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Effects of training on the WHO package of essential interventions on NCDS prevention and control on the clinical practices of primary health care workers in Benue state

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Abstract

Background: Non-communicable diseases (NCDs) pose a growing health challenge globally, especially in low-resource settings such as Nigeria. Primary healthcare workers (PHCWs) are critical to NCD prevention and control, but often lack adequate knowledge and skills. The World Health Organisation's Package of Essential Non-Communicable Disease Interventions (WHO PEN) aims to address these gaps.

Objective: To evaluate the impact of WHO PEN training on the knowledge, attitudes, and clinical practices of PHCWs in Benue State, Nigeria, and to identify factors associated with these preventive practices.

Methods: A quasi-experimental study with 400 PHCWs compared WHO PEN-trained (experimental) and untrained (control) groups using structured questionnaires on NCD knowledge, attitudes, and practices. Chi-square and regression analyses assessed sociodemographic influences.

Results: Findings showed that baseline NCD knowledge was high, aligning with national guidelines. Post-training, all participants showed good understanding, with no poor knowledge. Attitudes improved significantly, with 100% positive views on counselling, tobacco cessation, and patient education. Clinical practices varied: patient education improved, but routine BP screening remained low. Older and higher-cadre workers performed better, while sex and experience had no significant impact.

Conclusion: WHO PEN training boosted PHCWs' knowledge, attitudes, and clinical practices in NCD prevention in Benue State. While baseline knowledge was strong, the intervention improved confidence and practice consistency, particularly in patient education. Tailoring training for younger, less experienced workers, addressing resource constraints, and sustaining professional development are key to enhancing NCD care. The study recommended that expanding professional development programs in underserved areas is vital to reducing Nigeria's NCD burden.

Keywords: WHO PEN (Package of Essential NCD Interventions); NCD Prevention and Control; Clinical Practices; Primary Health Care Workers

1. Introduction

Non-communicable diseases (NCDs) pose a growing global health challenge, yet frontline primary healthcare workers often lack the necessary knowledge for effective prevention and control. According to the World Health Organisation

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[WHO] (2024), at least 43 million people died from non-communicable diseases (NCDs) in 2021, which accounted for 75 per cent of mortality worldwide that is not attributable to pandemics. Also, WHO asserted that low- and middle-income nations account for 73 per cent of these fatalities. Additionally, 18 million people died before the age of 70 from an NCD, with low- and middle-income nations accounting for 82 per cent of these premature fatalities. Specifically, WHO (2024) noted that at least 19 million deaths from NCDs are attributable to cardiovascular illnesses, with cancer coming in second with 10 million, chronic respiratory conditions with 4 million, and diabetes with over 2 million deaths, including deaths from kidney disease. Eighty percent of all premature deaths from NCDs are caused by these four disease categories (WHO, 2024). The European Commission (2025) also reported that NCDs such as cardiovascular diseases, diabetes, chronic respiratory diseases, mental disorders, neurological disorders, or cancer are responsible for 80 per cent of the disease burden in the European Union countries and are the leading causes of avoidable premature deaths. Non-communicable diseases are known to affect different populations in other continents and regions, including Africa.

The burden of NCDs, both in terms of disease morbidity, mortality and socio-economic impact, is increasing in Africa. According to the African Centre for Diseases Prevention and Control [African CDC] (2022), NCDs constitute a serious impediment to achieving the vision of Agenda 2063 to build an integrated, prosperous, and peaceful Africa driven by its citizens. The burden of NCDs in sub-Saharan Africa alone grew by 67 per cent between 1990 and 2017 (measured as disability adjusted life years–DALYs), reflecting a significant rise in the proportion of total DALYs attributable to NCDs from 18 per cent to 30 per cent (African CDC, 2022). Mohammed et al. (2023) asserted that the burden of NCDs among African Union Member States is higher than the global average. This led to the postulation that Africa has a triple burden of NCDs. The rise of NCDs is projected to accelerate and are estimated to cause more premature deaths on the continent than all ot45 – 65chapter her conditions combined by 2030 and, by far, most death and disability by 2063 (Mohammed et al., 2023). NCDs should no longer be neglected in Africa and must be prioritized on health and development agendas especially by continental, regional and national public health institutes, even in Nigeria.

Non-communicable diseases are a significant health problem in Nigeria. The WHO (2018) stated that the risk of premature death from cardiovascular diseases, cancers, respiratory diseases, and diabetes among Nigerians aged 30 to 69 years is quite substantial at 22 per cent. Specifically, cardiovascular diseases as a group now account for approximately 10 per cent of deaths and 3.8 per cent of DALYs (Collaborators and Ärnlöv, 2020). The DALYs lost to NCDs in general increased tremendously by approximately 21.3 per cent from 24,987 in 2010 to 30,306 in 2019, versus 6.5 per cent DALYs lost to infectious diseases over the same period (WHO, 2022). According to the WHO African Region (2023), Nigeria has a high burden of NCDs, making up 27 per cent of deaths in 2019. The mortality rate across four major NCDs (cardiovascular disease, chronic respiratory disease, cancer, diabetes) was 565 per 100,000 in males and 546 in females in 2021 (Oso, 2023; WHO African Region, 2023). Although there is a general increase in the burden of NCDs across states in Nigeria, there is a paucity of studies on NCDs in Benue State. This paucity of studies influences the prevention and control of NCDs in the state.

In an optimal healthcare system, primary healthcare workers (PHCWs) should possess comprehensive knowledge and skills for the prevention and control of non-communicable diseases (NCDs). The World Health Organisation Package of Essential Non-Communicable Disease (WHO PEN) interventions were designed to enhance the capacity of PHCWs to detect, manage, and prevent NCDs effectively at the primary healthcare level. Ideally, the full implementation of WHO PEN would equip PHCWs in Benue State, Nigeria, with the necessary expertise to provide early screening, promote lifestyle modifications, and deliver cost-effective treatments, thereby reducing the burden of NCDs and improving overall public health outcomes. However, the reality in Benue State presents a different scenario. NCDs such as cardiovascular diseases, diabetes, chronic respiratory diseases, and cancer are becoming increasingly prevalent, yet many PHCWs lack the necessary training, knowledge, and resources to implement effective prevention and control measures. The limited awareness and inadequate integration of WHO PEN interventions among PHCWs contribute to poor diagnosis, delayed treatment, and ineffective management of NCDs. Furthermore, systemic challenges such as poor healthcare infrastructure, lack of professional development opportunities, and insufficient policy implementation hinder the capacity of PHCWs to adequately address the growing NCDs burden. Despite the existence of WHO PEN interventions, there is limited empirical evidence on their effectiveness in improving PHCWs' knowledge and practice regarding NCDs prevention and control in Benue State. The extent to which WHO PEN guidelines have been adopted, implemented, and translated into improved knowledge and service delivery among PHCWs remains unclear. Addressing this gap is crucial for strengthening primary healthcare responses to NCDs. Therefore, this study seeks to assess the effects of WHO PEN interventions on PHCWs' knowledge of NCDs prevention and control in primary healthcare settings in Benue State, Nigeria.

1.1. Aim and Objectives of the Study

This study aimed to assess the effects of training on the WHO Package of Essential Interventions on NCDs Prevention and Control on the Clinical Practices of Primary Health Care Workers in Benue State. The specific objectives of the study were:

- To assess the level of knowledge of preventive practices of NCDs among primary health care workers in Benue State
- To assess the attitude towards preventive practices of NCDs among primary health care workers in Benue State
- To assess the preventive practices of NCDs among primary health care workers in Benue State

1.2. Research Questions

- What is the level of knowledge of preventive practices of NCDs among primary health care workers in Benue State?
- What is the attitude towards preventive practices of NCDs among primary health care workers in Benue State?
- What are the preventive practices of NCDs among primary health care workers in Benue State?

1.3. Hypotheses

The following null hypotheses are postulated to guide the study and will be tested at 0.05 level of significance:

- There is no statistically significant difference between the level of knowledge of preventive practices of NCDs in the pre- and post-intervention stages among the primary health care workers in Benue State.
- There is no statistically significant difference between the attitude towards preventive practices of NCDs in the pre- and post-intervention stages among the primary health care workers in Benue State
- There is no statistically significant difference between preventive practices of NCDs in the pre- and post-intervention stages among the primary health care workers in Benue State.

2. Material and methods

This study adopted a quasi-experimental research design, involving a pre-test-post-test non-randomised control group design. The study was carried out in Benue State. Benue State, located in north-central Nigeria. The population for the study consisted of primary health care workers (PHCWs), specifically 8 Doctors, 1,561 community health workers (CHWs) comprising 50 community health officers (CHO), 1,138 community health extension workers (CHEW) and 373 junior community health extension workers (JCHEW) employed in Benue State, Nigeria. The study included Health Workers, Doctors, Nurses, Public Health Scientists, Community Health Officers (CHO), Community Health Extension Workers (CHEW), Junior Community Health Extension Workers (JCHEW) and others actively working in primary healthcare facilities in Benue State who have at least six months of work experience in primary healthcare service delivery. Excluded in this study were non-practising Doctors, Nurses, Public Health Scientists, CHO, CHEW JCHEW or other health workers in Benue State at the time of the study. Also excluded were those who declined informed consent or withdrew participation at any stage. For the study, a sample size of 400 PHCWs was determined using the Yamane formula. Thus,

$$n = \frac{N}{1+ N(e^2)}$$

Where:

- n = the required sample size
- N = the population size (1,561)
- e = the level of precision (0.05)
- 1 = unity (a constant)

$$n = \frac{1561}{1+ 1.561(0.05^2)}$$

$$n = \frac{1561}{1+ 1.561(0.0025)}$$

$$n = \frac{1561}{1+ 3.9025}$$

$$n = \frac{1561}{4.9025}$$

n = 318.4 = 318.

Computing 1.2 design effect = 318 x 1.2 = 381.6. Hence, the sample size was approximated to 400. The sample size for the study was determined through a two-stage sampling procedure. First, a simple random sampling technique of balloting without replacement was used to select four local government areas (LGAs) from the 23 LGAs in Benue State. At a second stage, a simple random sampling technique of balloting without replacement was used to select 100 PHCWs, comprising 100 primary health care workers from each of the selected LGAs. At the end of the sampling procedure, 100 PHCWs were enrolled for the study in each of the selected four LGAs, giving a total of 400 PHCWs for both control and intervention. A researcher-developed instrument was used for data collection in this study. The instrument was developed in line with the WHO PEN recommended prevention and control of NCDs, such as cardiovascular diseases, diabetes, chronic respiratory diseases, and cancer. The instrument contained items organised in sections A, B, C and D. Section A comprised the sociodemographic characteristics of the respondents with varied response options. Section B contain items on the knowledge of preventive practices of NCDs. The options were dichotomously scored. This implies that only two scores are possible (True or False). Section C contained questions on attitude towards preventive practices of NCDS, which was on a Likert scale, and Section D contained questions on preventive practices of NCDs. The respondents were asked to place a tick (√) against the correct item. The face validity of the instrument was established by three experts in the fields of public and community health. To establish the construct validity of the instrument, the items of the instrument were subjected to principal component analysis (PCA) using the Statistical Package for Social Science (SPSS) version 26. Before performing the PCA, the suitability of the data for factor analysis was assessed. The items loading .40 and above were retained in the questionnaire. This decision is based on Tabachnik and Fidell's (2007) recommendation that the benchmark for retaining an item in a scale during factor analysis should be .40 and above. The reliability of the instrument was established using Kuder-Richardson-20 (KR-20) and Cronbach's Alpha. According to Cohen et al. (2018), if the correlation coefficient index obtained is 0.70 and above, the instrument was considered reliable for the study. Whereas, when the instrument yields less than .70, it was adjudged not reliable for use. The data collection stage was done in phases. First, the WHO Package of Essential Non-communicable Disease (WHO PEN) Interventions training was designed to aid primary healthcare workers (PHCWs) with essential knowledge and skills for the prevention, early detection, and management of non-communicable diseases (NCDs) at the primary care level. This was followed by the development of the WHO PEN interventions training lesson plan, which covered seven core modules, each focusing on a major NCDs category covered in WHO PEN: Cardiovascular Diseases (CVDs), Diabetes, Chronic Respiratory Diseases (CRDs), and Cancer, as well as integrated NCDs management and monitoring. Before the implementation of the WHO PEN interventions training, the researcher obtained a letter of introduction from the Director, School of Public Health, University of Port-Harcourt. The letter was presented to the Executive Secretary, Benue State Primary Health Care Board, indicating the LGA selected for the study, explaining the purpose of the study and seeking their permission to carry out the study. Furthermore, informed consent was obtained from the PHCWs before they participated in the study. Due to the nature of the study, the researcher employed the services of four research assistants, two with a PhD in Public Health and two with a Master of Science (M.Sc.) in Public Health. The research assistants were briefed on the modalities and the nature of the intervention training. The roles of the research assistants were thoroughly defined. The WHO PEN interventions training was administered to participants in the experimental group once a week for seven days. The control group did not receive any intervention or training. At the end of the intervention, the post-test measure was administered. The instruments were re-administered to the participants in both experimental and control groups within a period of two-week interval. To authenticate the outcome of the study, a one-month follow-up examination was conducted after the post-test. This further facilitated the determination of the effect of WHO PEN interventions training on knowledge of NCDs prevention and control among the participants. Data analysis was performed with Statistical Product and Service Solutions (SPSS) version 25 (IBM, Armonk, New York, USA). A descriptive analysis to report the frequency distributions, percentages, means, and standard deviations was performed. An inferential statistics analysis, such as chi-square and logistics regression, was done to determine factors associated with preventive practices of NCDs among health care workers. All the analyses were performed at 95% confidence intervals, and a p-value ≤0.05 was accepted as statistically significant. Ethical approval was sought from the Ethics Committee of the University of Port Harcourt, while approval had been obtained from the Primary Healthcare Management Board of Benue State. Permission was also sought from the heads of the facilities, and written informed consent was obtained from the primary healthcare workers recruited for the study.

3. Results

Table 1 Sociodemographic Characteristics of Respondents

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
Age (years)					
20-29	187(46.8)	194(48.5)	381(47.6)		
30-39	139(34.8)	164(41.0)	303(37.9)		
40-49	57(14.2)	36(9.0)	93(11.6)	12.194	0.007*
50 and above	17(4.3)	1(0.5)	23(2.9)		
Total	400(100.0)	400(100.0)	800(100.0)		
Sex					
Male	126(31.5)	126(31.5)	252(31.5)	0.000	1.000
Female	274(68.5)	274(68.5)	548(68.5)		
Cadre of Health Worker					
CHEW	253(63.2)	274(68.5)	527(65.9)		
CHO	77(19.3)	60(15.0)	137(17.1)		
Dental Therapist	2(0.5)	4(1.0)	6(0.8)		
Doctors	6(1.5)	8(2.0)	14(1.8)		
Health Records	4(1.0)	2(0.5)	6(0.8)		
JCHEW	15(3.8)	14(3.5)	29(3.6)	10.081	0.344
Medical Lab	7(1.8)	12(3.0)	19(2.4)		
Nurses	28(7.0)	16(4.0)	44(5.5)		
Pharmacy technician	3(0.8)	2(0.5)	5(0.6)		
Public Health Scientist	5(1.3)	8(2.0)	13(1.6)		
Professional training with certificate					
No	6(1.5)	10(2.5)	16(2.0)	1.020	0.312
Yes	394(98.5)	390(97.5)	784(98.0)		
Years of working experience					
0-4years	226(56.5)	260(65.0)	486(60.8)		
5-9years	88(22.0)	88(22.0)	176(22.0)		
10-14years	31(7.8)	18(4.5)	49(6.1)	10.786	0.029*
15-19years	32(8.0)	20(5.0)	52(6.5)		
20years and above	23(5.8)	14(3.5)	37(4.6)		
Location of Primary Health Centre					
Rural	285(71.3)	306(76.5)	591(73.9)	2.856	0.091
Urban	115(28.7)	94(23.5)	209(26.1)		

Table 1 indicates that several 187(46.8%) respondents in pre-phase compared to majority 194(48.5%) of the respondents in post-phase are of ages 20-29 years with a statistically significant difference at *p*=(0.007). There was found an equal proportion 274(68.5%) of female participants in the pre and post-phases with no statistically significant difference at *p*=(1.000). Majority 253(63.2%) of the respondents in the pre-phase are CHEW compared to a larger number 274(68.5%) of the respondents in the post-phase with no statistically significant difference at *p*=(0.344). Most 394(98.5%) of the respondents in the pre-phase have gone through professional trainings with certificate compared to lesser proportion 390(97.5%) of the respondents in the post-phase with a statistically significant difference at *p*=(0.312). A lesser number 226(56.5%) of the respondent in pre-phase compared to a larger number 260(65.0%) of the participants in the post-phase have 0-4years working experience with a statistically significant difference at *p*=(0.029). Majority 285(71.3%) of participants in the pre-phase compared to more 306(76.5%) of the participants in the post-phase Primary Healthcare Centres are located in the rural areas with no statistical significance *p*=(0.091).

Table 2a Knowledge of preventive practices of NCDs

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
Hypertension cannot be managed effectively with lifestyle changes such as dietary modification and regular exercise.					
True	16(4.0)	0(0.0)	16(2.0)	16.327	0.00001*
False	384(96.0)	400(100.0)	784(98.0)		
Screening for diabetes should not be conducted annually for individuals over 40 years old					
True	76(19.0)	2(0.5)	78(9.8)	77.790	0.0001*
False	324(81.0)	398(99.5)	722(90.3)		
The use of tobacco is linked to an increased risk of cardiovascular diseases					
True	309(77.3)	400(100.0)	709(88.6)	102.680	0.0001*
False	91(22.8)	0(0.0)	91(11.4)		
It is not important to incorporate regular physical activity and balanced nutrition in preventing chronic respiratory diseases					
True	56(14.0)	0(0.0)	56(7.0)	60.215	0.0001*
False	344(86.0)	400(100.0)	744(93.0)		
Cancer screening for cervical and breast cancer is not a key component of primary healthcare for women.					
True	61(15.3)	0(0.0)	61(7.6)	66.035	0.0001*
False	339(84.8)	400(100.0)	739(92.4)		
Maintaining a healthy body weight cannot reduce the risk of developing type 2 diabetes.					
True	20(5.0)	0(0.0)	20(2.5)	20.513	0.0001*
False	380(95.0)	400(100.0)	780(97.5)		

Table 2a shows that 384(96.0%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase agree that hypertension can be managed effectively with lifestyle changes such as dietary modification and regular exercise with a statistically significant difference at *p*=(0.0001). Screening for diabetes should be conducted annually for individuals over 40 years old was seen from the majority 324(81.0%) of the participants in the pre-phase compared to a higher proportion 398(99.5%) of the respondents in the post-phases with a statistically significant difference at *p*=(0.0001). The use of tobacco is believed to be linked to an increased risk of cardiovascular diseases by 309(77.3%) respondents in the pre-phase compared to all 400(100.0%) of the respondents in the post-phase with a statistically significant difference at *p*=(0.0001).

Most of the respondents 344(86.0%) in the pre-phase accepted that it is important to incorporate regular physical activity and balanced nutrition in preventing chronic respiratory diseases compared to all 400(100.0%) of the respondents in the post-phase with a statistically significant difference at *p*=(0.0001). Cancer screening for cervical and

breast cancer is a key component of primary healthcare for women was agreed by majority 339(84.8%) of the respondent in pre-phase compared to all 400(100.0%) of the participants in the post-phase with a statistical significant difference at *p*=(0.0001). Most 380(95.0%) of the participants in the pre-phase compared to all 400(100.0%) of the participants in the post-phase do accept that maintaining a healthy body weight can reduce the risk of developing type 2 diabetes with a statistical significance at *p*=(0.0001).

Table 2b Knowledge of preventive practices of NCDs

Variable	**Intervention**		**Total**	**X^2**	**p-value**
	Pre	**Post**			
Controlling blood pressure is important for reducing the risk of stroke.					
False	6(1.5)	0(0.0)	6(0.8)	6.045	0.014*
True	394(98.5)	400(100.0)	794(99.3)		
Regular handwashing is an effective practice for preventing chronic respiratory diseases					
False	111(27.8)	100(25.0)	211(26.4)	0.779	0.377
True	289(72.3)	300(75.0)	589(73.6)		
A high intake of fruits and vegetables is important for reducing the risk of cancers and cardiovascular diseases					
False	52(13.0)	0(0.0)	52(6.5)	55.615	0.0001*
True	348(87.0)	400(100.0)	748(93.5)		
Metformin is the recommended first-line pharmacological treatment for managing type 2 diabetes when lifestyle modifications alone are insufficient					
False	27(6.8)	0(0.0)	27(3.4)	27.943	0.0001*
True	373(93.3)	400(100.0)	773(96.6)		
Counseling patients on smoking cessation and avoidance of secondhand smoke exposure is an essential preventive strategy for individuals with both asthma and Chronic Obstructive Pulmonary Disease (COPD).					
False	5(1.3)	0(0.0)	5(0.6)	5.031	0.025*
True	395(98.8)	400(100.0)	795(99.4)		
Self-care strategies such as medication adherence and monitoring can help manage chronic diseases like hypertension and diabetes					
False	13(3.3)	0(0.0)	13(1.6)	13.215	0.0001*
True	387(96.8)	400(100.0)	787(98.4)		

Table 2b shows that most 394(98.5%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase agreed that controlling blood pressure is important for reducing the risk of stroke with a statistically significant difference at *p*=(0.014). Regular handwashing is an effective practice for preventing chronic respiratory diseases was agreed by the majority 289(72.3%) of the participants in the pre-phase compared to a higher proportion 300(75.0%) of the respondents in the post-phase with no statistically significant difference at *p*=(0.377). Most respondents 348 (87.0%) in the pre-phase and all 400 respondents (100.0%) in the post-phase agreed that eating a lot of fruits and vegetables is beneficial for lowering the risk of cardiovascular illnesses and malignancies, with a statistically significant difference at p=0.0001

Metformin is the recommended first-line pharmacological treatment for managing type 2 diabetes when lifestyle modifications alone are insufficient was identified by most 373(93.3%) of the respondents in the pre-phase compared to all 400(100.0%) of the respondents in the post-phase with a statistically significant difference at *p*=(0.0001). Counseling patients on smoking cessation and avoidance of secondhand smoke exposure is an essential preventive strategy for individuals with both asthma and Chronic Obstructive Pulmonary Disease (COPD) was accepted by majority 395(98.8%) of the respondent in pre-phase compared to all 400(100.0%) of the participants in the post-phase with a statistically significant difference at *p*=(0.025). Most 380(95.0%) of the participants in the pre-phase compared to all

400(100.0%) of the participants in the post-phase do accept that Self-care strategies such as medication adherence and monitoring can help manage chronic diseases like hypertension and diabetes with a statistical significance at *p*=(0.0001).

Table 3 Assessment of Knowledge of preventive practices of NCDs

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
Assessment of Knowledge					
Poor	51(12.8)	0(0.0)	51(6.4)		
Good	349(87.3)	400(100.0)	749(93.6)	54.473	0.0001*
Total	400(100.0)	400(100.0)	800(100.0)		

Table 3 reveals that few 51(12.8%) respondents in pre-phase compared to none 0(0.0%) of the respondents in post-phase has poor knowledge of preventive practices of NCDs, while majority 253(63.2%) of the respondents in the pre-phase compared to all 400(100.0%) of the respondents in the post-phase has good knowledge of preventive practices of NCDs with a statistically significant difference at *p*=(0.0001).

Table 4a Attitude towards preventive practices of NCDs

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
Providing lifestyle counseling, such as diet and exercise, are effective in preventing NCDs					
Agree	107(26.8)	32(8.0)	139(17.4)		
Disagree	4(1.0)	2(0.5)	6(0.8)		
Maybe	6(1.5)	4(1.0)	10(1.3)	51.319	0.0001*
Strongly Agree	222(55.5)	280(70.0)	502(62.7)		
Strongly Disagree	61(15.3)	82(20.5)	143(17.9)		
I feel confident in my ability to educate patients about the risks of smoking and the benefits of quitting					
Agree	96(24.0)	0(0.0)	96(12.0)		
Disagree	13(3.3)	0(0.0)	13(1.6)		
Maybe	7(1.8)	0(0.0)	7(0.9)	203.773	0.0001*
Strongly Agree	226(56.5)	394(98.5)	620(77.5)		
Strongly Disagree	58(14.5)	6(1.5)	64(8.0)		
Empowering patients with NCDs through self-care education and support significantly improves their health outcomes					
Agree	155(38.8)	0(0.0)	155(19.4)		
Disagree	1(0.3)	0(0.0)	1(0.1)		
Maybe	9(2.3)	0(0.0)	9(1.1)	231.954	0.0001*
Strongly Agree	166(41.5)	200(50.0)	366(45.8)		
Strongly Disagree	69(17.3)	200(50.0)	269(33.6)		
Following up regularly with patients diagnosed with NCDs is crucial for effective long-term management and prevention of complications					

Agree	126(31.5)	0(0.0)	126(15.8)		
Disagree	5(1.3)	0(0.0)	5(0.6)		
Maybe	9(2.3)	0(0.0)	9(1.1)	170.000	0.0001*
Strongly Agree	200(50.0)	300(75.0)	500(62.5)		
Strongly Disagree	60(15.0)	100(25.0)	160(20.0)		

Table 4a reveals that many 222(55.5%) study respondents in pre-phase compared to majority 280(70.0%) of the respondents in post-phase strongly agree that providing lifestyle counselling, such as diet and exercise, are effective in preventing NCDs with a statistically significant difference at *p*=(0.0001). Many 226(56.5%) of the participants in the pre-phase compared to a most 394(98.5%) of the respondents in the post-phases strongly agree that they feel confident in their ability to educate patients about the risks of smoking and the benefits of quitting with a statistically significant difference at *p*=(0.0001). Empowering patients with NCDs through self-care education and support significantly improves their health outcomes was strongly agreed to by fewer 166(41.5%) respondents in the pre-phase compared to a higher proportion 200(50.0%) of the respondents in the post-phase with a statistically significant difference at *p*=(0.0001). Following up regularly with patients diagnosed with NCDs is crucial for effective long-term management and prevention of complications as strongly agreed by half 200(50.0%) of the respondents in the pre-phase compared to more than half 300(75.0%) of the respondents in the post-phase with a statistically significant difference at *p*=(0.0001).

Table 4b Attitude towards preventive practices of NCDs

Variable	**Intervention**		**Total**	**X^2**	**p-value**
	Pre	**Post**			
Integrating tobacco cessation counselling into routine primary care consultations is critical for preventing cardiovascular diseases.					
Agree	138(34.5)	0(0.0)	138(17.3)		
Disagree	17(4.3)	0(0.0)	17(2.1)		
Maybe	14(3.5)	0(0.0)	14(1.8)	295.890	0.0001*
Strongly Agree	184(46.0)	400(100.0)	584(73.0)		
Strongly Disagree	47(11.8)	0(0.0)	47(5.9)		
I am willing to receive further training in NCD prevention strategies to improve my knowledge and practice					
Agree	121(30.3)	0(0.0)	121(15.1)		
Disagree	9(2.3)	0(0.0)	9(1.1)		
Maybe	5(1.3)	0(0.0)	5(0.6)	163.224	0.000*
Strongly Agree	207(51.7)	300(75.0)	507(63.4)		
Strongly Disagree	58(14.5)	100(25.0)	158(19.8)		

Table 4b indicates that fewer number 184(46.0%) of the respondents in pre-phase compared to majority 300(75.0%) of the respondents in post-phase strongly agree that integrating tobacco cessation counseling into routine primary care consultations is critical for preventing cardiovascular diseases with a statistically significant difference at *p*=(0.0001). Many 207(51.7%) of the participants in the pre-phase compared to a larger number 300(75.0%) of the respondents in the post-phases strongly agree that they are willing to receive further training in NCD prevention strategies to improve their knowledge and practice with a statistically significant difference at *p*=(0.0001).

Table 5 Assessment of Attitude towards preventive practices of NCDs

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
Assessment of Attitude					
Negative Attitude	143(35.8)	0(0.0)	143(17.9)		
Positive Attitude	257(64.3)	400(100.0)	657(82.1)	174.125	0.000*
Total	400(100.0)	400(100.0)	800(100.0)		

Table 5 shows that few 143(35.8%) respondents in pre-phase compared to none 0(0.0%) of the respondents in post-phase has negative attitude towards preventive practices of NCDs, while majority 257(64.3%) of the respondents in the pre-phase compared to all 400(100.0%) of the respondents in the post-phase has positive attitude towards preventive practices of NCDs with a statistically significant difference at *p*=(0.0001).

Table 6a Preventive Practices of NCDs

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
How often do you conduct routine screening for high blood pressure in your patients					
Daily	172(43.0)	198(49.5)	370(46.3)		
Monthly	65(16.3)	8(2.0)	73(9.1)		
Never	5(1.3)	6(1.5)	11(1.4)	49.224	0.000*
Rarely	21(5.3)	22(5.5)	43(5.4)		
Weekly	137(34.3)	166(41.5)	303(37.9)		
What steps do you take to educate your patients on the importance of a healthy diet and regular exercise (Provide informational brochures)					
No	75(18.8)	0(0.0)	75(9.4)	82.759	0.000*
Yes	325(81.3)	400(100.0)	725(90.6)		
What steps do you take to educate your patients on the importance of a healthy diet and regular exercise (Discuss during consultations)					
No	16(4.0)	16(4.0)	32(4.0)	0.000	1.000
Yes	384(96.0)	384(96.0)	768(96.0)		
What steps do you take to educate your patients on the importance of a healthy diet and regular exercise (Refer to specialists for dietary counseling)					
No	97(24.3)	0(0.0)	97(12.1)	110.384	0.000*
Yes	303(75.8)	400(100.0)	703(87.9)		
What steps do you take to educate your patients on the importance of a healthy diet and regular exercise (Use posters or visual aids in the clinic)					
No	35(8.8)	0(0.0)	35(4.4)	36.601	0.000*
Yes	365(91.3)	400(100.0)	765(95.6)		
What steps do you take to educate your patients on the importance of a healthy diet and regular exercise (No education is provided)					
No	300(75.0)	394(98.5)	694(86.8)	96.090	0.000*
Yes	100(25.0)	6(1.5)	106(13.3)		

A lesser number 172(43.0%) of the respondents in the pre-phase compared a higher number 198(49.5%) of the participants in the post-phase conduct routine screening for high blood pressure in their patients on daily basis with a statistically significant difference at *p*=(0.0001). Most 325(81.3%) of the respondents in the pre-phase compared to all 400(100.0%) of the respondents in the post-phase were provided informational brochures educate your patients on the importance of a healthy diet and regular exercise with a statistically significant difference at *p*=(0.0001). A large proportion 384(96.0%) of the respondent in pre and post-phase discuss during consultations as a step to educate their patients on the importance of a healthy diet and regular exercise with no statistically significant difference at *p*=(1.000).

Majority 303(75.8%) of participants in the pre-phase compared to all 400(100.0%) of the participants in the post-phase refer to specialists for dietary counseling as a step to educate their patients on the importance of a healthy diet and regular exercise with a statistical significance *p*=(0.0001). The use of posters or visual aids in the clinic is a step taken to educate patients on the importance of a healthy diet and regular exercise by most 365(91.3%) of the respondent in pre-phase compared to all 400(100.0%) the participants post-phase with a statistically significant difference at *p*=(0.0001). A larger number 300(75.0%) of participants in the pre-phase compared to more 394(98.5%) of the respondents in the post-phase provide education as a step taken to educate patients on the importance of a healthy diet and regular exercise with a statistically significant difference at *p*=(0.0001).

Table 6b Preventive Practices of NCDs

Variable	**Intervention**		**Total**	**X^2**	**p-value**
	Pre	**Post**			
How often do you discuss the risks of tobacco use with your patients					
Every consultation	277(69.3)	400(100.0)	677(84.6)	145.347	0.000*
Never	3(0.8)	0(0.0)	3(0.4)		
Occasionally, if the patient shows interest	106(26.5)	0(0.0)	106(13.3)		
Rarely	14(3.5)	0(0.0)	14(1.8)		
Do you routinely offer lifestyle counseling, including physical activity promotion, as part of your patient care for those at risk of NCDs					
No, I do not offer lifestyle counseling	2(0.5)	0(0.0)	2(0.3)	143.953	0.000*
Yes, but only for high risk patients	120(30.0)	0(0.0)	120(15.0)		
Yes, for every patient	278(69.5)	400(100.0)	678(84.8)		
How frequently do you use NCD-related educational materials or counseling tools in your practice					
Always	253(63.2)	400(100.0)	653(81.6)		
Never	2(0.5)	0(0.0)	2(0.3)	180.092	0.000*
Rarely	12(3.0)	0(0.0)	12(1.5)		
Sometimes	133(33.3)	0(0.0)	133(16.6)		
Do you engage in routine follow-up visits for patients diagnosed with chronic conditions such as hypertension or diabetes					
Never	3(0.8)	0(0.0)	3(0.4)		
Rarely	18(4.5)	0(0.0)	18(2.3)	150.966	0.000*
Yes, occasionally	106(26.5)	0(0.0)	106(13.3)		
Yes, regularly	273(68.3)	400(100.0)	673(84.1)		
How often do you provide advice on mental health and stress management as part of NCD prevention					
Always	257(64.3)	400(100.0)	657(82.1)		
Never	3(0.8)	0(0.0)	3(0.4)	174.125	0.000*

Rarely	23(5.8)	0(0.0)	23(2.9)		
Sometimes	117(29.3)	0(0.0)	117(14.6)		

Table 6b shows that majority 277(69.3%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase discuss the risks of tobacco use with your patients on every consultation with a statistically significant difference at *p*=(0.0001). A large proportion 278(69.5%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase routinely offer lifestyle counseling for every patient, including physical activity promotion, as part of their patient care for those at risk of NCDs with a statistically significant difference at *p*=(0.0001). Many 253(63.2%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase always se NCD-related educational materials or counseling tools in your practice with a statistically significant difference at *p*=(0.0001). Majority 273(68.3%) of the respondents in the pre-phase compared to all 400(100.0%) of the respondents in the post-phase regularly engage in routine follow-up visits for patients diagnosed with chronic conditions such as hypertension or diabetes with a statistically significant difference at *p*=(0.0001). A large proportion 257(64.3%) of the respondent in pre-phase compared to all 400(100.0%) of the respondents in the post-phase always provide advice on mental health and stress management as part of NCD prevention with a statistically significant difference at *p*=(0.0001).

Table 6c Preventive Practices of NCDs

Variable	**Intervention**		**Total**	**X^2**	**p-value**
	Pre	**Post**			
Do you provide guidance on alcohol consumption as part of your NCD prevention strategy					
Never	4(1.0)	0(0.0)	4(0.5)		
Rarely	9(2.3)	0(0.0)	9(1.1)	217.488	0.0001*
Yes, always	229(57.3)	400(100.0)	629(78.6)		
Yes, but only patients with alcohol-related issues	158(39.5)	0(0.0)	158(19.8)		
How often do you assess patients for signs of chronic respiratory diseases such as asthma or COPD during consultations					
Every consultation	216(54.0)	400(100.0)	616(77.0)		
Never	3(0.8)	0(0.0)	3(0.4)		
Occasionally, if symptoms are present	166(41.5)	0(0.0)	166(20.8)	238.961	0.0001*
Rarely	15(3.8)	0(0.0)	15(1.9)		
Do you provide patients with resources or referrals for weight management to reduce NCD risk					
Never	10(2.5)	0(0.0)	10(1.3)		
Rarely	20(5.0)	0(0.0)	20(2.5)	230.596	0.0001*
Yes, always	221(55.3)	400(100.0)	621(77.6)		
Yes, sometimes	149(37.3)	0(0.0)	149(18.6)		

Table 6c indicates that many 229(57.3%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase always provide guidance on alcohol consumption as part of your NCD prevention strategy with a statistically significant difference at *p*=(0.0001). Majority 216(54.0%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase assess patients for signs of chronic respiratory diseases such as asthma or COPD during consultations on every occasion with a statistically significant difference at *p*=(0.0001). Several 221(55.3%) of the respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase always provide patients with resources or referrals for weight management to reduce NCD risk with a statistically significant difference at *p*=(0.0001).

Table 7 Assessment of Preventive Practices of NCDs

Variable	Intervention		Total	X^2	p-value
	Pre	Post			
Assessment of Practice					
Good Practice	234(58.5)	400(100.0)	634(79.3)		
Poor Practice	166(41.5)	0(0.0)	166(20.8)	209.464	0.0001*
Total	400(100.0)	400(100.0)	800(100.0)		

Table 7 shows that many 234(58.5%) respondents in pre-phase compared to all 400(100.0%) of the respondents in post-phase has good preventive practices of NCDs, while more 166(41.5%) of the respondents in the pre-phase compared to none of the respondents in the post-phase has poor preventive practices of NCDs with a statistically significant difference at *p*=(0.0001).

4. Discussion of Findings

The study found that primary healthcare workers (PHCWs) consistently demonstrated high knowledge of non-communicable disease (NCD) prevention both before and after training. They understood the importance of lifestyle modifications, annual diabetes screening, tobacco risks, and cancer screening in primary care. This aligns with increasing NCD awareness in Nigeria, as noted in similar studies by Akinwumi et al. (2021) and Tajudeen et al. (2023), which attributed high baseline knowledge to frequent public health training. However, Maluka et al. (2017) reported lower pre-training knowledge in rural East Africa, suggesting regional disparities. The strong initial knowledge among PHCWs in Benue State likely results from prior sensitization efforts and training, explaining the minimal impact of additional instruction. Future capacity-building should shift focus from basic awareness to practical skills, advanced case management, and behavior change strategies to enhance NCD control at the primary care level.

The study found that primary healthcare workers (PHCWs) consistently recognized essential clinical practices for managing non-communicable diseases (NCDs) pre- and post-WHO PEN training. They understood blood pressure control for stroke prevention, handwashing for respiratory health, diet for cancer and cardiovascular risks, and metformin as the first-line treatment for type 2 diabetes. PHCWs also valued smoking cessation counseling and self-care strategies for chronic disease management. These findings align with established guidelines and professional development efforts (Oladele et al., 2023; Onagbiye et al., 2020). However, Ahmed et al. (2024) reported knowledge gaps in rural South Asia due to training disparities. Strong knowledge in Benue State reflects prior sensitization efforts. Future training should focus on clinical decision-making, patient education, and strengthening primary care for sustained NCD management.

The study showed a significant improvement in primary healthcare workers' (PHCWs) knowledge of non-communicable disease (NCD) prevention after WHO PEN training. While some had poor knowledge pre-training, none fell into this category post-training, with all respondents achieving good knowledge levels. This aligns with findings from Yenit et al. (2023) and Miner et al. (2022), which reported similar improvements from capacity-building programs. However, Ajisegiri et al. (2022) noted minimal gains in underserved Nigerian regions due to training limitations. The positive results likely reflect effective training content, clear delivery, and prior health education exposure. Sustained, well-structured training is crucial for strengthening PHCWs' capacity to manage NCDs and enhance Nigeria's primary healthcare system.

The study found a positive shift in primary healthcare workers' (PHCWs) attitudes and confidence toward non-communicable disease (NCD) prevention after WHO PEN training. More PHCWs strongly agreed on the effectiveness of lifestyle counseling, and confidence in educating patients about smoking risks increased. Belief in patient self-care education and follow-ups also rose post-training. These findings align with Yenit et al. (2023) and Nwankwo and Sambo (2020), who reported improved healthcare worker engagement after NCD training. However, Adepoju et al. (2017) found minimal attitude changes due to motivation, systemic support, and workload issues. The positive outcomes likely stem from effective training delivery, contextual relevance, and a supportive environment. Strengthening both knowledge and confidence can lead to better patient counseling, preventive adherence, and long-term NCD management.

The study found improved attitudes among primary healthcare workers (PHCWs) toward non-communicable disease (NCD) prevention after WHO PEN training. More PHCWs strongly supported integrating tobacco cessation into routine care and showed greater willingness for further training. This aligns with Akinwumi et al. (2021, 2023), who reported increased provider readiness after structured interventions. However, Ahmed et al. (2024) found low interest in continued training among rural PHCWs due to fatigue and systemic barriers. The positive shift likely reflects the training's relevance and growing recognition of early NCD intervention. Strengthening PHCWs' engagement in behavioral interventions and ongoing education can enhance primary healthcare responsiveness and reduce NCD burdens.

The study found a significant improvement in primary healthcare workers' (PHCWs) attitudes toward non-communicable disease (NCD) prevention after WHO PEN training. While some exhibited negative attitudes pre-training, none did post-training, and all showed a positive outlook. This aligns with Odusanya et al. (2022) and Badacho et al. (2024), who reported similar attitude shifts after training. However, Farzaei et al. (2023) noted persistent negativity due to burnout and systemic challenges. The success in this study likely stems from relevant training content and supportive management. A universally positive attitude among PHCWs can enhance NCD prevention and improve primary healthcare implementation.

The study revealed a mixed pattern in primary healthcare workers' (PHCWs) clinical practices for non-communicable disease (NCD) prevention. While fewer than half conducted routine blood pressure screenings pre- and post-training, most actively engaged in patient education through brochures, consultations, specialist referrals, and visual aids. The underutilization of screenings, despite training, likely stems from systemic challenges such as equipment shortages, high patient loads, or time constraints (Okoli et al., 2021; Otu et al., 2022). In contrast, Kolawole et al. (2023) found PHCWs more inclined toward educational strategies due to lower logistical demands. Addressing structural barriers through resource provision and workflow adjustments is essential for fully integrating routine screenings into daily care and maximizing NCD prevention efforts.

After the WHO PEN training, the study found significant improvements in primary healthcare workers' (PHCWs) clinical practices for non-communicable disease (NCD) prevention. All PHCWs in the post-phase consistently integrated key strategies such as tobacco risk discussions, lifestyle counselling, educational materials, follow-ups, and mental health support. While many had engaged in these practices pre-training, universal adoption post-training was expected due to the training's focus. These results align with Hyon et al. (2017) and Otu et al. (2022), who reported similar improvements, while Mutale et al. (2018) noted that a lack of institutional support hindered consistent application. The success of this study likely stems from effective training delivery and post-training supervision. Implementing these evidence-based practices strengthens early detection, risk reduction, and long-term disease control, ultimately improving public health outcomes.

After the WHO PEN training, the study found significant improvement in primary healthcare workers' (PHCWs) preventive practices for non-communicable diseases (NCDs). All PHCWs in the post-phase demonstrated good practices, whereas some in the pre-phase still exhibited poor ones. Targeted training like WHO PEN bridges gaps between knowledge and practice, aligning with Odusanya et al. (2022) and Anumah et al. (2024), who reported enhanced PHCW capacity post-training. However, Ajisegiri et al. (2022) found minimal improvement due to a lack of support and infrastructure. Differences may stem from variations in training implementation and monitoring. Effective training and support empower PHCWs to enhance early detection and reduce NCD burdens in communities .

5. Conclusion

The study showed significant improvement in healthcare workers' knowledge, attitudes, and preventive practices regarding non-communicable diseases (NCDs) after intervention. Post-phase results revealed increased awareness and application of key strategies, including lifestyle modification, routine screening, dietary counseling, tobacco cessation, and self-care education. Participants more widely acknowledged the role of physical activity, diet, diabetes screenings, Metformin for type 2 diabetes, and cancer screenings. Confidence in patient counseling, routine follow-ups, and mental health integration also increased. Age and professional cadre influenced engagement, with older and public health-focused workers showing stronger involvement. The findings highlight the value of targeted training and continuous professional development in strengthening NCD prevention and management at the primary care level.

Recommendations

Based on these findings, the following recommendations are suggested;

- Primary healthcare centres should institutionalise regular lifestyle counselling focused on dietary modification, physical activity, weight management, and tobacco cessation as a core component of patient consultations. This will reinforce the preventive role of healthcare providers and improve patient outcomes.
- Regular training programs and workshops should be organised for healthcare workers, especially targeted at different cadres (e.g., CHOs, doctors, JCHEWs, and public health scientists), to update their knowledge and boost confidence in NCD prevention, early detection, and management.
- Routine and age-appropriate screenings such as blood pressure checks, diabetes screening for individuals over 40, and cancer screenings (especially cervical and breast cancer for women) should be consistently implemented and integrated into standard healthcare delivery protocols.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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