mmHg)	89.82 ± 38.32	81.44 ± 8.20	0.001*
Systolic blood pressure (mmHg)	145.43 ± 80.23	128.77 ± 12.72	0.001*
Fasting blood glucose (mg/dL)	110.89 ± 42.39	94.51 ± 9.95	<0.001*
Short assessment of health literacy – English	12.60 ± 3.46	12.86 ± 3.30	0.002*
Diabetes knowledge assessment scale	12.35 ± 2.48	17.91 ± 0.35	<0.001*
Diabetes attitude assessment scale	57.33 ± 7.09	59.93 ± 4.33	0.002*
Hypertension knowledge assessment scale	9.95 ± 1.76	12.75 ± 0.49	<0.001*
Hypertension attitude assessment scale	48.51 ± 6.91	51.56 ± 5.44	<0.001*
Morisky, Green, Levine medication adherence assessment scale	1.50 ± 0.10	0.40 ± 0.04	<0.001*

Test statistics: Paired-samples t-test, * Statistically significant ($p<0.05$)

Commented [AS1]: Show the number of subjects (n) in each treatment group pre-intervention and post-intervention

DISCUSSION

Disease control for patients with diabetes and hypertension is multifactorial [17]. Community pharmacists are well positioned within the community to make positive impacts in the continuity of care of patients with chronic diseases [18]. In addition to patient assessment, using validated scales, on disease knowledge, disease attitude, health literacy, medication adherence, the impact of these variables on disease control was also evaluated in this study. The educational intervention carried out improved patients' health outcomes as significant improvements were observed in the variables assessed postintervention.

From the findings of this study, health literacy, diabetes knowledge and disease duration did not influence disease control. Despite this observation, it is important for healthcare professionals to be deliberate at communicating with patients in a manner that they can comprehend the information meant to be passed across for effective application. Several factors are involved in disease control and an interplay among those confounding factors could explain this observation [19 – 20]. A similar finding was reported by a study in the US [21]. Contrary to our finding, a study in Pakistan reported that patients' diabetes knowledge influenced disease control [22].

Diabetes attitude, hypertension knowledge, hypertension attitude significantly affected disease control in this study. Community pharmacists can do a lot at interfacing patients for better disease management [23]. It is important to regularly counsel patients on disease knowledge and attitude. Community pharmacists must be mindful of engaging patients on any grey area concerning their health. Lots of information is flung at them on the internet and from other sources that could require clarification; an enabling environment for such discussions must be created in community pharmacies. Negative attitude to disease may affect patients' disposition towards adherence to information provided by healthcare professionals as well as self-care practices, thereby preventing optimal disease control.

The influence of medication adherence and age on disease control was also observed in this study. Medication adherence has been reported to improve disease control [24 – 26]. Medication adherence requires lots of attention. Patients should be probed in a non-judgmental manner to find out the reason(s)

for medication nonadherence so that appropriate remedy can be proffered to resolve it. One major way to improve medication adherence is to encourage the patients to regularly make use of their self-monitoring blood glucose/pressure monitoring device. The values obtained are expected to reveal the effect of medication nonadherence and make them take their medications regularly.

The educational intervention led to significant reduction in patients' blood pressure and glycemic control. The finding agrees with several studies which also reported improved disease control among patients, sequel to pharmacists' intervention [13 – 32]. We cannot limit patient education, counselling and monitoring to hospital appointment days for effective disease management. Community pharmacists ought to enhance the care provided during hospital visits with adequate patient follow up during medication refills.

Patients' disease knowledge and attitude, medication adherence and health literacy improved significantly during the study. This is a clarion call for community pharmacists, especially in developing nations, to offer evidence-based services to patients to improve the quality of care received by patients. With proper patient follow-up the narrative around disease control for patients with chronic diseases can be changed.

A limitation to the study was the use of fasting blood glucose as the point-of-care testing for glycemic control. Glycated haemoglobin is a more sensitive test that could have been used. Also, the findings from the study cannot be generalized to patients in different levels of care since it was carried out among ambulatory patients in community pharmacies.

Abbreviations

FBG: Fasting Blood Glucose

DBP: Diastolic Blood Pressure

SBP: Systolic Blood Pressure

SAHLE: Short Assessment for health literacy in English

SPSS: Statistical Package for Social Sciences

HTN: Hypertension

DM: Diabetes mellitus

CONSORT: Consolidated Standards of Reporting Trial

SA: Strongly Agree

A: Agree

DK: Don't Know

D: Disagree

SD: Strongly Disagree

DKAS: Diabetes knowledge assessment scale

DAAS: Diabetes attitude assessment scale

HKAS: Hypertension knowledge assessment scale

HAAS: Hypertension attitude assessment scale

MGL: Morisky-Green-Levine medication adherence measurement scale

SD: Standard deviation

Declarations

Ethics approval and consent to participate

Approval for the study was granted by the joint University of Ibadan/University College Hospital Health Research and Ethics Committee with approval number UI/EC/23/0675. The purpose of the study was

explained to the pharmacists and only those who gave informed consent were recruited for this study. The research was carried out in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and material

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interest

The authors declared that there was no competing interest.

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Authors' contributions

Mrs. Modupe Olubukola Aroyewun: Principal investigator. Contributions: Data collection, data entry, manuscript review.

Dr. Akinniyi Akinbiyi Aje: Corresponding author. Contributions: Study design, data analysis, manuscript writing.

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Title of the manuscript: Impact of disease knowledge and attitude, health literacy and medication adherence on disease control for patients with diabetes and/or hypertension – an interventional study

No.	General comments
	The manuscript discusses the results of improving hypertension and T2DM therapy through patient education interventions. There were significant results in adherence, and reductions in blood pressure and blood glucose levels, but not in health literacy, diabetes knowledge and duration of treatment.
1.	**Introduction** OK. The introduction describes the problems often encountered in the treatment of chronic diseases, namely hypertension and T2DM, which are associated with a low understanding of the disease and its treatment. Therefore, the authors conducted an educational intervention for the patients.
2.	**Material and Methods** The procedures for recruitment of pharmacists, patients and educational interventions to improve knowledge and understanding of disease and treatment are well established.
3.	**Results** All results derived from the research questions are presented fully, clearly, and in detail.
4.	**Discussion** The results of the study are discussed comprehensively by comparing the results of other studies. It is recognised by researchers that the parameter for monitoring the success or failure of T2DM therapy is HbA1c. This is often the case in developing countries, because in general, HbA1c testing is not included in the national health insurance system, so patients have to pay for it themselves.
5.	**Conclusion** The authors argue that providing information by pharmacists about the disease and its treatment to patients is very important, so that patients have a high level of adherence and this results in achieving therapeutic goals.
6.	**References** OK.
7.	**Recommendation** Manuscript is suitable for publication.

8.	**Additional comments** Since 117 subjects (48.5%) had education equivalent to tertiary-education, this may be why the intervention results had a significant impact, it is worth investigating if the subjects had education lower than tertiary education.

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Your review report

Manuscript

Impact of disease knowledge and attitude, health literacy and medication adherence on disease control for patients with diabetes and/or hypertension – an interventional study

Feedback for the author(s)

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Comments to the author(s)

No comments added.

Confidential feedback for the Editor

Your recommendation	• ***Accept***

Is the study design appropriate to answer the research question (including the use of appropriate controls), and are the conclusions supported by the evidence presented?	• ***Yes***
Are the methods sufficiently described to allow the study to be repeated?	• ***Yes***
Is the use of statistics and treatment of uncertainties appropriate?	• ***Yes***
Has guidance been provided on how overstated claims should be rewritten?	• ***This was not needed***
Comments	***Because the results and discussion and conclusions of the research are in accordance with the research objectives.***
Is the presentation of the work clear?	• ***Yes***
Are the images in this manuscript (including electrophoretic gels and blots) free from apparent manipulation?	• ***Not applicable***
Comments	***Manuscript does not contain images only tables that are very clearly written***

Confidential comments to the Editor