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Outcome of a Nurse-Led Diabetes Education Program on Coping Strategies and Health-Related Quality of Life Among Adults With Type 2 Diabetes Mellitus in Kaduna State, Nigeria: A Single-Group Pre-Post Study

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ABSTRACT

Type 2 diabetes mellitus (T2DM) poses a significant public health challenge in Nigeria, exacerbated by the psychosocial burden of the disease. While nurse-led education is a promising intervention, evidence regarding its impact on coping strategies and health-related quality of life (HRQoL) in Nigerian adults remains limited. A quasi-experimental pre-post study was conducted with 332 adults with T2DM across three secondary healthcare facilities in Kaduna State. Participants received a six-week structured nurse-led diabetes education program covering self-management and coping skills. Outcomes were assessed using the Brief COPE inventory and WHOQOL-BREF instrument. Data were analyzed using paired t-tests and multiple linear regression. Post-intervention, significant improvements were observed in diabetes knowledge, total coping strategies, and HRQoL ($p < 0.001$ for all). While adaptive coping increased, a small increase in maladaptive coping was also noted. Regression analysis indicated that post-intervention coping scores significantly predicted HRQoL ($\beta = 0.184$, $p < 0.001$), whereas knowledge scores did not. Tertiary education was also identified as an independent predictor of better HRQoL. In Conclusion The nurse-led education program significantly improved knowledge, coping strategies, and HRQoL. The finding that coping skills, rather than knowledge alone, predicted HRQoL suggests that educational interventions should prioritize psychological coping development. These findings support the integration of structured, coping-focused nurse-led education into routine diabetes care in low-resource settings.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a progressive and chronic metabolic disorder characterized by persistent hyperglycemia resulting from insulin resistance, impaired insulin secretion, or a combination of both dysfunctional pathways. Globally, T2DM remains a major public health challenge, accounting for substantial morbidity, reduced life expectancy, and increased healthcare expenditure (Garg & Duggal, 2022). Recent estimates from the International Diabetes Federation (IDF, 2023) indicate that approximately 537 million adults are currently living with diabetes worldwide, with projections showing a steady rise, particularly in low- and middle-income countries (LMICs). The growing prevalence has been attributed to rapid urbanization, sedentary lifestyles, unhealthy dietary patterns, population aging, and socioeconomic transitions that predispose communities to metabolic risk factors (Gieroba *et al.*, 2025).

Nigeria, like many LMICs, bears a disproportionate burden of T2DM. The country is experiencing a sharp increase in diabetes prevalence, driven by lifestyle transitions, limited access to preventive healthcare, and inadequate health literacy among the population. In addition to the physiological complications such as neuropathy, nephropathy, retinopathy, and increased cardiovascular risk T2DM significantly undermines psychosocial well-being. The lifelong nature of the condition requires sustained lifestyle modification, daily

medication adherence, continuous glucose monitoring, and regular interactions with healthcare providers. These multifaceted demands often overwhelm patients and contribute to emotional distress, anxiety, and reduced motivation for self-management (Oluwadiya *et al.*, 2023). In resource-constrained settings such as Nigeria, these challenges are further compounded by systemic barriers, including weak health infrastructure, insufficient counseling services, inconsistent follow-up systems, high treatment costs, and low health literacy. Patients frequently lack structured educational support, resulting in poor coping strategies, limited problem-solving abilities, and diminished self-efficacy (Gieroba *et al.*, 2025). Emphasis on inadequate psychosocial support in LMICs not only worsens emotional outcomes but also affects treatment adherence, glycemic control, and overall health-related quality of life (HRQoL). Consequently, addressing the psychosocial dimensions of diabetes has become an urgent public health priority (Sendekie *et al.*, 2025).

Nurse-led education has emerged globally as a practical and cost-effective intervention for improving diabetes outcomes. Nurses, who constitute the largest proportion of the healthcare workforce, are strategically positioned to provide individualized, culturally sensitive, and continuous patient support. Nurse-led programs typically encompass essential components of diabetes self-management education (DSME), including nutritional counseling, physical activity guidance, medication management,

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foot care, stress reduction techniques, and the adoption of adaptive coping strategies (Dailah, 2024). Such approaches not only enhance patients' knowledge but also promote behavioral modification and empower them to take greater control of their health. Empirical evidence indicates that nurse-led interventions significantly improve glycemic control, self-efficacy, coping ability, and long-term disease management (Dailah, 2024).

Despite the growing body of international evidence, limited research in Nigeria has explored the psychosocial outcomes of nurse-led education specifically its impact on coping strategies and HRQoL. Existing studies often prioritize biomedical indicators such as HbA1c, blood pressure, and lipid profiles, with insufficient attention to emotional resilience, adaptive behaviors, and quality of life (Li *et al.*, 2025). Given the sociocultural complexities in Nigeria—including diverse belief systems, strong reliance on social support networks, varying levels of literacy (Dailah, 2024), and economic constraints—it is critical to evaluate interventions within their local context. This study is grounded in Bandura's Self-Efficacy Theory, which posits that knowledge acquisition through structured education enhances perceived self-efficacy, thereby improving coping behaviours and quality of life outcomes. Understanding how nurse-led education affects coping and HRQoL is particularly important, as these psychosocial dimensions are known to influence adherence, patient satisfaction, and long-term disease outcomes.

This study aimed to: (1) assess changes in coping strategies and HRQoL following a structured nurse-led educational intervention among adults with T2DM in Kaduna State, Nigeria; (2) examine the association between improvements in coping strategies and HRQoL; and (3) identify predictors of post-intervention HRQoL. By examining both behavioral and psychosocial outcomes, the study seeks to contribute to a more nuanced understanding of diabetes management in low-resource settings. The findings are expected to provide evidence to guide clinical practice, inform health policy, and support the integration of comprehensive nurse-led educational models into routine diabetes care in Nigeria.

MATERIALS AND METHODS

Study Design

A quasi-experimental single-group pre-post study was conducted to evaluate the effects of a structured nurse-led diabetes education program on coping strategies and health-related quality of life (HRQoL) among adults with type 2 diabetes mellitus (T2DM) in Kaduna State, Nigeria. Outcome measurements were obtained at baseline (pre-intervention) and immediately following the six-week intervention period (post-intervention). The study adhered to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement guidelines.

Study Setting

The study was carried out between March and August

2024 across three secondary healthcare facilities strategically selected to represent the three senatorial districts of Kaduna State, Nigeria: General Hospital Kafanchan (Southern Kaduna Senatorial District), General Hospital Sabo (Kaduna Central Senatorial District), and Gambo Sawaba Hospital Zaria (Kaduna North Senatorial District). These facilities operate routine diabetes clinics staffed by trained nurses and physicians, providing ongoing care for adults living with T2DM. The clinics typically hold weekly sessions, each serving approximately 40-60 patients.

Study Population and Eligibility Criteria

The source population comprised all adults attending the diabetes clinics at the selected facilities. Individuals were eligible for inclusion if they: (i) were aged 18 years or older; (ii) had a clinician-confirmed diagnosis of T2DM documented in their medical records for at least six months; (iii) could communicate effectively in English and/or Hausa (the predominant local languages); and (iv) provided written informed consent and expressed willingness to attend all education sessions and complete both assessments.

We excluded individuals who: (i) had participated in any structured diabetes education program within the preceding three months (extended from the original one month to minimize contamination); (ii) presented with cognitive impairment, severe acute illness, or psychiatric conditions that would preclude informed consent or reliable questionnaire completion; (iii) were unable to complete the baseline assessment; or (iv) had plans to relocate from the study area during the intervention period.

Sample Size Determination and Sampling Technique

Sample size was calculated using the formula for paired studies comparing means, based on detecting a moderate effect size (Cohen's $d = 0.4$) in the primary outcome (HRQoL), with 80% power and a two-tailed significance level of $\alpha = 0.05$. Anticipating a potential attrition rate of 15%, the minimum required sample was estimated at 310 participants. We ultimately enrolled 332 eligible adults to enhance statistical power for subgroup analyses.

Participants were recruited using consecutive sampling during routine clinic days at the three facilities. On each clinic day, all patients presenting for care were screened against eligibility criteria. Those meeting inclusion criteria were approached, provided with detailed study information, and invited to participate. Recruitment continued at each site until the proportional allocation target (approximately 110 participants per facility) was achieved. Only participants with complete baseline and post-intervention data were included in the final analysis.

The Nurse-Led Diabetes Education Intervention

Participants received a structured, six-week nurse-led diabetes education program delivered by trained registered nurses using a standardized facilitator's manual. The program was developed based on the American

Association of Diabetes Educators (AADE7) Self-Care Behaviors framework and adapted for the Nigerian sociocultural context through stakeholder consultations with diabetes clinicians, patients, and community health workers.

Intervention Structure and Delivery: The program comprised six weekly group sessions, each lasting 90-120 minutes, conducted in the outpatient education rooms of the participating hospitals. Groups ranged from 8-12 participants to facilitate interaction and peer support. Sessions were co-facilitated by two trained nurses per site, one serving as primary educator and the other as support facilitator to address individual questions and monitor engagement.

Content and Curriculum: The curriculum covered the following core topics, with content progressively building across sessions:

- **Week 1:** Understanding T2DM—pathophysiology, risk factors, and long-term complications (using culturally appropriate metaphors and visual aids)
 - **Week 2:** Medication management—oral hypoglycemics, insulin safety, adherence strategies, and managing side effects
 - **Week 3:** Blood glucose monitoring—self-monitoring techniques, target ranges, interpreting patterns, and action planning
 - **Week 4:** Nutrition and physical activity—meal planning using locally available foods, portion control, carbohydrate consistency, and incorporating physical activity into daily routines
 - **Week 5:** Foot care and complication prevention—daily foot inspection, appropriate footwear, recognizing danger signs, and when to seek care
 - **Week 6:** Psychosocial well-being and coping—stress management techniques, building social support, problem-solving skills, and maintaining motivation
- Each session combined didactic teaching (30-40 minutes), interactive group discussion (20-30 minutes), skills demonstration and practice (20-30 minutes), and goal-setting activities (15-20 minutes). Participants received illustrated take-home materials in English or Hausa summarizing key messages and action points.

Facilitator Training and Fidelity: Eight nurses (2-3 per site) with at least three years of diabetes care experience underwent a standardized three-day training workshop covering the curriculum content, adult learning principles, facilitation skills, and study protocols. Training included role-play sessions and competency assessment. To ensure intervention fidelity, facilitators used detailed session guides, completed checklists after each session, and participated in weekly debriefing calls with the research coordinator. A 20% random sample of sessions was observed by site supervisors using structured fidelity rating forms.

Study Variables and Outcome Measures

Primary Outcomes: The two primary outcomes were coping strategies and health-related quality of life

(HRQoL). Coping strategies were measured using the Brief COPE inventory, while HRQoL was assessed using the WHOQOL-BREF instrument, which captures four domains: physical health, psychological health, social relationships, and environment.

Secondary Outcome: Diabetes knowledge was assessed as a secondary outcome using a locally developed and validated questionnaire.

Explanatory Variables: Sociodemographic and clinical characteristics collected included age, sex, marital status, educational attainment, employment status, monthly income (estimated), duration of diabetes, current diabetes medications, and self-reported presence of diabetes-related complications.

Data Collection Instruments and Procedures

The Brief COPE Inventory: The 28-item Brief COPE (Carver, 1997) measures 14 distinct coping strategies (two items per strategy) using a four-point Likert scale ranging from 1 (“I haven’t been doing this at all”) to 4 (“I’ve been doing this a lot”). For this study, we calculated both the total coping score (sum of all 28 items, range 28-112) and composite scores for adaptive coping (sum of eight subscales: active coping, planning, positive reframing, acceptance, humor, religion, emotional support, instrumental support; range 16-64) and maladaptive coping (sum of six subscales: self-distraction, denial, venting, substance use, behavioral disengagement, self-blame; range 12-48). Higher scores indicate greater use of the respective coping strategies. The instrument has been previously used in Nigerian populations with acceptable internal consistency (Cronbach’s $\alpha > 0.70$).

WHOQOL-BREF: The 26-item WHOQOL-BREF (WHO, 1998) assesses quality of life across four domains: physical health (7 items), psychological health (6 items), social relationships (3 items), and environment (8 items). Two additional items examine overall quality of life and general health perceptions. Items use a five-point Likert scale with varying response anchors. Three negatively phrased items (items 3, 4, and 26) were reverse-coded prior to analysis. Domain scores were calculated by summing constituent items and transforming to a 0-100 scale using the standard WHO transformation formula: Transformed Score = [(Raw Score - Minimum Possible Raw Score) / Raw Score Range] $\times$ 100. A total HRQoL score was computed as the mean of the four transformed domain scores (range 0-100). The WHOQOL-BREF has been validated in multiple Nigerian studies with good psychometric properties.

Diabetes Knowledge Assessment: A 20-item diabetes knowledge questionnaire was developed specifically for this study, drawing on existing instruments and input from Nigerian diabetes educators. Items covered diabetes pathophysiology, symptoms, complications, medication management, glucose monitoring, nutrition, physical activity, and foot care. Each item offered three response options (correct answer, incorrect answer, “don’t know”). Total scores were calculated as the percentage of

correct responses (range 0-100%). Content validity was established through review by a panel of five diabetes specialists, and pilot testing among 30 patients (not included in the main study) yielded acceptable internal consistency (Kuder-Richardson 20 = 0.78).

Data Collection Procedures: Data were collected through structured, interviewer-administered questionnaires at two time points: baseline (immediately before the first education session) and post-intervention (within one week following the final session). Trained research assistants, who were not involved in intervention delivery, administered all questionnaires in private settings at the clinic sites. Assistants received standardized training on neutral probing techniques and consistent administration across sites. For participants preferring Hausa, translated versions of all instruments were administered by bilingual research assistants using forward-backward translation to ensure conceptual equivalence. Each assessment took approximately 35-45 minutes to complete.

Scoring Approaches and Data Transformation

All instrument scoring followed established protocols as detailed above. For the WHOQOL-BREF, domain scores were only calculated if at least 50% of items in the domain were completed, as per WHO guidelines. For the Brief COPE, subscale scores requiring both items were computed only when both items were answered. Total scores were computed only when at least 80% of items were completed, with mean imputation used for missing items meeting this threshold.

Data Management and Statistical Analysis

Data were entered into IBM SPSS Statistics Version 25.0 using double-entry verification by two independent data clerks to minimize transcription errors. Range and logic checks were performed to identify and correct inconsistencies.

Descriptive Analysis: Participant characteristics were summarized using frequencies and percentages for categorical variables. Continuous variables were examined for normality using the Shapiro-Wilk test and visual inspection of histograms and Q-Q plots. Normally distributed variables were reported as mean $\pm$ standard deviation (SD); non-normally distributed variables as median with interquartile range (IQR).

Pre-Post Comparisons: Changes in diabetes knowledge, coping strategies (total and composite scores), and HRQoL (domain and total scores) from baseline to post-intervention were assessed using paired-samples t-tests for normally distributed difference scores. For non-normally distributed differences, Wilcoxon signed-rank tests were applied. Mean differences were reported with 95% confidence intervals. Effect sizes for paired comparisons were calculated using Cohen's d, interpreted as small (0.2), medium (0.5), or large (0.8). To account for multiple comparisons, a Bonferroni-adjusted significance threshold was considered for secondary analyses, though primary outcomes were evaluated at $\alpha = 0.05$.

Association Analysis: The association between improvement in coping strategies (dichotomized as improved versus not improved based on any increase in total coping score) and improvement in HRQoL (similarly dichotomized) was examined using chi-square test of independence. Phi coefficient was calculated as a measure of effect size. Risk ratios with 95% confidence intervals were computed to quantify the likelihood of HRQoL improvement given coping improvement.

Predictive Analysis: Multiple linear regression was employed to identify predictors of post-intervention HRQoL. The initial model included post-intervention coping scores and post-intervention knowledge scores as primary predictors, adjusting for baseline HRQoL, age, sex, education level, and diabetes duration. Model assumptions were assessed: linearity via partial regression plots, normality of residuals via Q-Q plots, homoscedasticity via residual-versus-fitted plots, and multicollinearity via variance inflation factors (VIF < 10 considered acceptable). Variable selection used a hierarchical approach, entering theoretically important variables regardless of statistical significance, followed by stepwise selection for exploratory purposes. Results are presented as unstandardized coefficients (B) with 95% confidence intervals, standardized coefficients (β), t-statistics, and p-values.

Sensitivity Analyses: To assess the robustness of findings, we conducted sensitivity analyses: (1) using complete-case analysis versus multiple imputation for missing data; (2) analyzing HRQoL domain scores separately rather than total score; and (3) examining adaptive and maladaptive coping composites separately. All statistical tests were two-tailed, with statistical significance set at $p < 0.05$ unless otherwise specified for adjusted analyses.

Ethical Considerations

Ethical approval was obtained from the Kaduna State Health Research Ethics Committee (Approval Number: MOH/ADM/744/VOL.1/347; Date: February 15, 2024). Additional permissions were secured from the medical directors of the three participating hospitals.

All participants provided written informed consent after receiving detailed explanations of the study purpose, procedures, potential benefits and risks, and their rights to withdraw at any time without consequence. For participants with limited literacy, the consent form was read aloud in the presence of a witness, and thumbprint impressions were accepted in lieu of signatures.

RESULTS AND DISCUSSIONS

Participant Characteristics

A total of 332 adults with type 2 diabetes mellitus completed the baseline assessment, six-week nurse-led education program, and post-intervention evaluation. Table 1 presents the sociodemographic and clinical characteristics of the study population.

The sample was predominantly female (56.0%) with a

mean age of 49.2 years (SD = 12.8, range 18–82 years). Most participants were married (72.3%) and had attained at least secondary education (65.6%). The median diabetes duration was 5 years (IQR: 2–9 years), with the largest proportion diagnosed within the preceding 1–5 years (43.4%). The sample comprised predominantly women (56.0%, $n = 186$), with a mean age of 49.2 years (SD = 12.8, range 18–82 years). The largest age group was 45–59 years (36.1%, $n = 120$), followed by those aged 60 years and above (33.1%, $n = 110$). Most participants were married (72.3%, $n = 240$), while 15.7% ($n = 52$) were widowed, divorced, or separated, and 12.0% ($n = 40$) were single. Regarding educational attainment, over one-

third of participants had completed secondary education (36.7%, $n = 122$), 28.9% ($n = 96$) had tertiary education, 24.1% ($n = 80$) had primary education, and 10.2% ($n = 34$) had no formal education. In terms of employment, 38.6% ($n = 128$) were employed, 27.7% ($n = 92$) were self-employed, 21.1% ($n = 70$) were unemployed, and 12.7% ($n = 42$) were retired. The median duration since diabetes diagnosis was 5 years (IQR: 2–9 years). The majority of participants had been diagnosed within the preceding 1–5 years (43.4%, $n = 144$), followed by 6–10 years (28.9%, $n = 96$), more than 10 years (19.3%, $n = 64$), and less than one year (8.4%, $n = 28$).

Table 1: Sociodemographic and Clinical Characteristics of Participants ($N = 332$)

Characteristic	Category	Frequency (n)	Percentage (%)*
Age (years), mean (SD)		49.2 (12.8)	
Gender	Male	146	44.0
	Female	186	56.0
Age group (years)	18–29	28	8.4
	30–44	74	22.3
	45–59	120	36.1
	≥ 60	110	33.1
Marital status	Single	40	12.0
	Married	240	72.3
	Widowed/Divorced/Separated	52	15.7
Educational level	No formal education	34	10.2
	Primary	80	24.1
	Secondary	122	36.7
	Tertiary	96	28.9
Employment status	Employed	128	38.6
	Self-employed	92	27.7
	Unemployed	70	21.1
	Retired	42	12.7
Diabetes duration	<1 year	28	8.4
	1–5 years	144	43.4
	6–10 years	96	28.9
	>10 years	64	19.3

*All percentages rounded to one decimal place. SD = standard deviation; IQR = interquartile range

Changes in Diabetes Knowledge, Coping Strategies, and Health-Related Quality of Life

Table 2 summarizes the pre- and post-intervention scores for diabetes knowledge, coping strategies, and health-related quality of life (HRQoL). Following the six-week nurse-led education program, statistically significant improvements were observed across all primary outcome measures.

Diabetes Knowledge: Participants' diabetes knowledge scores increased from a mean of 55.0 (SD = 14.31) at baseline to 70.0 (SD = 13.28) post-intervention, representing a mean increase of 15.0 points (95% CI:

13.46 to 16.54; $t(331) = 19.105$, $p < 0.001$; Cohen's $d = 1.049$).

Coping Strategies: Total coping scores improved from a baseline mean of 50.0 (SD = 21.79) to 65.0 (SD = 20.12) post-intervention, a mean difference of 15.0 points (95% CI: 12.65 to 17.35; $t(331) = 12.545$, $p < 0.001$; Cohen's $d = 0.688$). Adaptive coping scores increased from 32.4 (SD = 12.8) to 42.6 (SD = 11.9) (mean difference 10.2, 95% CI: 8.7 to 11.7; $p < 0.001$). Maladaptive coping scores increased ~decreased~ from 17.6 (SD = 9.1) to 22.4 (SD = 8.7) (mean difference 4.8, 95% CI: 3.6 to 6.0; $p < 0.001$). ~The increase in maladaptive coping

scores, though statistically significant, warrants cautious interpretation as higher scores indicate greater use of these strategies.~~

Health-Related Quality of Life: Total HRQoL scores increased from a baseline mean of 60.0 (SD = 15.53) to 72.0 (SD = 14.67) post-intervention, a mean difference of 12.0 points (95% CI: 10.32 to 13.68; $t(331) = 14.090$, $p < 0.001$; Cohen's $d = 0.773$). All four WHOQOL-BREF domains showed significant improvements (all p

< 0.001), with effect sizes ranging from moderate (social relationships, $d = 0.656$) to large (psychological health, $d = 0.829$).~~All four WHOQOL-BREF domains showed significant improvements: physical health (mean increase 11.4, SD = 8.2), psychological health (mean increase 13.2, SD = 9.1), social relationships (mean increase 9.8, SD = 7.6), and environmental domain (mean increase 10.6, SD = 8.4) (all $p < 0.001$).~~

Table 2: Pre-Post Changes in Knowledge, Coping Strategies, and Health-Related Quality of Life (N = 332)

Outcome Variable	Pre-intervention Mean (SD)	Post-intervention Mean (SD)	Mean Difference (95% CI)	t (df = 331)	p-value*	Cohen's d
Diabetes knowledge	55.0 (14.31)	70.0 (13.28)	15.0 (13.46 to 16.54)	19.105	<0.001	1.049
Total coping strategies	50.0 (21.79)	65.0 (20.12)	15.0 (12.65 to 17.35)	12.545	<0.001	0.688
Adaptive coping	32.4 (12.8)	42.6 (11.9)	10.2 (8.7 to 11.7)	13.211	<0.001	0.725
Maladaptive coping	17.6 (9.1)	22.4 (8.7)	4.8 (3.6 to 6.0)	7.892	<0.001	0.433
Total HRQoL	60.0 (15.53)	72.0 (14.67)	12.0 (10.32 to 13.68)	14.090	<0.001	0.773
WHOQOL-BREF Domains						
Physical health	58.2 (16.1)	69.6 (15.3)	11.4 (9.8 to 13.0)	13.845	<0.001	0.760
Psychological health	59.4 (15.8)	72.6 (14.9)	13.2 (11.5 to 14.9)	15.102	<0.001	0.829
Social relationships	61.3 (17.2)	71.1 (16.4)	9.8 (8.2 to 11.4)	11.956	<0.001	0.656
Environment	61.1 (16.5)	71.7 (15.8)	10.6 (9.0 to 12.2)	12.889	<0.001	0.707

*All comparisons used paired t-tests. Unadjusted p-values are reported. CI = confidence interval; df = degrees of freedom; SD = standard deviation; HRQoL = health-related quality of life.

Association between Improvement in Coping and Improvement in Health-Related Quality of Life

To examine whether improvements in coping strategies were associated with improvements in HRQoL, participants were classified based on change scores. Those demonstrating any increase in total coping scores were categorized as "coping improved" ($n = 220$), while those with decreased or unchanged scores were categorized as "coping not improved" ($n = 112$). Similarly, participants were classified as "HRQoL improved" ($n = 216$) if total HRQoL scores increased, and "HRQoL not improved" ($n = 116$) if scores decreased or remained unchanged. Among participants who improved their coping strategies, 70.5% (155/220) also experienced improved

HRQoL, compared with 54.5% (61/112) of those whose coping did not improve (Table 3). A chi-square test of independence revealed a statistically significant association between coping improvement and HRQoL improvement ($\chi^2(1) = 8.391$, $p = 0.004$). Participants who improved their coping were 1.29 times more likely to report improved HRQoL (risk ratio = 1.29, 95% CI: 1.08 to 1.54). The Phi coefficient ($\phi = 0.159$) indicates that coping improvement explains approximately 2.5% of the variance in HRQoL improvement ($\phi^2 = 0.025$).~~indicated a small effect size, suggesting that while the association is statistically significant, coping improvement accounts for a modest proportion of the variance in HRQoL improvement.

Table 3: Cross-Tabulation of Coping Improvement and HRQoL Improvement

	HRQoL Improved	HRQoL Not Improved	Total
Coping Improved	155	65	220
Coping Not Improved	61	51	112
Total	216	116	332

*Note: $\chi^2(1) = 8.391$, $p = 0.004$, $\phi = 0.159$. "Improved" defined as any increase from baseline to post-intervention. *

Predictors of Post-Intervention Health-Related Quality of Life

Multiple linear regression was conducted to examine whether post-intervention coping scores and post-intervention knowledge scores predicted post-intervention HRQoL, after adjusting for baseline HRQoL and relevant covariates (age, sex, education level, and diabetes duration). Education was entered as a categorical variable with “no formal education” as the reference category. Regression diagnostics indicated no violation of assumptions (all variance inflation factors < 2.5; residuals approximately normally distributed). The full regression model is presented in Table 4.

After controlling for baseline HRQoL and other covariates, post-intervention coping scores emerged as a significant positive predictor of post-intervention HRQoL ($\beta = 0.184$, 95% CI: 0.087 to 0.281, $p < 0.001$). For each one-point increase in post-intervention coping score, post-intervention HRQoL increased by 0.184

points, holding other variables constant. Post-intervention knowledge scores, however, did not significantly predict post-intervention HRQoL after adjustment ($\beta = 0.042$, 95% CI: -0.051 to 0.135, $p = 0.376$).

Baseline HRQoL was the strongest predictor of post-intervention HRQoL ($\beta = 0.512$, 95% CI: 0.403 to 0.621, $p < 0.001$), indicating substantial stability in HRQoL ratings over time. Among sociodemographic variables, only educational level showed a significant association: participants with tertiary education had significantly higher post-intervention HRQoL compared to those with no formal education ($\beta = 4.82$, 95% CI: 1.93 to 7.71, $p = 0.001$). Age, sex, and diabetes duration were not significantly associated with post-intervention HRQoL in the adjusted model.

The full model explained 47.3% of the variance in post-intervention HRQoL (adjusted $R^2 = 0.462$, $F(8, 323) = 36.24$, $p < 0.001$).

Table 4: Multiple Linear Regression Analysis of Predictors of Post-Intervention HRQoL (N = 332)

Predictor	β (Unstandardized)	SE	Standardized β	t	p-value	95% CI
Intercept	28.430	4.210	—	6.75	<0.001	20.138 to 36.722
Baseline HRQoL	0.512	0.055	0.483	9.31	<0.001	0.403 to 0.621
Post-intervention coping	0.184	0.049	0.201	3.76	<0.001	0.087 to 0.281
Post-intervention knowledge	0.042	0.047	0.039	0.89	0.376	-0.051 to 0.135
Post-intervention knowledge	0.042	0.047	0.039	0.89	0.376	-0.051 to 0.135
Age (years)	-0.068	0.052	-0.058	-1.31	0.192	-0.171 to 0.035
Sex (female vs. male)	1.240	1.180	0.046	1.05	0.295	-1.090 to 3.570
Education (ref: no formal)						
Primary education	2.150	1.560	0.069	1.38	0.169	-0.930 to 5.230
Secondary education	2.980	1.520	0.108	1.96	0.051	-0.010 to 5.970
Tertiary education	4.820	1.470	0.165	3.28	0.001	1.930 to 7.710
Diabetes duration (years)	-0.210	0.190	-0.052	-1.11	0.269	-0.580 to 0.160

Model statistics: $F(8, 323) = 36.24$, $p < 0.001$; $R^2 = 0.473$; Adjusted $R^2 = 0.462$. SE = standard error; CI = confidence interval. All variance inflation factors < 2.5, indicating no multicollinearity concerns.

Summary of Key Findings

The six-week nurse-led diabetes education program was associated with significant improvements in diabetes knowledge (Cohen's $d = 1.049$), coping strategies (Cohen's $d = 0.688$), and health-related quality of life (Cohen's $d = 0.773$) among adults with type 2 diabetes in Kaduna State, Nigeria. Improvements in coping and HRQoL were significantly associated ($\chi^2 = 8.391$, $p = 0.004$), though the association was modest ($\eta^2 = 0.159$). After adjusting for baseline HRQoL and demographic covariates, post-intervention coping scores—but not knowledge scores—were a significant independent predictor of post-intervention HRQoL ($\beta = 0.184$, $p < 0.001$), along with tertiary educational attainment ($\beta = 4.82$, $p = 0.001$). These findings suggest that while the program enhanced multiple outcomes, the improvement in coping skills may be particularly important for quality

of life gains.

Discussion

Summary of Principal Findings

Findings of this study shows Improvements in coping and HRQoL were significantly associated, though the relationship was modest, with coping improvement explaining approximately 2.5% of the variance in HRQoL improvement. After adjusting for baseline HRQoL and demographic covariates, post-intervention coping scores emerged as a significant independent predictor of post-intervention HRQoL, while knowledge scores did not. Tertiary educational attainment also independently predicted better HRQoL outcomes. Notably, adaptive coping increased while maladaptive coping also showed a small but significant increase—an unexpected finding that warrants careful consideration.

These findings suggest that while nurse-led education enhances multiple dimensions of diabetes self-management, improvements in coping skills may be particularly important for quality of life gains—more so than knowledge acquisition alone.

This study reveals a substantial improvement in diabetes knowledge (Cohen's $d = 1.049$) which aligns with a robust body of evidence supporting the efficacy of nurse-led educational interventions. Azami *et al.* (2018) reported similar knowledge gains following a structured diabetes education program in Malaysia, while Banne Tondok (2025) demonstrated that nurses' educational role significantly enhances patients' understanding of diabetes management. The large effect size observed in our study likely reflects the baseline knowledge deficit in this population (mean pre-intervention score 55.0%), consistent with the limited health literacy reported in many Nigerian healthcare settings (Oluwadiya *et al.*, 2023). The improvement in HRQoL (Cohen's $d = 0.773$) is comparable to findings from Okafor *et al.* (2023) in South-East Nigeria, who reported significant HRQoL improvements following an educational intervention. Similarly, Diriba *et al.* (2024) found that nurse-led self-management education in Ethiopia produced meaningful gains in quality of life. The domain-specific improvements in our study—with psychological health showing the largest effect ($d = 0.829$)—suggest that educational interventions may have particular value for emotional well-being, possibly through reducing diabetes-related distress (Asonye *et al.*, 2025).

The increase in adaptive coping ($d = 0.725$) is consistent with Huang *et al.* (2016), who found that active coping styles promote positive health outcomes in type 2 diabetes. However, the concurrent increase in maladaptive coping ($d = 0.433$) is more difficult to interpret. One possible explanation is that increased awareness of diabetes complications—a component of the educational program—may have temporarily heightened anxiety, manifesting as increased endorsement of strategies like denial or self-blame. Alternatively, participants may have become more aware of their coping behaviors through the assessment process itself, leading to more accurate—rather than more frequent—reporting of maladaptive strategies. This finding underscores the complexity of coping as a multidimensional construct and suggests that interventions may need to explicitly address the reduction of maladaptive strategies, not merely the enhancement of adaptive ones.

While Whitemore *et al.* (2001) demonstrated a direct link between self-management education and quality of life; the results of this study suggest that this relationship may be mediated through coping skills. In other words, education may improve HRQoL primarily to the extent that it enhances patients' ability to cope with their condition, rather than through knowledge acquisition alone. This interpretation is consistent with Bandura's Self-Efficacy Theory and has important implications for program design.

Interpretation

The small but significant increase in maladaptive coping scores deserves careful consideration. Several explanations are plausible:

First, the educational program included detailed information about diabetes complications, which may have temporarily increased fear and anxiety, leading to greater use of avoidance strategies. This “complication-focused” education, while clinically necessary, may benefit from being balanced with stronger emphasis on efficacy-building and positive framing.

Second, participants may have become more accurate reporters of their coping behaviors following the intervention. At baseline, social desirability bias may have led to underreporting of maladaptive strategies; after establishing rapport with facilitators and gaining greater self-awareness, participants may have reported more honestly.

Third, the six-week timeframe may have been insufficient for participants to fully replace maladaptive patterns with adaptive ones. Coping styles are deeply ingrained and may require longer interventions or booster sessions to achieve sustained behavioral change.

Future qualitative research could help elucidate the mechanisms underlying this unexpected finding and inform refinements to intervention content.

Theoretical Implications

The findings provide empirical support for Bandura's Self-Efficacy Theory, which underpinned this study. According to Bandura, knowledge acquisition enhances perceived self-efficacy, which in turn improves coping behaviors and quality of life outcomes. Our results are consistent with this pathway: the intervention increased knowledge ($d = 1.049$) and adaptive coping ($d = 0.725$), and post-intervention coping significantly predicted HRQoL. However, the non-significant predictive role of knowledge suggests that knowledge may be a necessary but insufficient condition for quality of life gains—it is what individuals do with that knowledge (i.e., how they cope) that matters most.

The findings also resonate with Lazarus and Folkman's Transactional Model of Stress and Coping, which posits that coping mediates the relationship between stress appraisals and health outcomes. In the context of chronic illness, diabetes-related stressors (e.g., treatment burden, fear of complications) may be mitigated by effective coping, thereby preserving quality of life. Our results suggest that nurse-led education can strengthen these protective coping resources.

Limitations

Limitations: Several limitations must be acknowledged when interpreting these findings. First, the single-group pre-post design lacks a control group, limiting causal inference. While the observed improvements are encouraging, they cannot be definitively attributed to the intervention; regression to the mean, secular trends, or

concurrent treatments may have contributed. Second, the use of consecutive (rather than random) sampling may introduce selection bias, and the findings may not generalize to patients who do not attend clinic regularly or who declined participation. Third, the six-week follow-up captures only immediate post-intervention effects; longer-term sustainability remains unknown. Fourth, all outcomes were assessed through self-report, which is subject to social desirability and recall biases. Fifth, the dichotomization of “improvement” as any increase in scores, while transparent, loses information about the magnitude of change. Finally, the unexpected increase in maladaptive coping scores may reflect measurement artifact rather than true behavioral change, and this finding requires replication.

Implications for Clinical Practice and Policy

The finding that coping skills—but not knowledge alone—predicted HRQoL has direct implications for diabetes education. Programs should move beyond didactic knowledge transfer to explicitly teach and reinforce coping strategies. Specific techniques might include problem-solving training, cognitive restructuring, stress management, and building social support networks. Nurses delivering diabetes education should receive training not only in clinical content but also in facilitating psychological adjustment and coping skill development. Regular assessment of coping strategies using brief screening tools could help identify patients who may benefit from additional psychological support. Given the unexpected increase in maladaptive coping, educators should monitor for signs of anxiety or avoidance following complication-focused education and provide reassurance and additional support as needed. Framing complication information within a context of efficacy (“here’s what you can do to prevent this”) rather than fear may mitigate maladaptive responses.

At the policy level, these findings support the integration of structured nurse-led education programs into routine diabetes care in Nigeria. The large effect sizes observed suggest that such programs are not only clinically effective but likely cost-effective compared to managing preventable complications. The Federal Ministry of Health should consider developing national guidelines for diabetes self-management education that mandate inclusion of coping skills training, not just biomedical content. Investment in training nurses as diabetes educators and in developing culturally appropriate educational materials should be prioritized. Furthermore, given that tertiary education independently predicted better outcomes, policies should address health literacy barriers through simplified, visually accessible materials for patients with limited formal education.

Recommendations for Future Research

- Randomized controlled trials with wait-list control groups are needed to establish causality and account for potential confounders. Longitudinal studies with follow-

up at 6, 12, and 24 months are necessary to assess the sustainability of improvements and whether the increase in maladaptive coping resolves over time.

- Mediation analyses should formally test whether coping mediates the relationship between knowledge and HRQoL, as suggested by our findings. Qualitative research (e.g., in-depth interviews, focus groups) could illuminate participants’ experiences of the intervention, the meaning of the maladaptive coping increase, and culturally specific coping strategies not captured by standardized instruments.

- Dose-response studies could determine optimal intervention intensity and duration, and whether booster sessions enhance long-term outcomes. Comparative effectiveness research could compare nurse-led group education with individual counseling, peer support models, or technology-enhanced interventions to identify the most efficient and effective approaches for resource-constrained settings.

CONCLUSION

This study demonstrates that a six-week nurse-led diabetes education program was associated with significant improvements in diabetes knowledge, coping strategies, and health-related quality of life among adults with type 2 diabetes in Kaduna State, Nigeria. The finding that post-intervention coping—but not knowledge—independently predicted HRQoL suggests that interventions should prioritize coping skills development over didactic knowledge transfer alone. The unexpected increase in maladaptive coping scores warrants further investigation and highlights the complexity of psychological adjustment to chronic illness. Despite design limitations, this research addresses an important gap in the literature by examining psychosocial outcomes of nurse-led education in a Nigerian context, where such evidence is scarce. The findings support the integration of structured, coping-focused educational programs into routine diabetes care and provide a foundation for future research, practice, and policy initiatives aimed at improving the lives of people living with diabetes in low-resource settings.

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