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Effectiveness of the Chronic Care Model on Self-Management Behaviour and Glycaemic Control among Adults with Type 2 Diabetes in North-Central Nigeria: A Randomised Controlled Study

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Abstract

Background: Type 2 diabetes mellitus (T2DM) is a major public health challenge in Nigeria. The Chronic Care Model (CCM) provides a structured framework for strengthening patient-centred chronic disease management. This study evaluated the effectiveness of a CCM-based intervention on self-management behaviours and glycaemic outcomes among adults with T2DM in North Central Nigeria. **Participants and Methods**: A single-blinded randomised controlled trial was conducted among 90 adults with T2DM attending the General Outpatient Clinic of the Federal University Teaching Hospital, Lafia. Participants were randomly allocated to an intervention group (CCM-based care) or control group (usual care), with 45 participants per arm. The intervention lasted 12 weeks and incorporated structured education, goal setting, clinical information support, and follow-up. Outcomes included glycated haemoglobin (HbA1c), fasting blood glucose (FBG), blood pressure, and self-management behaviours measured using the Diabetes Self-Management Questionnaire (DSMQ). Data were analysed using intention-to-treat principles at a 5% significance level. **Results:** Eighty-four participants completed follow-up. The

intervention group demonstrated a significantly greater reduction in HbA1c (mean reduction 1.3 ± 0.5) compared with the control group (0.63 ± 0.2; $p < 0.001$). Significant improvements were observed in fasting blood glucose ($p < 0.001$). Overall DSMQ scores increased significantly (+0.5; $p < 0.001$), particularly in dietary control, physical activity, and glucose monitoring. Multiple linear regression identified medication adherence ($\beta = -0.38$), dietary control ($\beta = -0.27$), and glucose monitoring ($\beta = -0.31$) as significant predictors of HbA1c. **Conclusion**: A CCM-based intervention significantly improved self-management behaviours and glycaemic outcomes compared with usual care, supporting its integration into routine diabetes management in resource-constrained settings.

Subject Areas

Diabetes, Endocrinology

Keywords

Type 2 Diabetes Mellitus, Glycaemic Control, Self-Management, Patient Satisfaction, Chronic Care Model

1. Introduction

Type 2 diabetes mellitus (T2DM) is a leading contributor to global morbidity and mortality and represents a rapidly escalating public health challenge, particularly in low- and middle-income countries [1]-[3]. Sub-Saharan Africa is experiencing one of the fastest growth rates in diabetes prevalence, driven by demographic transition, urbanisation, and lifestyle change [4]-[6]. Globally, the same set of factors consistently appear to affect glycaemic control including mental illness, long duration of diagnosis, age and poor self-care [7] [8]. In Nigeria, recent national estimates and systematic reviews indicate a rising prevalence of T2DM, high rates of undiagnosed disease, and persistently poor glycaemic control, with consequent increases in preventable complications and healthcare costs [9]-[11].

Despite the availability of effective pharmacological therapies, glycaemic outcomes among people living with T2DM in Nigeria remain suboptimal [12] [13]. Facility-based studies consistently report that a large proportion of patients fail to achieve recommended glycated haemoglobin (HbA1c) targets [9] [10]. This gap reflects not only clinical factors but also systemic weaknesses in diabetes care delivery, including fragmented services, limited continuity of care, inadequate patient education, and insufficient support for long-term self-management [10]-[12]. Conventional care remains largely episodic and provider-centered, with limited emphasis on empowering patients to manage the behavioural and psychosocial demands of diabetes [14].

Optimal diabetes control depends heavily on sustained engagement in self-management behaviours such as medication adherence, dietary modification, physical activity, blood glucose monitoring, and foot care [14]-[16]. Evidence from

Nigeria and other sub-Saharan African settings indicates that while medication adherence is often relatively high, adherence to lifestyle-related behaviours and self-monitoring practices is frequently poor [17]-[19]. These patterns are shaped by structural and contextual barriers including low health literacy, financial constraints, sociocultural norms, and limited access to monitoring equipment [4] [15] [20]. Addressing these challenges requires models of care that systematically strengthen patients' capacity, motivation, and confidence to engage in self-care.

The Chronic Care Model (CCM) offers a comprehensive framework for improving outcomes in chronic illness by reorienting health systems toward proactive, patient-centred care [21]. The model emphasizes six interrelated components: organisation of healthcare, self-management support, delivery system design, decision support, clinical information systems, and mobilisation of community resources [21]-[23]. Substantial evidence demonstrates that CCM-based interventions improve quality of care, self-management behaviours, and glycaemic outcomes among people with diabetes [24]-[26].

Despite this evidence, most CCM-based diabetes interventions have been evaluated in high-income settings, with limited data from resource-constrained environments in sub-Saharan Africa [22] [27]. In Nigeria, diabetes care is predominantly delivered through outpatient clinics in secondary and tertiary facilities, where structured education, continuity of care, and behavioural support are inconsistently implemented [17] [18] [20].

Against this background, the present study evaluated the effectiveness of an integrated CCM-based intervention on self-management behaviours and glycaemic outcomes among adults with type 2 diabetes attending a tertiary hospital in North Central Nigeria.

2. Objectives

2.1. General Objective

To determine the effectiveness of the Chronic Care Model (CCM) on self-management behaviour and glycaemic control compared to normal care among adults with type 2 diabetes mellitus.

2.2. Specific Objectives

1) To determine the mean change in glycated haemoglobin among subjects allocated to the Chronic Care Model compared with those receiving usual care.

2) To determine the mean change in self-management behaviour among subjects allocated to the Chronic Care Model compared with those receiving usual care.

3. Methodology

3.1. Study Design

This study was a single-blinded randomised controlled trial comprising an inter-

vention group that received Chronic Care Model-based care and a control group that received the usual model of care.

3.2. Study Setting

The study was conducted at the General Outpatient Clinic (GOPC) of the Federal University Teaching Hospital, Lafia, (formerly Dalhatu Araf Specialist Hospital) Lafia. The state had an estimated population of 2,886,000, while Lafia had a projected population of 509,300 as at 2022 [28].

The GOPC operates weekdays from 8:00 a.m. to 4:00 p.m. and is staffed by medical officers, resident doctors, and family medicine consultants. Unpublished outpatient records indicate that approximately 13 to 15 patients aged ≥ 40 years with diabetes mellitus attend daily.

3.3. Study Population

The study population comprised adults aged 40 years and above with confirmed type 2 diabetes mellitus.

3.4. Sample Size Determination

Sample size was determined using the formula for comparison of mean differences between two groups [29].

$$N = \left(Z_{\alpha/2} + Z_{\beta}\right)^2 \left(I^2 + c^2\right) \Big/ \Delta^2$$

where:

N = minimum sample size required for each group.

$Z_{\alpha/2}$ = 1.96, representing the t-value for a 95% confidence level when $\alpha = 0.05$.

Z_{β} = 0.84, representing the t-value for 80% power when $\beta = 0.2$.

I = mean difference of the effect of CCM on glycaemic control in the intervention group from a previous study in Pakistan = 1.06 [30].

c = mean difference of the effect of usual care on glycaemic control in the control group from a previous study in Kenya = 0.60 [31].

Δ = mean difference between the study groups = 0.46.

Therefore:

$N = (1.96 + 0.84)^2 (1.06^2 + 0.60^2)/0.46^2$

$N = 7.84 \times 2.19/0.21$

$N \approx 82$

Accounting for a 10% attrition rate, a total of 90 participants (45 per group) were recruited.

3.5. Sampling Technique

Participants were randomly allocated into control (Group A) and intervention (Group B) groups using opaque envelopes containing numbered slips. Odd numbers were assigned to the control group, and even numbers to the intervention group.

3.5.1. Inclusion Criteria

Individuals aged ≥ 40 years and diagnosed with type 2 diabetes mellitus for ≥6 months, with good medication adherence and availability during the study period.

3.5.2. Exclusion Criteria

Individuals who were pregnant, with major psychiatric illness, or were unlikely to complete follow-up.

3.6. Data Collection

1) Structured questionnaires for biodata and socioeconomic characteristics.

2) Self-management behaviour records.

3) The Diabetes Self-Management Questionnaire (DSMQ), a validated tool for assessing diabetes self-care behaviours [32]-[35].

4) Clover A1c point-of-care analyser for HbA1c measurement.

3.7. Study Protocol

After written informed consent, questionnaires were interviewer-administered. The control group received routine care, while the intervention group received structured CCM-based education and follow-up. Of the 45 participants in the control group, 41 completed the study, while 43 of 45 completed in the intervention group, supporting internal validity. All patients were seen at in the consulting rooms at the GOPD of the center and their follow-up visits were scheduled at 0, 4, 8 and 12 weeks. The participants in the two groups were seen on different follow-up dates to avoid contamination during the entire study. Full participation of each participant in this study entailed four clinic visits, completely filled study questionnaires, provision of HbA1c and FBG results pre- and post-intervention. Any participant that did not meet these criteria was categorized as been lost to follow-up.

3.7.1. Control Group

Each patient in this arm was seen at an average of 20 minutes. The diabetes self-management instruction sheet was used as a structured guide for consultation to the usual care group and for ease of replication in similar studies in the future. They were verbally advised on dietary and lifestyle modification as per standard procedure. The following activities were carried out in each clinic visit:

- At the first encounter (recruitment point), the purpose of the study was explained to each participant and an informed written consent form for the study was given. Their BP, weight and height were checked and BMI were recorded. HbA1C and FBG were requested to be presented during the next visit. They were verbally counselled on dietary and medication adherence. Their medications were reviewed and they were advised to check their FBG at each visit as they usually did.
- At the second and third visit (4^{th} and 8^{th} week), the participants were given verbal dietary and medication adherence counselling. Their medications were

reviewed and any other health challenges they presented with were addressed. They were asked to do HbA1c and FBG to be presented at the last visit.

- During the last encounter (12th week), their BP, weight, height and BMI were recorded. Self-management behaviour of each participant was also recorded during this visit using the self-management behaviour form. They were encouraged to adhere to their medications and keep to their usual follow-up as scheduled with their doctors.

3.7.2. Intervention Group

This group of patients were seen at an average of 35 minutes. In addition to what was done for the control group, the following was included:

1) A simple protocol was designed and faithfully adhered to. Primarily, caregivers including doctors and nurses were trained on motivational interviewing skills. Managing physicians and selected nurses were coached on communication skills.

2) Proper documentation of results of each participant was ensured and made easily available on each appointment day. The clinical information system which is a component of CCM was achieved through this approach. The following activities were carried out during each clinic visit:

3) For the participants who were obese, they were encouraged to lose 0.5 kg of body weight weekly by carrying out moderate intensity exercise at least four or five days in a week such as brisk walking for at least 30 minutes per day, skipping for 15 minutes.

4) To significantly reduce alcohol or abstain.

5) To stop smoking.

6) To consume plenty of fresh fruits and vegetables daily-at least five servings each day, reduce salt intake and oily meals.

7) To adhere to medications by setting reminders on phone or asking family member/friend to remind them daily.

8) To practice foot care daily by checking for sores, and cracks, wearing of soft padded shoes and to take caution when cutting nails by using a nail cutter instead of razor blade.

9) To get their personal glucometer to monitor their sugar level at home, and symptoms of hypo-hyper glycemia and steps to take.

At the second and third visit (4th and 8th week), their hospital records were made available by the designated record officer. Pre-intervention HbA1c was recorded and the form given to the participants was reviewed and assessed.

3.8. Statistical Analysis

Data were analysed using SPSS. Descriptive statistics summarised baseline characteristics. Independent-samples *t*-tests compared continuous variables, while chi-square and Fisher's exact tests analysed categorical variables. Significance was set at $p < 0.05$, and analysis followed an intention-to-treat approach.

3.9. Ethical Considerations

The study adhered to ethical principles approved by the ethics committee of FUTH, Lafia. All participants provided written informed consent prior to enrolment. Confidentiality was ensured, and all data were anonymised and securely stored.

4. Results

Final analysis was done on 87 patients. One patient on the intervention arm left to another state while two patients on the control arm stopped coming and could not reached. Although intention-to-treat analysis was initially planned, final analysis was conducted among participants who completed follow-up. Sensitivity analyses using baseline-adjusted ANCOVA were performed to account for baseline imbalances (See Table 1).

Table 1. Socio-demographic characteristics of the study participants.

	Intervention group N = 45 (%)	Control group N = 45 (%)	t-test	p-value
Mean Age (years)	57.48 ± 1.53	54.17 ± 1.39	−1.599	0.113
40 - 59	27 (60.0)	29 (64.4)	4.026**	0.402
60 and above	18 (40.0)	16 (35.6)		
Sex				
Male	33 (73.3)	36 (80.0)	χ^2	0.455
Female	12 (26.7)	9 (20.0)	0.559	
Religion				
Christianity	16 (35.6)	15 (33.3)	0.049	0.82
Islam	29 (64.4)	30 (66.7)		
Marital status				
Married	32 (71.1)	30 (66.7)		
Unmarried	13 (28.9)	15 (33.3)		
Educational qualification				
No education	4 (8.9)	7 (15.6)	1.061*	0.786
Primary	7 (15.6)	7 (15.6)		
Secondary	14 (31.1)	14 (31.1)		
Tertiary	20 (44.4)	17 (37.7)		
Address				
Urban	39 (86.6)	31 (68.9)	4.113	0.043
Rural	6 (13.3)	14 (31.1)		

Continued

Occupation				
Civil servants	16 (35.6)	20 (44.4)	5.980	0.542
Business	19 (42.2)	15 (33.3)		
Artisans	10 (22.2)	10 (22.2)		

(* = Fisher's exact test, ** = Chi-square test).

Clinical characteristics are largely similar, including mean BMI (27.5 ± 5.7 vs 27.8 ± 6.5 kg/m^2; p = 0.454), systolic blood pressure (120.9 ± 6.2 vs 121.9 ± 6.8 mmHg; p = 0.093), and fasting blood glucose (8.9 ± 1.2 vs 9.16 ± 2.9 mmol/L; p = 0.053) (See Table 2).

Table 2. Baseline clinical characteristics of participants (N = 90).

Variable	Intervention (n = 45)	Control (n = 45)	Test Statistic	p-value
BMI (kg/m^2), mean ± SD	27.5 ± 5.7	27.8 ± 6.5	t = −0.751	0.454
Underweight (<18.5), n (%)	0 (0.0)	3 (6.6)	χ^2 = 3.163	0.367
Normal (18.5 - 24.9), n (%)	12 (26.7)	12 (26.7)		
Overweight (25 - 29.9), n (%)	16 (35.6)	14 (31.1)		
Obese (≥30), n (%)	17 (37.7)	16 (35.6)		
Systolic BP (mmHg)	120.9 ± 6.2	121.9 ± 6.8	t = 1.696	0.093
Diastolic BP (mmHg)	78.9 ± 6.6	79.1 ± 5.8	t = 2.609	0.010*
Fasting Blood Glucose (mmol/L)	8.9 ± 1.2	9.16 ± 2.9	t = −1.95	0.053
HbA1c (%), mean ± SD	8.2 ± 1.1	7.6 ± 0.5	t = 3.309	0.001*

*Statistically significant at p < 0.05.

However, statistically significant baseline differences were observed in:

- Diastolic blood pressure (78.9 ± 6.6 vs 79.1 ± 5.8 mmHg; p = 0.010)
- HbA1c (8.2% ± 1.1% vs 7.6% ± 0.5%; p = 0.001)

Given these imbalances, primary outcomes were analysed using analysis of co-variance (ANCOVA) adjusting for baseline values (See Table 3).

Table 3. Baseline self-management behaviour of study participants in both groups.

Variables	Intervention group N = 45 (%)	Control group N = 45 (%)	Chi-square	p-value
Trying to lose weight				
Yes	8 (17.8)	9 (20.0)	2.318	0.089
No	37 (82.2)	36 (80.0)		

Continued

Reduced total food intake				
Yes	10 (22.3)	12 (26.7)	20.991	0.112
No	35 (77.7)	33 (73.3)		
Take fresh fruits				
Yes	6 (13.3)	5 (11.1)	36.000	0.629
No	39 (86.7)	40 (88.9)		
Reduced the intake of fried foods				
Yes	13 (28.9)	12 (26.7)	45.123	0.564
No	32 (71.1)	33 (73.3)		
Reduced oil food				
Yes	11 (24.4)	8 (17.8)	52.675	0.543
No	44 (75.6)	37 (82.2)		
Reduced salt & seasoning intake				
Yes	15 (33.3)	16 (35.6)	17.227	0.129
No	30 (66.7)	29 (64.4)		
Examined feet daily				
Yes	14 (31.1)	13 (28.9)	21.646	**0.000**
No	31 (68.9)	32 (71.1)		
Self-monitoring				
Yes	6 (13.3)	8 (17.8)	8.012	0.346
No	39 (86.7)	37 (82.2)		

These results indicated that the participants had difficulties, especially in life-style changes and self-blood glucose monitoring (See Table 4).

Table 4. Baseline diabetes self-management behaviours mean scores (DSMQ scores, N = 90).

Subdomain	Mean ± SD
Medication adherence	3.8 ± 0.7
Dietary control	2 9 ± 0.8
Physical activity	2.7 ± 0.8
Glucose monitoring	2.6 ± 0.9
Overall D SMQ score	3.0 ± 0.6

Compared with baseline, participants demonstrated statistically significant improvements in dietary control (mean change +0.5, $p < 0.001$), physical activity (+0.6, $p < 0.001$), and glucose monitoring (+0.9, $p < 0.001$). Medication adherence remained high and unchanged ($p = 0.301$). Overall DSMQ scores improved significantly from 3.0 to 3.5 (mean change +0.5, $p < 0.001$) (See Table 5 and Table 6).

Table 5. Post-intervention self-management behaviour of study participants in both groups.

Variables	Intervention group N = 43 (%)	Control group N = 41 (%)	Chi-square χ^2	p-value
Trying to lose weight/exercise				
Yes	26 (60.47)	13 (31.70)	6.97	**0.0083**
No	17 (39.53)	28 (68.29)		
Reduced total food intake				
Yes	27 (62.79)	15 (36.59)	6.134	**0.013**
No	16 (37.21)	26 (63.41)		
Take fresh fruits				
Yes	43 (100.0)	18 (43.90)	43.64*	**0.00001**
No	0 (0.0)	23 (56.09)		
Reduced the intake of fried foods				
Yes	41 (95.34)	19 (46.7)	30.06*	**0.00001**
No	2 (4.65)	22 (53.65)		
Reduced oil food				
Yes	41 (95.34)	14 (34.14)	38.39*	**0.00001**
No	2 (4.65)	27 (65.85)		
Reduced salt/ seasoning intake				
Yes	38 (88.37)	14 (34.14)	25.84	**0.000**
No	5 (11.63)	27 (65.85)		
Examined feet daily				
Yes	40 (93.03)	11 (26.82)	41.76*	**0.00001**
No	3 (6.97)	30 (73.17)		
Self-monitoring				
Yes	14 (32.55)	7 (17.07)	2.659	**0.103**
No	30 (67.44)	34 (82.92)		

* = Fisher's exact test.

Table 6. Change in Diabetes Self-Management Behaviours (DSMQ Scores) from baseline to post-intervention follow-up.

Subdomain	Baseline (N = 90) Mean ± SD	Follow-up (N = 84) Mean ± SD	Mean Change (95% CI)	p-value
Medication adherence	3.8 ± 0.7	3.9 ± 0.6	+0.1 (−0.1, 0.3)	0.301
Dietary control	2.9 ± 0.8	3.4 ± 0.7	+0.5 (0.3, 0.7)	<0.001
Physical activity	2.7 ± 0.8	3.3 ± 0.8	+0.6 (0.4, 0.8)	<0.001
Glucose monitoring	2.6 ± 0.9	3.5 ± 0.8	+0.9 (0.7, 1.1)	<0.001
Overall DSMQ score	3.0 ± 0.6	3.5 ± 0.5	+0.5 (0.4, 0.6)	<0.001

*($p < 0.05$).

Post-Intervention Clinical Outcomes (Unadjusted Comparisons)

At 12 weeks, the intervention group demonstrated:

- Lower systolic BP (117.1 ± 5.3 vs 120.6 ± 6.4 mmHg; p = 0.006)
- Lower fasting blood glucose (6.4 ± 1.4 vs 8.0 ± 2.0 mmol/L; p < 0.001)

Post-intervention HbA1c was identical in both groups (6.9%), and diastolic BP did not differ significantly (74.8 ± 5.8 vs 75.2 ± 5.2 mmHg; p = 0.679). BMI and BMI category distributions were not significantly different between groups at follow-up (p = 0.626 and p = 0.459 respectively) (See Table 7).

Table 7. Post-intervention clinical characteristics of both groups.

Variable	Intervention (n = 43)	Control (n = 41)	Test Statistic	p-value
BMI (kg/m^2)	28.0 ± 5.0	27.4 ± 6.1	t = −0.489	0.626
Systolic BP (mmHg)	117.1 ± 5.3	120.6 ± 6.4	t = 2.813	0.006*
Diastolic BP (mmHg)	74.8 ± 5.8	75.2 ± 5.2	t = 0.415	0.679
Fasting Blood Glucose (mmol/L)	6.4 ± 1.4	8.0 ± 2.0	t = 3.902	<0.001*
HbA1c (%)	6.9 ± 0.7	6.9 ± 0.5	t = 0.844	0.400

significance set at *$p < 0.05$.

4.1. Baseline-Adjusted Treatment Effects (ANCOVA Results)

Because significant baseline imbalances were observed in HbA1c and diastolic blood pressure, and fasting glucose showed borderline imbalance, adjusted analyses were conducted using ANCOVA with baseline values entered as covariates (See Table 8).

Table 8. Baseline-adjusted treatment effects.

Outcome	Adjusted Mean Difference	95% CI	p-value
HbA1c (%)	−0.67	−0.91 to −0.43	<0.001*

Continued

Fasting Blood Glucose (mmol/L)	−1.5	−2.3 to −0.7	<0.001*
Systolic BP (mmHg)	−3.4	−5.8 to −1.0	0.005*
Diastolic BP (mmHg)	−0.3	−1.6 to 1.0	0.620
BMI (kg/m^2)	0.4	−1.2 to 2.0	0.610

significance set at *$p < 0.05$.

4.1.1. Glycated Haemoglobin (Primary Outcome)

After adjusting for baseline HbA1c:

Adjusted mean difference = −0.67%;

95% CI: −0.91 to −0.43;

$p < 0.001$.

This indicates a statistically and clinically significant greater reduction in HbA1c among participants receiving the intervention compared with controls.

4.1.2. Fasting Blood Glucose

After baseline adjustment:

Adjusted mean difference = −1.5 mmol/L;

95% CI: −2.3 to −0.7;

$p < 0.001$.

4.1.3. Systolic Blood Pressure

Baseline-adjusted analysis showed:

Adjusted mean difference = −3.4 mmHg;

95% CI: −5.8 to −1.0;

$p = 0.005$.

4.1.4. Diastolic Blood Pressure

After adjusting for baseline values:

Adjusted mean difference = −0.3 mmHg;

95% CI: −1.6 to 1.0;

$p = 0.62$.

No statistically significant intervention effect was observed.

4.1.5. Body Mass Index

After baseline adjustment:

Adjusted mean difference = 0.4 kg/m^2;

95% CI: −1.2 to 2.0;

$p = 0.61$.

No significant difference was observed between groups.

4.2. Summary of Findings

After adjusting for baseline imbalances, the intervention produced statistically significant improvements in:

- Glycaemic control (HbA1c)
- Fasting blood glucose
- Systolic blood pressure

No significant effects were observed for:

- Diastolic blood pressure
- Body mass index

The magnitude of HbA1c reduction (0.67%) is clinically meaningful and consistent with structured diabetes self-management interventions among adults with type 2 diabetes (See Table 9).

Table 9. Multiple linear regression predicting HbA1c from self-management behaviours post intervention.

Predictor	β	SE	t	p
Medication adherence	−0.38	0.09	−4.22	<0.001
Dietary control	−0.27	0.09	−3.01	0.004
Physical activity	−0.15	0.08	−1.84	0.067
Glucose monitoring	−0.31	0.10	−3.17	0.002
Constant	11.2	1.3	8.62	<0.001

*($p < 0.05$).

$HbA1c = \beta_0 + \beta_1$ (Medication adherence) + β_2 (Dietary control) + β_3 (Physical activity) + β_4 (Glucose monitoring) + ε.

5. Discussion

This study evaluated the effectiveness of a Chronic Care Model (CCM) based intervention in improving self-management behaviours and glycaemic outcomes among adults with type 2 diabetes mellitus attending a tertiary health facility in north-central Nigeria. The findings demonstrate that implementation of the CCM resulted in statistically and clinically significant improvements in key domains of diabetes self-management, as well as superior reductions in fasting blood glucose and glycated haemoglobin compared with usual care.

5.1. Baseline Self-Management Behaviours in Context

At baseline, participants in both the intervention and control groups exhibited suboptimal engagement in lifestyle-related self-management behaviours, particularly dietary control, physical activity, foot care, and blood glucose monitoring. In contrast, medication adherence scores were relatively high. This pattern is consistent with previous Nigerian studies, which have repeatedly shown that while patients often adhere to prescribed medications, adherence to behavioural components of diabetes care remains poor [12]-[14]. Similar findings have been reported across sub-Saharan Africa, where structural barriers such as limited access to glucometers, financial constraints, inadequate diabetes education, and soci-

ocultural beliefs undermine sustained self-care [7] [8] [15].

5.2. Effect of the CCM on Self-Management Behaviours

Following the intervention, participants exposed to CCM-based care demonstrated significant improvements across multiple self-management domains, including dietary modification, physical activity, glucose monitoring, and foot care. These improvements were consistently greater than those observed in the control group, which received usual care. The magnitude and breadth of behavioural change observed in the intervention group align closely with the core principles of the CCM, particularly structured self-management support, proactive follow-up, and continuous patient–provider interaction [14].

Comparable improvements have been reported in studies from high-income settings, where CCM-based interventions have been shown to enhance diabetes self-care behaviours and patient activation [21] [22] [24]. Importantly, the present study extends this evidence to a resource-constrained Nigerian context, demonstrating that meaningful behavioural change is achievable even in settings with limited infrastructure when care delivery is systematically restructured.

The largest behavioural gains were observed in glucose monitoring and dietary practices, domains that were explicitly targeted through education, goal setting, and reinforcement during follow-up visits. This finding is consistent with prior work showing that structured education and regular feedback are critical drivers of behaviour change in chronic disease management [23] [27].

5.3. Effect of the CCM on Glycaemic Outcomes

The improvements in self-management behaviours translated into superior clinical outcomes. Participants in the intervention group experienced significantly lower post-intervention fasting blood glucose levels and a greater reduction in glycated haemoglobin compared with those receiving usual care. Although post-intervention HbA1c values were similar between groups, the significantly larger mean reduction observed in the intervention arm indicates a clear intervention effect over the 12-week follow-up period.

These findings are consistent with evidence from systematic reviews and meta-analyses demonstrating that CCM-based interventions are associated with modest but clinically meaningful reductions in HbA1c [26] [31]. Even relatively small reductions in HbA1c have been shown to substantially reduce the risk of microvascular and macrovascular complications, a consideration of particular relevance in Nigeria, where access to advanced diabetes care is limited and complication-related morbidity remains high.

5.4. Predictors of Glycaemic Control

Regression analysis revealed that medication adherence, dietary control, and glucose monitoring were significant independent predictors of glycated haemoglobin levels, collectively explaining 43% of the variance in HbA1c. This finding rein-

forces the central role of self-management behaviours in determining glycaemic outcomes and is consistent with previous studies showing that behavioural factors are often stronger predictors of metabolic control than demographic or clinical characteristics [14] [18] [19] [22].

While physical activity showed a favourable association with HbA1c, this relationship was not statistically significant. Similar findings have been reported in other studies, where improvements in physical activity behaviours did not immediately translate into measurable changes in glycaemic indices [31].

5.5. Strengths and Limitations

5.5.1. Strengths

Randomised controlled design;

High participant retention;

Use of validated instruments;

Use of objective biochemical outcomes (HbA1c, FBG).

5.5.2. Limitations

Short follow-up duration;

Single centre design;

Per protocol rather than intention to treat analysis.

5.6. Implications for Diabetes Care in Nigeria

The findings of this study have important implications for diabetes care delivery in Nigeria and similar low- and middle-income settings. The findings suggest that structured CCM-based diabetes management can:

- Improve glycaemic control
- Reduce cardiovascular risk factors
- Enhance chronic disease outcomes in Nigerian tertiary settings

Integration of CCM principles into routine diabetes care may reduce complication rates and healthcare burden.

5.7. Recommendations

1) Adoption of structured diabetes self-management programmes in tertiary hospitals.

2) Integration of CCM components into national diabetes care guidelines.

3) Longer-duration interventions to assess sustained metabolic and anthropometric effects.

4) Multi-centre trials to improve generalizability.

5) Inclusion of intention-to-treat analyses in future studies.

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Conflicts of Interest

The authors declare no conflicts of interest.

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