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How Group-Based Cardiovascular Health Education Affects Treatment Adherence and Blood Pressure Control among Insured Hypertensive Nigerians: A Pre-Test, Post-Test Study

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Abstract

In sub Saharan Africa (SSA), access to affordable hypertension care through health insurance is increasing. But due to poor adherence, hypertension treatment outcomes often remain poor. Patient-centered educational interventions may reverse this trend. Using a pre-test/post-test design,

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in this study we investigated the effects of a structured cardiovascular health education program (CHEP) on treatment adherence, blood pressure (BP) control and body mass index (BMI) among Nigerian hypertensive patients who received guideline-based care in a rural primary care facility, in the context of a community based health insurance program. Study participants included 149 insured patients with uncontrolled BP and/or poor self-reported medication adherence after 12 months of guideline-based care. All patients received three group-based educational sessions and usual primary care over 6 months. We evaluated changes in self-reported adherence to prescribed medications and behavioral advice (primary outcomes); systolic BP (SBP) and/or diastolic BP (DBP) and BMI (secondary outcomes); and beliefs about hypertension and medications (exploratory outcomes). Outcomes were analyzed with descriptive statistics and regression analysis. 140 patients completed the study (94%). At 6 months, more participants reported high adherence to medications and behavioral advice than at baseline: respectively, 101 (72%) versus 70 (50%), ($p < 0.001$) and 126 (90%) versus 106 (76%), ($p < 0.001$). Participants with controlled BP doubled from 34 (24%) to 65 (46%), ($p = 0.001$). The median SBP and DBP decreased from 129.0 to 122.0 mmHg, ($p = 0.002$) and from 80.0 to 73.5 mmHg, ($p < 0.001$), respectively. BMI did not change ($p = 0.444$). Improved medication adherence was associated with a decrease in medication concerns ($p = 0.045$) and improved medication self-efficacy ($p < 0.001$). By positively influencing patient perceptions of medications, CHEP strengthened medication adherence and, consequently, BP reduction among insured hypertensive Nigerians. This educational approach can support cardiovascular disease prevention programs for Africa's growing hypertensive population.

Keywords

BP-Control, Education, Adherence, Self-Efficacy, Insurance, Nigeria

1. Introduction

Hypertension is a major risk factor for cardiovascular disease (CVD) [1]. The highest prevalence of adults with hypertension has been found in SSA, where a quarter of all premature deaths are due to this condition [1] [2]. In Nigeria, 49% of the adults, aged 25 years and older, had hypertension in 2008 [2]. Long-term treatment with behavioral interventions alone, or in combination with drugs can lower BP and, thereby, the risk of developing CVD [1] [3]-[5]. However, as in many other African countries, in Nigeria anti-hypertensive treatment coverage is low and treatment outcomes are poor [6] [7].

Previous research in Nigeria and other countries in SSA has indicated that health system interventions such as health insurance coverage, organizational support to facilities and the training of health professionals can facilitate the access to and delivery of high quality CVD prevention care in primary care settings [8]-[14]. But even if high quality care is available, there is evidence that many patients fail to adhere to the recommended treatment and do not meet their treatment goals [15]-[17]. For that reason, the World Health Organization has emphasized that any attempt to improve hypertension and cardiovascular care should also address barriers to treatment adherence [18].

Theoretical models of health behavior have proposed that patients and health professionals have different explanatory models or beliefs about health and illness and that beliefs held by patients are important determinants of treatment adherence [19] [20]. This has been confirmed by empirical studies of treatment adherence among patients with hypertension [20] [21]. Evidence suggests that patient education can be effective in supporting treatment adherence and hypertension self-management, especially if the educational programs pay attention to underlying barriers to adherence such as patients' beliefs and concerns about the nature of hypertension and the prescribed treatment, medication self-efficacy and specific social, cultural and individual barriers to optimal hypertension management [22]-[25]. A systematic review of studies on various strategies for improving the quality of primary hypertension care in high income countries concludes that organizational health system changes and patient education have the biggest impact on blood pressure (BP) outcomes [26]. Some recent primary care studies from Nigeria also demonstrate that organizational quality improvement interventions can lead to improved clinical outcomes in hypertensive patients [14] [27] [28]. However, to date little information is

available about the impact of patient education on hypertension management in low resource communities in Nigeria or other countries in SSA. We had the opportunity to investigate this issue in a rural primary care facility in Kwara State Nigeria, where clinical guidelines were introduced in 2010 in order to improve the quality of hypertension management for patients enrolled in a Community Based Health Insurance (CBHI) program. To strengthen this quality improvement program, we implemented a tailored community-based cardiovascular health education program (CHEP) for patients. CHEP was developed and structured on the basis of the theoretical frameworks of Kleinman and Leventhal [19] [20], and the content was based on findings from a previous qualitative study on perspectives on hypertension and treatment adherence among hypertensive patients from the local community [29]. Because patients in this facility had been offered free guideline-based cardiovascular prevention care, in the context of their health insurance, the setting allowed for a focused analysis of the value of patient education. The aims of this study were to evaluate the effects of CHEP on treatment adherence, BP control and body mass index (BMI) and to explore to what extent the changes that occurred in medication adherence after patients had completed CHEP were related to changes in the underlying determinants of adherence behavior that were addressed during the training (*i.e*. patients' perceptions of hypertension, medication, and self-efficacy).

2. Methods

The study design has been published previously [30]. This section summarizes the main procedures.

2.1. Study Site and Context

The study was conducted at Ogo Oluwa hospital (OOH) in Bacita, a rural low-income community in Kwara State. OOH was contracted by the Kwara State Health Insurance (KSHI) program to provide primary and limited secondary care to patients who are enrolled in the health insurance plan. Financed by an international organization—the Health Insurance Fund (HIF) [31], the KSHI program was launched in Kwara State in 2007 with the aim to provide subsidized health insurance for low and middle income groups.

As part of the insurance company's quality assurance program, OOH had implemented guidelines and treatment protocols for CVD prevention [4] [32] [33], and upgraded its diagnostic equipment and medical record system. In a previously reported study, Quality Improvement Cardiovascular care Kwara (QUICK)-I, we evaluated the feasibility and quality of this program [28] [34]. The QUICK-I study included 349 insured patients with hypertension and/or diabetes from OOH between June 2010 and January 2011, followed these patients over a period of 12 months and assessed them for health-related and other outcomes, including medication adherence, systolic BP (SBP) and diastolic BP (DBP). Of the 349 included patients 323 completed the study at one year of follow up [28].

2.2. Study Design and Participants

The present study, QUICK-II, was an observational one-group pre-test post-test study of 149 patients who had completed the QUICK-I study [30]. QUICK-I patients were recruited for QUICK-II if the following criteria were present at the one-year follow up assessment of QUICK-I: enrolled in KSHI program; registered at OOH; aged ≥ 18 years; diagnosed with hypertension; having uncontrolled BP (SBP ≥ 140 mmHg or DBP ≥ 90 mmHg without co-morbidity—diabetes, renal disease, cardiovascular diseases—or SBP ≥ 130 mmHg or DBP ≥ 80 mmHg with co-morbidity) *and/or* being non-adherent to behavioral recommendations or prescribed medications (score < 8 on the Morisky Medication Adherence Scale (MMAS-8) [35] [36]; and willing to provide informed consent. Pregnant or lactating females were excluded from the study.

Baseline assessments for QUICK-II patients (T_0) were conducted between November 2011 and March 2012, and six-month-follow up assessments (T_1) were conducted between April 2012 and September 2012. Between T_0 and T_1, all included patients were offered cardiovascular health education program (CHEP) counseling, in addition to their regular hypertension care. Two trained research nurses, fluent in local languages, conducted baseline and follow-up assessments of physiological and self-report measures. Questionnaires for assessing self-report measures were designed and piloted in English, and translated into the two dominant local languages (Yoruba and Nupe). Patients received a reminder 2 days before the scheduled study visits. Incurred travel costs were reimbursed if study visits took place outside a patient's usual clinic days.

2.3. Intervention—*CHEP*

The intervention, CHEP, consisted of: (i) three group-based educational sessions; and (ii) culturally tailored written and audio-visual educational materials (see table, **Additional File 1**). The content of CHEP was inspired by a hypertension education program that was developed by Beune *et al*. [23], and results of a previous interview study with hypertensive patients of OOH [29]. All patients were randomly assigned to a group of 12 - 15 "trainees" which held the same composition throughout the program. The CHEP training sessions took place at OOH, at respectively 2, 6 and 14 weeks after T_0. The first session lasted 2 hours and the second and third sessions lasted 2.5 hours each. The training was given by the researcher (AOO) and a trained research nurse. Sessions were held in the languages of choice of the group and interactive training techniques were used in all sessions.

2.4. Outcome Measures and Data Collection

2.4.1. Primary and Secondary Outcomes

The primary outcomes were the proportion of study participants who had improved self-reported adherence to medication and behavioral recommendations at six months past baseline.

Medication adherence was assessed with the MMAS-8 [35] [36]. The MMAS-8 asks participants 7 "yes" or "no" questions and 1 question that can be answered on a 5-point Likert scale. Low adherence is defined as MMAS-8 scores < 6; medium adherence as scores ranging from 6-to < 8, and high adherence as a score of 8 [36]. We defined improvement in medication adherence as a shift to a higher category of adherence between T_0 and T_1 (e.g. from low to medium adherence) or as 'high adherence' (MMAS-8 score of 8) at both points in time.

Adherence to behavioral advice was measured with the question "to what extent do you follow the behavioral advice from your doctor about smoking/nutrition/drinking alcohol/losing weight/physical activity or something else"? Answers were provided on a 4-point Likert scale, (1) never, (2) sometimes, (3) usually or (4) always. We defined improvement in adherence to behavioral recommendations as a shift from lower to a higher category of adherence between T_0 and T_1 or as high adherence (category 4) at both points in time.

Secondary outcomes were: the proportion of patients who showed an improvement in BP between T_0 and T_1; and the proportion of patients who showed a decrease in body mass index (BMI) by ≥1 unit kg/m^2 between T_0 and T_1.

BP was measured three times, 5 minutes apart, with an automated BP monitor (Omron M6 Comfort, OMRON Corporation, Kyoto, Japan), after the patient had been seated for 5 minutes. The second and third readings were averaged to calculate the SBP and DBP. A controlled BP was defined as a SBP of <140 mmHg and a DBP of <90 mmHg for patients without co-morbidity, or as SBP < 130 mmHg and DBP < 80 mmHg for patients with co-morbidity. Improvement in BP was defined as a ≥10% decrease in SBP and/or DBP between T_0 and T_1 or having a controlled BP at both T_0 and T_1.

BMI was calculated from measures of the patient's height and weight. Weight was measured with validated Omron BF 400 weighing scale, and height with a validated Leicester Stadiometer SECA 217. Both measures were taken without the patient wearing shoes and/or heavy clothing. Measurements were recorded to the nearest 0.1 cm (height) and 0.1 kg (weight). Normal weight was defined as a BMI below 25 kg/m^2, overweight as a BMI between 25 and 29.9 kg/m^2, and obesity as a BMI ≥ 30 kg/m^2. Improvement in BMI was defined as a ≥ 1 unit kg/m^2 decrease in BMI between T_0 and T_1 for patients with a baseline BMI ≥ 25 kg/m^2.

2.4.2. Other Measures

The intervention targeted some determinants of medication adherence: patients' perceptions of hypertension, medication, and medication self-efficacy. We measured these variables in order to obtain a better understanding of the expected change in primary outcomes.

Patients' perceptions of hypertension were assessed with the well validated Revised Illness Perception Questionnaire (IPQ-R) [37]. The IPQ-R asks participants to provide answers to statements on a 5-point Likert scale (1 = "strongly disagree", 5 = "strongly agree") on 9 dimensions of illness (hypertension), 7 of which were used in this study. Scores are totaled and overall score represents the degree to which hypertension is perceived as threatening or benign. High scores on the dimensions 1) emotional representations, 2) timeline chronic, 3) consequences, 4) timeline cyclical represent strongly held beliefs about 1) number of symptoms attributed to hypertension, 2) its chronicity, 3) its negative consequences and 4) its cyclical nature. High scores on the personal

control, treatment control and illness coherence dimensions represent positive beliefs about the controllability of hypertension and a personal understanding of the illness.

Patients' beliefs about medicines were assessed with the Beliefs about Medicines Questionnaire (BMQ) [38]. BMQ is a well validated 18-item tool that consists of two sections. In this study we used only section 1 (BMQ-specific) which consists of two 5-item subscales. The first scale (Specific-necessity) assesses hypertensive patients' beliefs about how necessary it is to take medications in order to improve/maintain their health. The second scale (Specific-concern) assesses respondents' "concerns" about potential adverse consequences from taking their medications. BMQ uses 5-point Likert questions ranging from 1 = "strongly disagree" to 5 = "strongly agree". The respondents' scores on each item are totaled. Higher scores indicate stronger beliefs about the necessity of taking medicines and concerns about adverse effects of medications.

Medication self-efficacy was measured with the shortened Medication Adherence Self-Efficacy Scale (MASES-R) [39] [40]. This 13-item scale assesses the patients' beliefs in their confidence to adhere to prescribed anti-hypertensive medications under a variety of challenging situations, such as when busy at home, when there are symptoms, while traveling etc. Items are scored using a 4-point Likert scale, (1 = "not at all sure", 4 = "extremely sure"). The scores on all items are totaled. Higher scores indicate higher self-reported medication adherence self-efficacy.

In order to collect additional information about self-reported health behaviors, participants were asked questions about physical activity, dietary salt intake, alcohol and tobacco use. Daily moderate physical activity was defined as performing sports or exercise (e.g. walking to the market, performing heavy work) in addition to one's normal daily activities such as dressing, washing and walking. Salt use was defined as adding any salt (a little/a lot) when cooking or when eating food. Alcohol use was defined as any self-reported use of alcohol daily, weekly or monthly. Tobacco use is self-reported use of any tobacco products, such as cigarettes, cigars or pipes. Information about patients' socio-demographic characteristics was obtained from the QUICK-I study.

2.5. Statistical Analysis

Data were analyzed using STATA, version 12.0 (StataCorp LP, College Station, Texas, USA). Adherence to medications and behavioral advice, BP control and BMI were calculated using descriptive statistics. Changes between T_0 and T_1 were compared using the Wilcoxon signed rank test for categorical and continuous variables and the McNemar exact test for binary variables. Changes in illness perceptions, medication beliefs and self-efficacy between T_0 and T_1 were compared using the Wilcoxon signed rank test.

A first multivariable logistic regression analysis was performed to evaluate the association between improvement in BP between T_0 and T_1 (secondary outcome) and medication and behavioral adherence (primary outcome).

A second multivariable logistic regression analysis was performed to explore the associations between improvement in adherence to medications between T_0 and T_1 (primary outcome) and illness perceptions, medication beliefs, and self-efficacy. The illness perceptions, medication beliefs and self-efficacy variables showing a p-value below 0.2 in a univariate analysis were included in the multivariate model.

In both models no control variables (*i.e.* age, gender, level of education, ethnicity, co-morbidities, etc.) were included since no substantial change was expected in these variables during the study period. The odds ratios (OR), 95% confidence interval (CI) and p-values were reported.

To evaluate the association between change in SBP and DBP (between T_0 and T_1) and medication and behavioral adherence, two multivariable linear regression analyses were performed. Coefficients (in mmHg), 95% CI and p-values were reported and similar to the logistic regression models, no control variables were included in the analyses.

Endline measurements in QUICK-I were used to determine patients eligibility for QUICK-II (uncontrolled BP and/or non-adherence to medications). On average, there was a gap of 4.7 months between the endline QUICK-I assessment and the baseline QUICK-II assessment (T_0). During this period, 33% (n = 49) of the eligible QUICK-II patients had improved in BP and/or medication adherence (see Additional file 2). The number of patients with a controlled BP at T_0 was high (59.7%), resulting in a low power for the first multivariable regression analysis. In the original design of the study [30], our definitions of the secondary outcome measure, BP improvement was very strict (a $\geq$ 10% decrease in SBP and/or DBP between T_0 and T_1 or having a controlled BP at both T_0 and T_1). We believe, however, that any BP decrease can be favorable in the studied participants. For this

reason, the research group decided to measure the secondary outcome also by assessing the BP improvement continuously as the delta of SBP and DBP between T_0 and T_1 and to perform the two multivariable linear regression analyses mentioned above.

2.6. Ethics

Ethical approval for the study was obtained on 30th March, 2010 from the Ethics committee of the University of Ilorin Teaching Hospital, Kwara State (Ref: UITH/CAT/189/13/13). Patients were adequately informed about the study and informed consents were taken prior to commencement of study by signature or fingerprint.

3. Results

3.1. Patient Characteristics

The QUICK-II cohort consisted of 149 patients. Participant flow is shown in **Figure 1**.

Out of 323 patients who completed QUICK-I study 156 were referred to QUICK-II, 7 of whom were excluded because they had diabetes but not hypertension. The remaining 149 patients were included in QUICK-II. For different reasons, nine patients (6%) were lost to follow-up. Of those who completed the study (n = 140), 132 (94%) attended all three CHEP sessions.

Table 1 shows participants' socio-demographic characteristics. The median age was 56.5 years (IQR: 49.4 - 65.5), 63 (42%) were males and 85 (57%) were not formally educated.

3.2. Changes in Adherence to Medication and Behavioral Recommendations, BP and BMI

As **Table 2** shows, medication adherence improved during the study period ($p < 0.001$). As compared to T_0, more patients reported a high level of medication adherence (MMAS-8 = 8) at T_1: N = 70 (50%) versus N = 101 (72%). A similar pattern was observed for adherence to behavioral recommendations; the proportion of patients

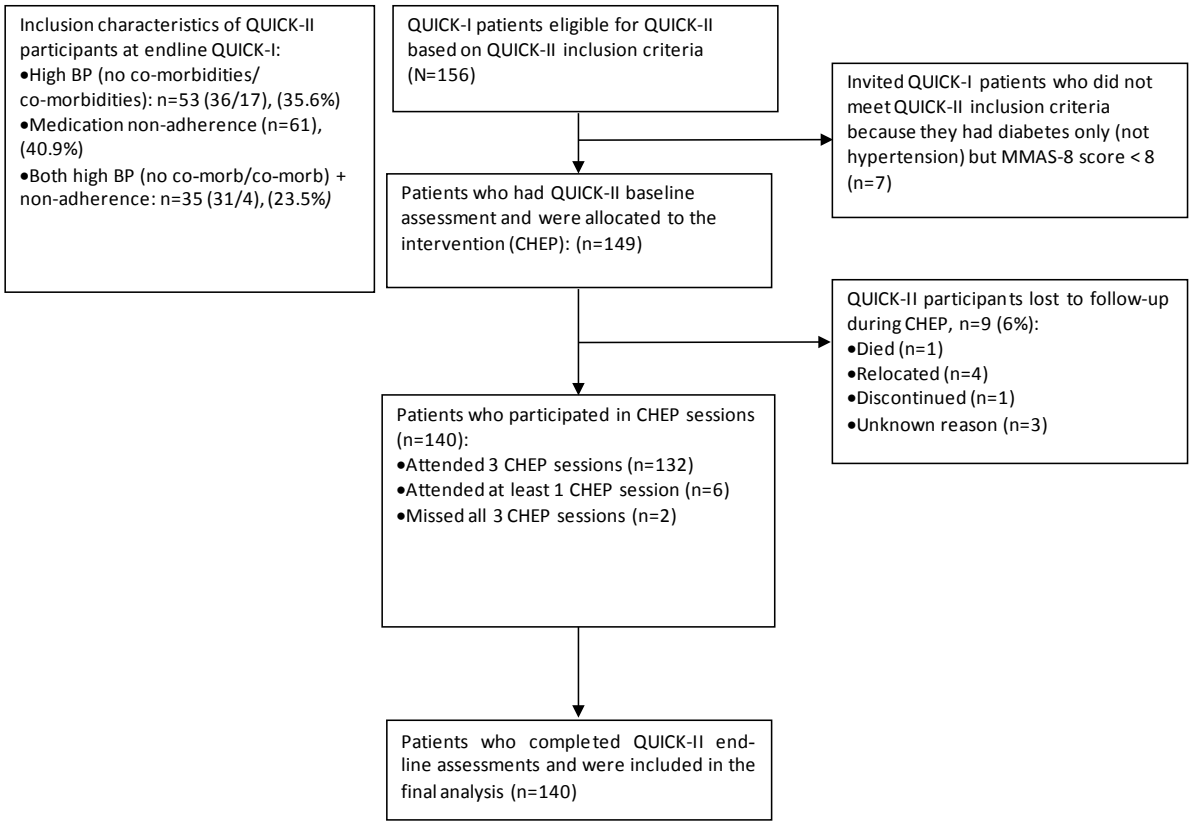

Figure 1. Flow of QUICK-II study participants.

Table 1. Characteristics of study participants (N = 149).

Characteristics	N (%)
Male, n (%)	63 (42.3)
Age in years, median (IQR)	56.5 (49.4 - 65.5)
Educational level attained, n (%)	
No school at all	85 (57.0)
<Primary	3 (2.0)
Primary	33 (22.1)
Secondary	12 (8.1)
Tertiary	16 (10.7)
Employment status, n (%)	
Farmer/fisherman	36 (24.2)
Trader	59 (39.6)
No paid job	23 (15.4)
Other	31 (20.8)
Marital status, n (%)	
Married	133 (89.3)
Widowed	16 (10.7)
Religion, n (%)	
Muslim	80 (53.7)
Christian	69 (46.3)
Ethnicity, n (%)	
Nupe	60 (40.3)
Yoruba	67 (45.0)
Igbo	10 (6.7)
Other	12 (8.1)
Household size, median (IQR)*	5.0 (3.0 - 6.0)
Co - morbidities, n (%)**	
None	121 (81.2)
Diabetes	19 (12.8)
CVD	4 (2.7)
Renal disease	1 (0.7)
Two or three co - morbidities	4 (2.7)
Start anti - hypertensive treatment, n (%)	
<1.5 year	49 (32.9)
>1.5 year	100 (67.1)
Number of prescribed antihypertensive pills per day, n (%)*****	
<= 4 pills	71 (50.8)
5 - 6 pills	34 (24.2)
>= 7 pills	35 (25.0)
Travel time to the clinic during hypertension visits (in minutes), median (IQR)	14.0 (9.8 - 29.0)

*n = 147; Note: Characteristics are taken at baseline QUICK-I. Age is newly calculated using the date of QUICK-II baseline assessment and the date of birth recorded in QUICK-I; **Based on end-line QUICK-I assessment; ***n = 140.

Table 2. Changes in adherence to medications and behavioral advice, BP and BMI between baseline and endline.

Measures	Baseline (N = 140)	Endline (N = 140)	p-value (baseline vs. end line)
Adherence to medication (Morisky), n (%)			<0.001
Low adherence (<6)	31 (22.1)	16 (11.4)	
Medium adherence (6 - 7.9)	39 (27.9)	23 (16.4)	
High adherence (=8)	70 (50.0)	101 (72.1)	
Adherent to behavioral advices, n (%)	106 (75.7)	126 (90.0)	<0.001
Alcohol use, n (%)	8 (5.7)	3 (2.1)	0.063
Tobacco use, n (%)	6 (4.3)	1 (0.7)	0.125
Moderate physical activity, n (%)	98 (70.0)	124 (89.2)*	<0.001
Salt use, n (%)	72 (51.8)*	72 (51.4)	1.000
Fully adherent to medication and behavioral advice, n (%)	58 (41.4)	94 (67.1)	<0.001
Systolic BP, median (IQR)	129.0 (118.3 - 147.3)	122.0 (108.0 - 138.0)	<0.001
Diastolic BP, median (IQR)	80.0 (71.3 - 87.8)	73.5 (65.0 - 85.0)	<0.001
Hypertension classification (JNC7), n (%)			<0.001
Normal (SBP < 120 and DBP < 80)	34 (24.3)	65 (46.4)	
Pre-hypertension (SBP 120 - 139 or DBP 80 - 89)	57 (40.7)	40 (28.6)	
Stage 1 hypertension (SBP 140 - 159 or DBP 90 - 99)	30 (21.4)	24 (17.1)	
Stage 2 hypertension (SBP ≥ 160 or DBP ≥ 100)	19 (13.6)	11 (7.9)	
Body Mass Index, median (IQR)	25.1 (22.2 - 29.3)	24.9 (22.2 - 29.4)	0.444
Body Mass Index, n (%)			0.739
Normal weight (<25)	69 (49.3)	71 (50.7)	
Overweight (25 - 29.9)	43 (30.7)	40 (28.6)	
Obesity (≥30)	28 (20.0)	29 (20.7)	

BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure. *n = 139.

who reported to always adhere to behavioral advice increased from 106 (76%) at T_0 to 126 (90%) at T_1 ($p < 0.001$). Median SBP and DBP levels dropped significantly from 129.0 mmHg (IQR: 118.3 - 147.3) to 122.0 mmHg (IQR: 108.0 - 138.0) ($p < 0.001$) and from 80.0 mmHg (IQR: 71.3 - 87.8) to 73.5 mmHg (IQR: 65.0 - 85.0) ($p < 0.001$), respectively. No significant change was found for BMI ($p = 0.444$). However, more participants reported engaging in moderate physical activity for 30 or more minutes a day, on 3 or more days a week at T_1: 124 (89%) versus 98 (70%) at T_0 ($p < 0.001$). No statistically significant changes were observed in dietary salt intake, smoking or alcohol consumption between T_0 and T_1.

3.3. Improvement in Treatment Adherence Associated with Improvement in BP

Although trends were positive, no statistically significant associations was observed between BP improvement and changes in medication adherence (OR = 1.55, p = 0.351) and adherence to behavioral recommendations (OR = 1.93, p = 0.327) during the study period (**Table 3**).

But when using our second definition of BP improvement (**Table 4**), improvement in medication adherence during the study was associated with a 9.2 mmHg (p = 0.038) reduction in SBP and a 6.1 mmHg (p = 0.027) reduction in DBP. The improvement in adherence to behavioral recommendations was not associated with decrease in BP (SBP: p = 0.214; DBP: p = 0.318). Included in the definition of improvements in medication adhe-

Table 3. Association between treatment adherence and improvement in BP at six months; multivariable logistic regression models.

Measures	Improvement in BP*, n (%) (N = 140)	OR (95% CI)	p-value
Medication adherence**			
Ref: Did not improve at six months	21 (15.0)	1.00	
Improved at six months	87 (62.1)	1.55 (0.62 - 3.86)	0.351
Behavioral adherence			
Ref: Did not improve at six months	7 (5.0)	1.00	
Improved at six months	101 (72.1)	1.93 (0.52 - 7.15)	0.327

*Improvement in blood pressure (BP) is defined as having BP on target at endline or a > 10% decline in BP at endline compared to baseline; **Improvement in adherence to medication/behavioral advice is defined as having moved to a higher category of adherence between T_0 and T_1, or as having remained in the highest category of adherence at both time points.

Table 4. Association between treatment adherence and improvement in BP at six months; multivariable linear regression model.

Measures	All respondents (N = 140)	
	Coef. (95% CI)	p-value
1. Systolic BP change		
Improved medication adherence*	−9.2 (−17.9 to −0.5)	0.038
Improved behavioral adherence	−8.4 (−21.6 to 4.9)	0.214
2. Diastolic BP change		
Improved medication adherence	−6.1 (−11.5 to −0.7)	0.027
Improved behavioral adherence	−4.2 (−12.4 to 4.1)	0.318

*Improved adherence to medication/behavioral advice is defined as having moved to a higher category of adherence between T_0 and T_1, or as having remained in the highest category of adherence at both time points.

rence are the patients that remained adherent at T_0 and T_1. In this subgroup we observed no association between medication adherence and decrease in SBP ($p = 0.610$) and DBP ($p = 0.820$) (results not shown).

3.4. Illness Perceptions, Medication Beliefs and Self-Efficacy and Medication Adherence

As intended by CHEP, statistically significant differences between T_0 and T_1 were observed in some of the illness perception variables, namely for the dimensions timeline chronic ($p < 0.001$), consequences ($p < 0.001$), timeline cyclical ($p = 0.001$) and emotional representations ($p < 0.001$) (**Table 5**). Similarly, statistically significant changes between T_0 and T_1 were observed with respect to participants' medication self-efficacy ($p < 0.001$), beliefs about the necessity of medications ($p < 0.001$), and their concerns about adverse effects of medications ($p = 0.002$) (**Table 5**).

An improvement in medication adherence during the study period was associated with an increase in medication self-efficacy (OR = 5.99, $p < 0.001$) and a decrease in patients' concerns about adverse effects of medications (OR = 2.57, $p = 0.045$) (**Table 6**).

The association between improved adherence to behavioral advice and illness perceptions, medication beliefs and self-efficacy could not be assessed because of the high number of participants who reported a high adherence to behavioral advice at T_0 (76%) and T_1 (89%), (**Table 2**).

Furthermore, in the multivariate analysis, the most important determinants of the improvements in medication adherence (directly), and BP control (indirectly) were changes in perceived medication self-efficacy (OR = 5.99, $p < 0.001$); concerns about medications (OR = 2.57, $p = 0.045$); and personal control (OR = 0.45, $p = 0.092$), although the latter association was not statistically significant.

Table 5. Changes in illness perceptions, medication self-efficacy and beliefs about medicines between baseline and endline.

Measures	Baseline (N = 140) median (IQR)	Endline (N = 140) median (IQR)	p-value (baseline vs. end line)	Min-max
Illness perceptions (IPQ)				
Timeline chronic	2.6 (2.3 - 3.0)	3.0 (2.5 - 4.0)	<0.001	(1.0 - 5.0)
Consequences	2. (1.4 - 3.0)	1.4 (1.0 - 2.2)	<0.001	(1.0 - 5.0)
Personal control	2.0 (1.7 - 2.7)	2.0 (1.7 - 3.0)	0.166	(1.0 - 5.0)
Treatment control	4.3 (4.0 - 4.7)	4.7 (4.0 - 5.0)	0.080	(1.0 - 5.0)
Illness coherence	3.0 (1.0 - 4.0)*	3.0 (1.0 - 4.0)	0.179	(1.0 - 5.0)
Timeline cyclical	3.0 (3.0 - 3.5)	3.5 (3.0 - 4.5)	0.001	(1.0 - 5.0)
Emotional representations	2.5(1.8 - 3.6)	1.8 (1.0 - 3.3)	<0.001	(1.0 - 5.0)
Self-efficacy medication (MASES-R)	3.8 (3.4 - 4.0)	4.0 (3.8 - 4.0)	<0.001	(1.0 - 4.0)
Beliefs about medication (BMQ)				
Necessity	20.0 (17.0 - 23.0)	23.0 (20.0 - 25.0)	<0.001	(5.0 - 25.0)
Concern	10.0 (9.0 - 14.0)	9.0 (7.0 - 13.0)	0.002	(5.0 - 25.0)

*n = 139.

Table 6. Associations between changes in IPQ, MASES-R, BMQ, and improvement in medication adherence; multivariable logistic regression models.

	Improvement in medication adherence, n (%) (N = 140)	OR	95% CI	p-value
Illness perceptions (IPQ)				
Consequences				
Ref: decrease + no change (low + med)	84 (60.0)	1.00		
Increase + no change (high)	26 (18.6)	0.83	(0.29-2.38)	0.728
Personal control				
Ref: decrease + no change (low + med)	59 (42.1)	1.00		
Increase + no change (high)	51 (36.4)	0.45	(0.17 - 1.14)	0.092
Emotional representations				
Ref: Increase + no change (med + high)	31 (22.1)	1.00		
Decrease + no change (low)	79 (56.4)	1.65	(0.60 - 4.55)	0.335
Self-efficacy medication (MASES-R)				
Ref: decrease + no change (low + med)	13 (9.3)	1.00		
Increase + no change (high)	97 (69.3)	5.99	(2.19 - 16.37)	<0.001
Beliefs about medicine (BMQ)				
Concern				
Ref: Increase + no change (med + high)	37 (26.4)	1.00		
Decrease + no change (low)	73 (52.1)	2.57	(1.02 - 6.51)	0.045

4. Discussion

Our study demonstrated that a tailored group-based cardiovascular health education program strengthened guideline-based CVD prevention care among hypertensive patients from primary care clinic in a rural community in Nigeria. The patients in question did not adhere to treatment recommendations or had a blood pressure outside the normal range after they had received guideline-based care alone for one year. We observed that 89% of the patients completed all educational sessions. Studies of similar educational interventions in primary care settings in Europe and the USA recorded lower attendance rates, namely 79% and 58% [23] [41]. The high attendance rate in this study suggests that CHEP responded to patients' needs, which is plausible in the light of a previous qualitative study that was conducted in the area [29].

Secondly, we observed that patients who attended CHEP showed improvements in adherence to medication and behavioral recommendations. These improvements may, of course, simply be explained by the fact that patients knew that their hypertension management and adherence was monitored in this study (Hawthorn effect). However, our study provides several indications that the intervention itself has contributed to the improvement in medication adherence. The education program was specifically designed to address previously identified contextual or behavioral barriers to treatment adherence, including patients' perceptions about hypertension and the treatment (see **Additional File 1**). We found that improved medication adherence after CHEP was positively associated with improved medication self-efficacy (MASES-R) and with a reduction of concerns about medications as measured by the BMQ. It is unlikely that changes in these underlying determinants of adherence to hypertension treatment [42]-[49] would have occurred without the educational intervention. More patients had begun to engage in moderate physical activity during the study period. This improvement may be explained by the fact that CHEP addressed cultural barriers to physical exercise in the community and suggested opportunities for exercise that are part of people's usual everyday activities, such as yam pounding, drawing water from the well, walking, dancing, clapping, fishing or farming. However, for salt use and other behavioral risk factors for CVD no improvements were observed despite the fact that possibilities for changing these behaviors were also specifically addressed during CHEP. Anthropological studies have indicated that dietary practices are particularly difficult to change as they are an important component of one's culture and cultural identity [50]. Changes in dietary behaviour may need more specific approaches than CHEP could offer in three sessions [51]-[53].

Third, we did not find the expected >10% decline in SBP/DBD. However, we observed that the median SBP declined with 9.2 mmHg ($p < 0.001$) and the median DBP with 6.1 mmHg ($p < 0.001$). Moreover, after the study period, more patients could be classified as having a BP within the normal range according to the JNC7 hypertension classification system. These results are, as such, clinically relevant [54]. Moreover, we found that the decline of the median BP levels was associated with an improvement in medication adherence.

To our knowledge this is one of the first studies that analyzed the potential impact of hypertension education in the context of a CBHI program that aims to improve the quality of CVD prevention in low resource primary care setting in Africa. The study is also unique in its explicit description of the educational intervention and its potential replicability by healthcare providers and researchers in other settings (**Additional File 1**).

4.1. Limitations

Yet, this study has several limitations, the most important being the lack of a control group. Although, we observed significant improvements in outcome measures, the lack of a control group limits the possibility of drawing firm conclusions as to the causality of the measured effects. The link between CHEP and behavioral and clinical outcomes should be further tested in randomized controlled trials or prospective studies. Medication adherence (MMAS-8) and behavioral adherence were measured through self-report scales, and answers could have been influenced by social desirability. Nevertheless, MMAS-8 is a validated, reliable, simple, and low-cost instrument that has been successfully used to estimate medication adherence in many previous studies involving hypertensive patients [55]-[59], including low-income patients of African origin [36]. Furthermore, due to the relatively small sample size, only a limited number of variables could be taken into consideration within our multivariate analysis. We have opted for the inclusion of variables that refer to behavioral determinants of adherence. The inclusion of additional variables such as the type or the number of medications used might have strengthened this study. In addition, the limited sample size also made it impossible to conduct sub-group analyses, for instance for patients with different levels of formal school education or for those with different levels of treatment adherence at the start of the study. Furthermore, to evaluate the long-term effect of CHEP longer follow-up studies are needed. Finally,

a recent study from Nigeria reported that the adherence level was higher among hypertensive patients attending specialized clinics compared to those attending general outpatient clinics, despite the former's use of more medications [60]. In future studies evaluating CHEP, attention should be given to the influence of the context in which care is provided and to the type and the number of medications patients are being prescribed.

CHEP was designed to meet the specific needs of the study population. Some of the culturally specific issues that were addressed by CHEP may not be relevant to patients who live in other socio-cultural settings. Yet the description of CHEP provides general outlines for structuring and providing patient education, which makes it possible to adapt the specific contents to the needs of other patient populations. It should be realized, however, that the patients in our study had access to free primary care through health insurance. The findings might therefore not automatically be generalizable to the broader group of (mostly uninsured) hypertensive patients in the larger hypertensive population in Africa or to those who are treated at secondary and tertiary levels of care. Finally, the study was conducted in a health care facility that had participated in a CVD quality improvement program (for over a year) that was subsidized by a CBHI program. It is likely that the usual care that was being provided in this facility is better than that in other facilities. Consequently, the effects of CHEP might have been greater if we had conducted the study in a common primary care setting in Nigeria or elsewhere in Africa.

4.2. Implication for Practice and Further Research

This study found that CHEP responds to patients' needs and that it can be a useful component of the primary care management of hypertension in low resource communities in SSA, if it is combined with appropriate pharmaceutical treatment. Further (controlled) studies are needed to confirm or refute these findings. This type of health education can be delivered (efficiently) by nurses and other trained health workers, and not just by physicians. The modules of the cardiovascular health education program (CHEP) are well described (**Additional File 1**) and can serve as a (useful) framework for further development and evaluation of educational interventions for patients who are at risk of developing CVD, and particularly for those living in disadvantaged communities in SSA.

5. Conclusion

This study suggested that the evaluated education program (CHEP) improved adherence to medications, followed by an increase in BP control among insured hypertensive patients in rural Nigeria. At the end of the study, more participants reported high adherence to medications and behavioral advice than at baseline: respectively, 101 (72%) versus 70 (50%), ($p < 0.001$) and 126 (90%) versus 106 (76%), ($p < 0.001$). Participants with controlled BP doubled from 34 (24%) to 65 (46%), ($p = 0.001$). The median SBP and DBP decreased from 129.0 to 122.0 mmHg, ($p = 0.002$) and from 80.0 to 73.5 mmHg, ($p < 0.001$), respectively. BMI did not change ($p = 0.444$). Improved medication adherence was associated with a decrease in medication concerns ($p = 0.045$) and improved medication self-efficacy ($p < 0.001$). Making such programs available to affected populations in SSA has the potential to help reduce burden of cardiovascular diseases and associated mortality.

Competing Interests

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Author Contributions

AOO drafted the manuscript, conducted the study and participated in the design, reporting, analysis and revision. JH, JL, KS and MH participated in the original study design. JH and KS made substantial revision of several drafts of the manuscript. HN conducted the statistical analyses with critical contributions from FW. AOO drafted the education program with critical contributions from JH. AO, CA, CS, FW, GO, HN, JH, KS, MH, OAB and TA reviewed the manuscript critically. KA and PA provided vital logistic supports. CS, JH and KS reviewed the data collection and management procedures. AO, TA, CS, JH, and KS are members of the supervisory board. All authors read and approved the final draft.

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Additional Files

Additional File 1: (1) CSV; Table; Cardiovascular Health Education Program (CHEP); Overview of group-based Cardiovascular Health Education Program used in QUICK-II study; (2) CSV; Table; Changes in inclusion characteristics of QUICK-II participants between endline QUICK-I and baseline QUICK-II assessments.

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Additional File 1

Table 1. Overview of group-based Cardiovascular Health Education Program (CHEP) used in QUICK-II study.

	Intervention		
Sessions	**Group session 1 (*CHEP*-1) (week 3)**	**Group session 2 (*CHEP*-2) (week 7)**	**Group session 3 (*CHEP*-3) (week 15)**
Theme	Patients' knowledge about hypertension and its management	How patients should cope with hypertension	How patients should cope with hypertension
Session objective(s)	To elicit participants' ideas about hypertension and treatment; inform them about medical perspective; reach consensus; and establish treatment objectives for next session – *CHEP-2*	To explore daily challenges participants face in managing hypertension; how they currently cope with the identified challenges; inform them on how they may cope better; and establish objectives for next session – *CHEP-3*	To explore daily challenges participants face in managing hypertension; how they currently cope with the identified challenges, inform them on how they may cope better; and establish how they can continue to deal with the challenges in future
Session duration	2 hours	2 hours, 30 minutes	2 hours, 30 minutes
Protocol instructions	**1.1: Hypertension and its management: group discussion (30 minutes)** **Themes**: • What is hypertension? • Is hypertension a disease? • What are your views about hypertension? • What causes hypertension? • Who can get hypertension? • Is hypertension dangerous, If so, how dangerous is it? • Is hypertension curable? • How long does hypertension last? • How does hypertension present? • How did you get your hypertension? • What can you do to prevent hypertension? • How can hypertension be treated? • How is hypertension related to your lifestyle and what you eat? **1.2: What patients can do to manage hypertension: interactive instruction (30 minutes)*** Themes: • Take your medications regularly as prescribed • Seek support from your family/friends on reminders in taking your drugs regularly and in reducing salt intake • Adopt healthy diet (described) • Decrease amount of sodium/salt in your diet • Stay physically active/exercise regularly • Lose excess weight • Quit smoking • Quit/reduce alcohol intake • Quit snuff, Kola nuts • Limit exposure to physical/emotional stress **1.3: Addressing what can make hypertension management difficult for patients: group discussion (30 minutes)**	**2.1: Medication use: group discussion (15 minutes)** • What challenges do you face? • How did you cope? **2.2: Dietary advice/salt: group discussion (15 minutes)** • What challenges do you face? • How did you cope? **2.3: Weight reduction/exercise group discussion (15 minutes)** • What challenges do you face? • How did you cope? **2.4: Attending your follow-up appointments regularly as advised group discussion (15 minutes)** • What challenges do you face? • How did you cope? **2.5: Audiovisual '*Living positively with hypertension*': Instruction (25 minutes)** • View and discuss video "living positively with hypertension" and some patient-centred exercise regimes to help coping (**35 minutes**) **2.6: Simple exercises you can do at home (20 minutes)** • Poster teaching session (**5 minutes**) • Practical exercise session (**15 minutes**) **2.7: Individual assignment (10 minutes)**: • Set 3 goals on what you want to achieve before your next CHEP visit to keep your blood pressure controlled (e.g. reduce salt consumption, increase physical activity through exercise)	**3.1: Medication use: group discussion (15 minutes)** • What challenges do you face? • How did you cope? **3.2: Dietary advice/salt: group discussion (15 minutes)** • What challenges do you face? • How did you cope? **3.3: Weight reduction/exercise group discussion (15 minutes)** • What challenges do you face? • How did you cope? **3.4: Attending your follow-up appointments regularly as advised group discussion (15 minutes)** • What challenges do you face? • How did you cope? **3.5: Audiovisual '*Living positively with hypertension*': Instruction (25 minutes)** • View and discuss video "living positively with hypertension" and some patient-centered exercise regimes to help coping (**35 minutes**) **3.6: Simple exercises you can do at home (20 minutes)** • Patient friendly exercise practice sessions using: local activities such as wood cutting, gardening, mortar grinding, drawing water from well, other household chores, farming, biking, brisk walking, leisure activities e.g. drumming, dancing. **3.7: Final closing session (Instructions), 10 minutes** In moving forward: • Make the lessons learnt from this program your daily routine for life • Take your drugs regularly • Exercise daily, regularly • Reduce salt intake and adopt healthy diet • Attend your follow-up clinic regularly • Get needed support from family members/friends in your hypertension self-management efforts

Continued

	Themes: • Taking your pills regularly • Reducing salt intake • Adopting a healthy diet • Staying physically active **1.4: How to overcome obstacles: instruction (20 minutes) **** **1.5: Individual assignment (10 minutes)** • Set 3 goals on what you want to achieve before your next CHEP visit to keep your blood pressure controlled (e.g. reduce salt consumption, increase physical activity through exercise)	• Read/consult your hypertension information leaflet/pamphlet regularly for additional support • View attentively the audiovisuals that will be made available to you during waiting time in clinic

Additional information:
- Two instructors guided the sessions
- Sessions were held in English, Yoruba and Nupe with a translator
- All sessions included a 5 minute welcome
- Results of participants' homework assignments were discussed with the trainers 15 minutes before the start of next sessions
- During breaks, patients viewed educational posters

*Power points are used; ** Posters are used.

Table 2. Changes in inclusion characteristics of QUICK-II participants between endline QUICK-I and baseline QUICK-II assessments.

Measurements	Endline QUICK-I (N = 149)	Baseline QUICK-II (N = 149)
High BP no co-morbidities	36 (24.2)	15 (10.1)
High BP with co-morbidities	17 (11.4)	10 (6.7)
Low or medium adherence	61 (40.9)	40 (26.9)
High BP no co-morbidities AND low/med adherence	31 (20.8)	25 (16.8)
High BP with co-morbidities AND low/med adherence	4 (2.7)	10 (6.7)
Low BP and high adherence	0 (0.0)	49 (32.9)

List of Abbreviations

BMQ: Beliefs about Medicines Questionnaire
BP: Blood pressure
CHEP: Cardiovascular Health Education Program
DBP: Diastolic Blood Pressure
HIF: Health Insurance Fund
IPQ-R: Revised Illness Perception Questionnaire
KSHI: Kwara State Health Insurance
MASES-R: Revised Medication Adherence Self Efficacy Scale
MMAS: Morisky Medication Adherence Scale
NUFFIC: Netherlands organization for international cooperation in higher education
OOH: Ogo Oluwa Hospital
QUICK: Quality Improvement Cardiovascular Care Kwara
SBP: Systolic Blood Pressure