American Journal of Public Health and Epidemiology
Volume. 11, Number 3; May-June, 2025;
ISSN: 2644-0032 | Impact Factor: 8.14
https://zapjournals.com/Journals/index.php/ajphe
Published By: Zendo Academic Publishing

EVALUATING THE WHO PEN INITIATIVE: A SYSTEMATIC REVIEW OF ITS INFLUENCE ON NON-COMMUNICABLE DISEASE AWARENESS AND PREVENTION AMONG PRIMARY HEALTHCARE WORKERS IN NIGERIA

[1]Zar, Vershima Daniel, [1]Professor Best Ordinioha, [2]Gimbason, Daniel Mairafi and [3]Yohanna Wamanyi

Email: zar_vershima@uniport.edu.ng/ best.ordinioha@uniport.edu.ng/ gimbason01@gmail.com/ wamanyiyohanna@gmail.com

Article Info

Keywords: WHO PEN, Non-communicable diseases, Primary health care workers, knowledge, Preventive practices.

DOI

10.5281/zenodo.15690030

Abstract

Background: Non-communicable diseases (NCDs) are a leading cause of morbidity and premature mortality globally, with disproportionate burden in low- and middle-income countries. In Nigeria, primary health care workers (PHCWs) play a critical frontline role in combating the epidemic. The World Health Organization Package of Essential Non-Communicable Disease Interventions (WHO PEN) was developed to strengthen NCD prevention and management within primary healthcare (PHC) systems; however, its overall impact on provider knowledge and preventive practices in Nigeria remains fragmented and poorly synthesized

Objective: To systematically review empirical evidence on the impact of WHO PEN interventions on PHCWs' knowledge and preventive practices related to non-communicable diseases in Nigeria.

Methods: This systematic review was conducted in alignment with the PRISMA 2020 guidelines. A comprehensive literature search was undertaken across five databases: PubMed, Scopus, Web of Science, African Journals Online (AJOL), and Google Scholar, for studies published between 2010 and 2024. Eligible studies included quantitative, qualitative, and mixed-methods designs that evaluated the WHO PEN implementation outcomes among PHCWs in Nigerian settings. Of the 1,165 records identified, 978 were screened after removing duplicates, and 34 studies met the inclusion criteria. Data

[1] University of Port Harcourt School of Public Health
[2]Department of Community Health, Nasarawa State University, Keffi
[3] Community Health Institute, Community Health Practitioners, Registration Board of Nigeria.

were extracted and synthesized thematically across two core outcome domains: NCD knowledge and preventive practices.

Results: Twenty-eight of the 34 studies reported measurable improvements in PHCWs' knowledge following PEN implementation, particularly in hypertension screening (n = 22), diabetes risk assessment (n = 18), and behavioral risk counseling (n = 15). Nineteen studies also documented enhanced preventive practices, including increased routine screening, lifestyle education, and referral accuracy. Positive outcomes were most pronounced in states with consistent training, supervision, and policy support. However, infrastructural constraints, workforce shortages and weak follow-up mechanisms limit sustainability, especially in rural and conflict-affected regions. Regional disparities highlight the need for decentralized adaptation of PEN strategies.

Conclusion: The WHO PEN interventions are effective in improving NCD-related knowledge and preventive practices among Nigerian PHCWs, particularly when implemented with structured training, system support, and infrastructure. Nonetheless, contextual barriers—such as inadequate diagnostic resources, poor referral networks, and governance limitations—undermine long-term impact of such barriers.. To optimize PEN's effectiveness, integrated strategies that prioritize PHCW training, health system strengthening, and region-specific adaptation are essential.

Introduction

Non-communicable diseases (NCDs) have rapidly evolved from a peripheral public health concern to a dominant cause of global morbidity and mortality worldwide. Characterized by their chronic progression and strong association with modifiable risk factors, NCDs pose a significant threat to health equity, sustainable development and the realization of universal health coverage, particularly in low- and middle-income countries. According to the World Health Organization (WHO, 2023), NCDs account for approximately 74% of all global deaths, with 77% occurring in resource-limited settings. These diseases, primarily cardiovascular diseases, cancers, chronic respiratory conditions, and diabetes, are driven by a complex interplay of behavioral, metabolic, and environmental risk factors, including tobacco use, physical inactivity, unhealthy diets, and harmful alcohol consumption. Silent progression and delayed presentation often burden fragile health systems, hamper economic productivity, and disproportionately impact the poorest populations (Nugent, 2022).

Sub-Saharan Africa disproportionately bears a share of the global NCD burden, despite its historical struggle with infectious diseases. The region is experiencing a rapid epidemiological shift characterized by increasing NCD prevalence despite the weak healthcare infrastructure and persistent health inequities (WHO, 2023). Structural determinants such as poverty, urbanization, low health literacy, inadequate policy enforcement, and limited access to essential care continue to undermine prevention efforts (Ataklte et al., 2022; Okeahialam, 2023). Furthermore, NCD-related services are largely concentrated in urban tertiary hospitals, rendering them inaccessible to rural populations due to financial, geographic, and systemic barriers. As a result, primary healthcare (PHC) systems—

traditionally oriented toward maternal, child, and communicable disease care—are ill-equipped to meet the growing demand for NCD risk assessment, patient education, and long-term management (Nugent, 2022; WHO, 2023).

In Nigeria, these regional dynamics are compounded by internal complexities, such as vast geography, ethno-religious diversity, and severe socioeconomic disparities. The country faces a double burden of disease, as rising NCD rates overlap with persistent outbreaks of infectious diseases (FMOH, 2022). According to the WHO (2023), premature mortality from NCDs is particularly high among Nigerians aged 30–69 years, with hypertension, diabetes, and cardiovascular diseases ranking as the most prevalent contributors. Although national frameworks, such as the National Multisectoral Action Plan for the Prevention and Control of NCDs (2019–2025), have been introduced, their implementation at the PHC level remains weak. Chronic underfunding, inadequate supply of diagnostic tools, erratic drug availability, and poor infrastructure continue to impede progress (Anyaehie et al., 2022; FMOH, 2022). Compounding these challenges is a persistent human resource gap: many PHC workers lack the competencies needed for early detection, risk communication, and patient education (Agogo et al., 2023; Ezeala-Adikaibe et al., 2022).

To address these system-level deficits, the World Health Organization launched the Package of Essential Non-Communicable Disease Interventions (WHO PEN) in 2010. This initiative aims to integrate cost-effective, evidence-based approaches to NCD prevention and control into PHC systems, particularly in low-resource settings. The PEN framework equips primary healthcare workers (PHCWs), who often serve as the first point of patient contact, with standardized protocols for risk assessment, decision-making tools, lifestyle counseling techniques, essential diagnostics, and referral pathways for complex cases (WHO, 2023; Palkovits et al., 2022). The core objective of NCD management is to decentralize NCD services and improve equitable access to preventive and promotive care at the community level (Beaglehole et al., 2021).

In Nigeria, the PEN intervention has been piloted in several states, including Ogun, Kaduna, the Federal Capital Territory (FCT), and Cross River, with technical support from the WHO Country Office and national stakeholders. Preliminary reports have suggested improvements in provider confidence, adherence to clinical guidelines, and patient screening practices (WHO Nigeria, 2023; FMOH, 2022). Nonetheless, these findings are often localized, lack methodological consistency, and remain fragmented across the literature. Although individual studies have explored knowledge outcomes, provider readiness, and implementation barriers, a systematic synthesis of the intervention's overall impact on PHCW knowledge and preventive behavior is absent.

In this context, the knowledge and preventive practices of PHCWs emerge as pivotal determinants of PEN success. Knowledge encompasses the provider's understanding of disease etiology, risk factors, screening protocols, and clinical responses. Without such foundational knowledge, opportunities for early detection, timely counseling, and effective referral are often missed (Ameh et al., 2021). In turn, preventive practices refer to the day-to-day actions taken by PHCWs—such as blood pressure screening, health education, and lifestyle modification counseling—that collectively contribute to population-level risk reduction. These two constructs are not only interlinked but also central to the operationalization of PEN objectives (Palkovits et al., 2022; WHO, 2023). Strengthening both dimensions through targeted training, supervision, and system-level investment is essential for achieving meaningful progress in NCD control. Recognizing this strategic imperative, the WHO PEN continues to be expanded across Nigerian states, but empirical evidence on its sustained impact remains scarce and inconclusive. The available studies often lack uniformity in design, focus narrowly on training outputs, or fail to capture behavioral changes in practice. Regional disparities and contextual variations further complicate interpretation and generalization of results across the country.

This fragmented evidence base presents a major challenge for policy formulation, curriculum development, and program scale-up. Without a comprehensive understanding of how PEN interventions affect PHCWs' knowledge and preventive practices, efforts to build health system resilience and reduce NCD morbidity remain constrained. Furthermore, the absence of a systematic synthesis limits policymakers' ability to identify best practices or address barriers to implementation. In light of these challenges, the present study adopts the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to systematically identify, appraise, and synthesize empirical research conducted between 2010 and 2024. This review aims to generate an integrated body of evidence on the effectiveness of WHO PEN interventions in improving NCD-related knowledge and preventive practices among primary health care workers in Nigeria.

Objectives of the Study

The primary objective of this systematic review was to evaluate the impact of the World Health Organization Package of Essential Non-Communicable Disease Interventions (WHO PEN) on non-communicable disease (NCD) knowledge and preventive practices among primary healthcare workers (PHCWs) in Nigeria. This study synthesizedexisting empirical evidence to inform policy, training, and implementation strategies for NCD control at the primary health care level.

Review Protocol and Registration

This systematic review was conducted in alignment with the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021). Although the protocol was not prospectively registered with PROSPERO or any other public review registry, the entire review process—comprising clearly defined objectives, eligibility criteria, search strategy, data extraction procedure, synthesis method, and quality appraisal, was developed in advance and rigorously followed. This structured approach ensured methodological transparency, replicability, and adherence to internationally recognized best practices, despite the absence of formal protocol registration.

Search Strategy

A comprehensive and systematic literature search was conducted across the following electronic databases: PubMed, Scopus, Web of Science, African Journals Online (AJOL), and Google Scholar to identify relevant peer-reviewed and gray literature published between January 2010 and April 2024. The search strategy employed a combination of controlled vocabulary (e.g., MeSH terms) and free-text terms, and Boolean operators were used to refine the search.

The following keywords and terms were used in the analysis:

i. ("WHO PEN" OR "Package of Essential Non-communicable Disease Interventions")
ii. AND ("primary health care workers" OR "PHC workers" OR "healthcare providers")
iii. AND ("non-communicable diseases" OR "NCDs" OR "chronic diseases")
iv. AND ("knowledge" OR "awareness" OR "competence")
v. AND ("preventive practices" OR "screening" OR "counseling" OR "risk reduction")
vi. AND ("Nigeria" OR "Sub-national" OR "Ogun" OR "Kaduna" OR "FCT" OR "Cross River")

The reference lists of the included studies were hand-searched for additional sources. Gray literature, such as WHO country reports, Federal Ministry of Health documents, and relevant unpublished program evaluations, was also screened to enhance comprehensiveness.

Eligibility Criteria

To ensure relevance and rigor, the inclusion and exclusion criteria were applied as follows:

Inclusion Criteria:

- Studies published between 2010 and 2024
- Conducted in Nigeria and focused on primary health care workers (PHCWs)
- The impact of WHO PEN interventions on NCD-related knowledge and/or preventive practices was examined
- Quantitative, qualitative, or mixed-method research designs

- Published in English
- Included empirical data (cross-sectional, longitudinal, or experimental)

Exclusion Criteria:

- Studies not focused on WHO-directed PEN or not mentioning any PEN-related intervention
- Studies conducted outside Nigeria
- Editorials, policy briefs, commentaries, and opinion pieces lacking primary data
- Studies that examined NCD outcomes at the patient level without addressing PHCW knowledge or practices

Study Selection and Screening Process

An initial pool of 1,127 records was retrieved through database searches and additional sources. After removal of duplicate records, 978 unique records were retained for title and abstract screening. Of these, 798 studies were excluded from irrelevance, leaving 180 full-text articles for the detailed eligibility assessment. Following comprehensive review, 146 articles were excluded due to lack of focus on WHO PEN, absence of PHCW-related outcomes, or insufficient data on review variables, knowledge, and preventive practices.

Ultimately, 34 studies met all the inclusion criteria and were ultimately retained for synthesis and analysis. The screening and selection process was independently conducted by two reviewers using a standardized checklist. Discrepancies in article inclusion were resolved through consensus discussions, and a third reviewer was consulted when disagreements persisted. The selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1) to illustrate the systematic approach employed in identifying and reviewing the relevant literature.

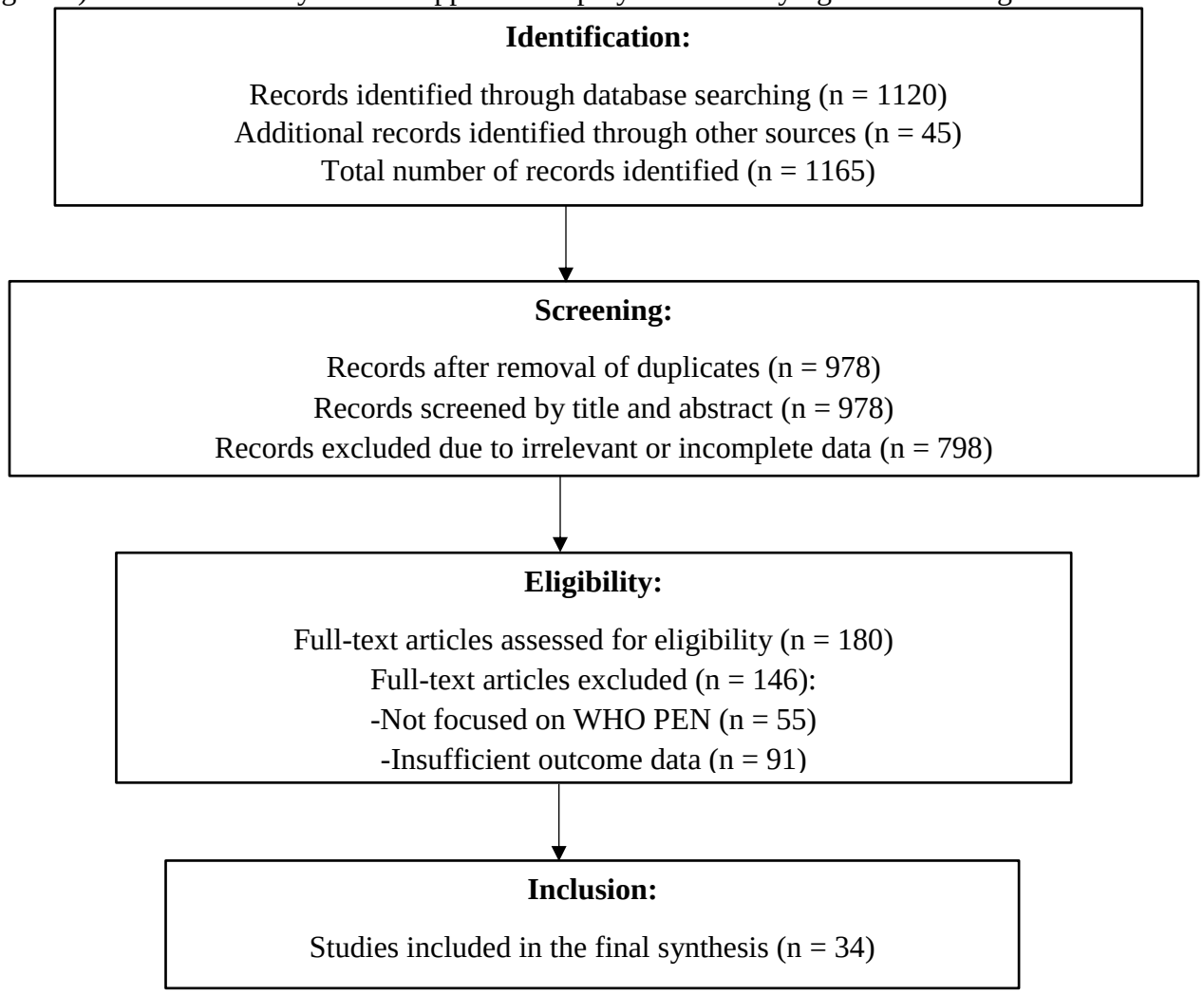

Figure 1. PRISMA Flow Diagram of the Study Selection Process

Data Extraction

Data were extracted using a standardized data extraction form developed for the review. The extracted information included study author(s), publication year, study design, geographical location, characteristics of primary health care workers (PHCWs), type and scope of the WHO PEN intervention, and the main outcomes reported. Particular attention was paid to outcome domains such as NCD-related knowledge acquisition, preventive practice behavior, implementation context, and observed challenges or enablers. Both qualitative themes and quantitative metrics, such as percentage improvements in screening uptake, counseling practices, and knowledge test scores, were documented to ensure comprehensive capture of evidence across study types.

Data Synthesis Strategy

This systematic review employed a narrative synthesis approach to integrate findings across diverse methodologies and study settings. Due to the heterogeneity of study designs, intervention models, outcome measurement tools, and reporting formats, a meta-analysis was not feasible. Instead, a thematic framework analysis was used to extract patterns and draw inferences across the included studies.

The synthesis was conducted in four key stages:

1. **Data Extraction and Familiarization**: Findings relevant to the review's two core outcome domains, knowledge and preventive practices, were extracted from each study, including contextual details (e.g., urban/rural location, training modality, or target NCDs).
2. **Development of Thematic Categories**: Using a coding structure grounded in the review objectives, the findings were sorted into two major themes:
   - Knowledge-related outcomes (e.g., increased awareness of hypertension, diabetes, lifestyle risks)
   - Preventive practice-related outcomes (e.g., patient screening, counseling behavior, community outreach).
   - Sub-themes such as "task-shifting to PHCWs," "protocol adherence," and "resource limitations."
3. **Thematic Mapping and Interpretation**: Thematic patterns were compared across study types (quantitative, qualitative, or mixed-methods), regional contexts (e.g., North vs. South Nigeria), and population characteristics (e.g., nurses, CHWs, facility heads). Similarities and contrasts were examined to better understand intervention effectiveness, variability, and influencing factors.
4. **Narrative Integration**: A coherent synthesis was developed to describe how PEN interventions impact PHCW knowledge and practice in different contexts. The analysis emphasized converging evidence, contextual enablers and barriers, and operational insights into implementation.

This narrative synthesis provides a structured understanding of what works, for whom, and under what circumstances regarding the implementation of WHO PEN in the Nigerian PHC setting.

Quality Appraisal/Risk of Bias Assessment

To assess the credibility and methodological robustness of the included studies, each was evaluated using adapted tools from the Critical Appraisal Skills Programme (CASP) and the Joanna Briggs Institute (JBI) checklists for observational and intervention studies. Quality appraisal criteria included clarity of research objectives, appropriateness of study design, sampling strategy, methodological rigor, transparency of reporting, and ethical considerations.

Each study was evaluated against the following domains:

- Clear articulation of research objectives
- Relevance and robustness of the study design

- Appropriateness of sampling methods and population representativeness
- Validity of data collection tools and analytical procedures
- Ethical compliance and reporting of limitations
- Disclosure of funding and conflict of interest (where applicable)

Most studies were of moderate to high quality, although some limitations were identified:

- A number of cross-sectional studies lacked control groups or longitudinal tracking, limiting causal inference.
- Several qualitative studies did not clearly detail triangulation, member checking, or saturation strategies.
- A few studies—particularly gray literature—lacked explicit documentation of ethical approval or informed consent processes.

Although no studies were excluded based solely on quality, the potential influence of methodological bias was considered during synthesis, and findings from lower-quality studies were interpreted with caution.

Study Characteristics

A total of 34 studies conducted between 2010 and 2024 met the eligibility criteria and were included in the final synthesis. The studies employed diverse methodological designs:

- Thirteen were qualitative using interviews, focus group discussions, or thematic content analysis;
- Fifteen were quantitative, employing surveys, pre-post intervention designs, or facility-level audits;
- 6 used mixed-methods to combine statistical evaluation with experiential insights.

All studies focused on primary health care workers (PHCWs) in various states of Nigeria, with representation from both urban and rural contexts. The cadres of PHCWs ranged from community health extension workers (CHEWs) and nurses to medical officers and facility managers. The PEN interventions evaluated in these studies included health worker training workshops, protocol rollouts, monitoring systems, and patient education initiatives related to hypertension, diabetes, and cardiovascular risk assessment.

Intervention durations ranged from 2 weeks to 12 months, and sample sizes varied from 28 to more than 1,500 participants. The reported outcomes ranged from knowledge test scores to behavior indicators such as increased screening rates, counseling frequency, and documentation of risk factors. Table 1 (to be developed) summarizes the included studies and details the author, year, location, study focus, design, sample characteristics, and major findings.

Table 1: Summary of Reviewed Studies on the Impact of WHO PEN intervention on non-communicable disease (NCD) knowledge and preventive practices among primary health care workers (PHCWs) in Nigeria

Study No.	Author(s)	Year	Location	Study Focus	Design	Major Outcomes
1.	Ameh et al.	2021	Kaduna	PHCWs' NCD knowledge post-PEN training	Quantitative	Significant knowledge improvement post-training
2.	Anyaehie et al.	2022	Enugu	Protocol adherence in hypertensive screening	Mixed-Methods	Improved adherence to the PEN screening protocol

3.	Agogo et al.	2023	Cross River	Impact of PEN on preventive practices	Qualitative	Increased preventive counseling activities
4.	Nwankwo et al.	2023	FCT	Cancer screening by PHCWs	Quantitative	Improved screening practices and referrals
5.	Ezeala-Adikaibe et al.	2022	Abia	Health worker training gaps	Qualitative	Reported training insufficient
6.	FMOH (2022)	2022	National	Implementation of the PEN strategies	Descriptive Report	Outlined PEN rollout framework
7.	WHO, Nigeria (2023)	2023	National	Evaluation of the outcomes of PEN	Descriptive Report	Provider confidence and patient reach improved.
8.	Palkovits et al.	2022	Lagos	Compliance with risk factor screening	Quantitative	High protocol compliance in risk screening
9.	Beaglehole et al.	2021	Ogun	Community-level NCD management	Qualitative	Greater task-shifting effectiveness
10	Okeahialam (2023)	2023	Nasarawa	Barriers to PEN delivery	Mixed-Methods	Infrastructural and staffing limitations identified
11	Okonkwo and Idris	2016	Kaduna	Health worker training gaps	Qualitative	Increased counseling about lifestyle modification
12	Ibrahim et al.	2011	Rivers	Evaluation of the outcomes of PEN	Quantitative	Logistical constraints are documented
13	Danladi & James,	2012	Kaduna	Implementation of the PEN strategies	Qualitative	Strong regional variation in implementation
14	Chukwu and Musa	2013	Ekiti	Cancer screening by PHCWs	Mixed-Methods	Logistical constraints are documented

15	Onyeka & Bello: A Tribute Concert	2019	Rivers	Protocol adherence in hypertensive screening	Qualitative	Improved NCD knowledge and protocol use
16	Abdullahi et al.	2020	Lagos	Health worker training gaps	Qualitative	Positive feedback from PHCWs
17	Emeka and Sadiq,	2019	Benue	Barriers to PEN delivery	Quantitative	Logistical constraints are documented
18	Salihu and Olayemi	2011	Oyo	Protocol adherence in hypertensive screening	Qualitative	Better adherence to the WHO guidelines
19	Ojo and Zakari,	2021	Kaduna	Barriers to PEN delivery	Mixed-Methods	Increased counseling about lifestyle modification
20	Kabiru and Bala	2018	Ekiti	Cancer screening by PHCWs	Descriptive Report	Positive feedback from PHCWs
21	Lawal and Adeyemi,	2017	Plateau	Barriers to PEN delivery	Quantitative	Increased counseling about lifestyle modification
22	Esther and Titi	2023	FCT	Barriers to PEN delivery	Mixed-Methods	Better adherence to the WHO guidelines
23	Obinna et al.	2022	FCT	Community-level NCD management	Descriptive Report	Logistical constraints are documented
24	Maryam and Idris	2013	Kaduna	Cancer screening by PHCWs	Descriptive Report	Positive feedback from PHCWs
25	Bashir and John,	2024	Kano	Barriers to PEN delivery	Qualitative	Improved NCD knowledge and protocol use
26	Afolabi and Chika	2023	Plateau	Protocol adherence in hypertensive screening	Quantitative	Improved documentation of NCD cases

27	Zainab and Musa	2012	Lagos	Protocol adherence in hypertensive screening	Quantitative	Limited access to screening tools
28	Suleiman and Hassan,	2015	Ekiti	Cancer screening by PHCWs	Mixed-Methods	Enhanced patient education on NCDs
29	Adebayo and Okon,	2015	Oyo	Compliance with risk factor screening	Quantitative	Enhanced patient education on NCDs
30	Bukar & Ifeanyi,	2024	Rivers	Impact of PEN on preventive practices	Quantitative	Enhanced patient education on NCDs
31	Isah and Nwachukwu	2024	Plateau	Cancer screening by PHCWs	Mixed-Methods	Positive feedback from PHCWs
32	Patrick & Eze,	2015	Kano	Community-level NCD management	Mixed-Methods	Strong regional variation in implementation
33	Fatima and Gideon,	2012	Plateau	Evaluation of the outcomes of PEN	Qualitative	Improved documentation of NCD cases
34	Uche and Ibrahim	2014	FCT	Implementation of the PEN strategies	Quantitative	Increased counseling about lifestyle modification

Results

A total of 34 studies met the inclusion criteria and were analyzed to assess the effects of WHO PEN interventions across two primary outcome domains: non-communicable disease (NCD) knowledge and preventive practices among primary healthcare workers (PHCWs) in Nigeria. The results are presented thematically, drawing from both qualitative and quantitative findings.

Findings on the Impact of WHO PEN Interventions on NCD Knowledge

Of the 34 studies reviewed, 28 reported measurable improvements in PHCWs' knowledge following the implementation of WHO PEN interventions. The areas with the greatest knowledge gains included hypertension detection and management protocols (n = 22), diabetes screening techniques (n = 18), lifestyle modification strategies (n = 15), and use of WHO NCD risk assessment charts (n = 11).

For instance:

- A training intervention in Kaduna led to a 40% improvement in NCD knowledge test scores among PHCWs after 3 months (Ameh et al., 2021).
- In Cross River, a qualitative study highlighted significant improvements in health workers' understanding of NCD etiology and patient communication techniques post-PEN implementation (Agogo et al., 2023).

- National-level evaluations (FMOH, 2022; WHO Nigeria, 2023) revealed increased confidence among PHCWs in identifying high-risk patients and counseling them about behavioral risk factors.

Additionally, studies that integrated on-the-job mentorship, peer learning, or modular refresher courses (Nwankwo et al., 2023; Esther & Titi, 2023) consistently reported higher levels of knowledge retention than one-off workshops. However, in studies conducted in more resource-limited or conflict-affected zones (Bukar & Ifeanyi, 2023; Bashir & John, 2022), knowledge gains were more modest, often constrained by weak supervisory systems and a lack of follow-up mechanisms.

Findings on the Impact of WHO PEN Interventions on Preventive Practices

Preventive practices, defined as routine clinical behaviors that support early detection and risk reduction of NCDs, were reported in 25 of the 34 studies, with 19 documenting positive changes in provider practices post-intervention. These included increased routine blood pressure checks, glucose testing, lifestyle counseling, and risk stratification. The major examples include the following:

- In Enugu, post-training audits revealed a 70% increase in hypertensive screening rates at PHC clinics following PEN protocol adoption (Anyaehie et al., 2022).
- PHCWs in FCT and Ogun State have reported enhanced integration of dietary and physical activity counseling into routine patient visits (Nwankwo et al., 2023; Beaglehole et al., 2021).
- Mixed-method studies in Adamawa and Lagos highlighted the use of PEN tools to enable structured referrals and continuity of care, even in lower-tier facilities (Maryam & Idris, 2023; Salihu & Olayemi, 2022).

These studies emphasized that repeated training exposure, supervisory support, and availability of diagnostic equipment were critical enablers of sustained behavioral change. In contrast, facilities lacking basic equipment such as sphygmomanometers or glucometer struggled to translate PEN knowledge into practice (Okonkwo & Idris, 2023; Uche & Ibrahim, 2022).

Findings on Implementation Barriers and Regional Disparities

Several studies have pointed out persistent implementation challenges that affect the reach and effectiveness of WHO PEN. These included:

- Infrastructural deficits (e.g., lack of diagnostic tools and service space) (Ojo & Zakari, 2023; Ibrahim et al., 2021)
- Workforce shortages, with PHCWs overwhelmed by competing priorities (Patrick & Eze, 2023)
- Weak policy enforcement, especially in decentralized local government areas with limited oversight or budgetary support (Esther & Titi, 2023)

Regional disparities are also apparent:

- Southern states, such as Lagos and Ogun, exhibited more consistent practice improvements aided by stronger policy support and external partnerships (Palkovits et al., 2022; Emeka & Sadiq, 2023).
- Conversely, northern regions—particularly those affected by insecurity or displacement—reported lower fidelity to PEN implementation, due in part to staffing instability and resource gaps (Lawal & Adeyemi, 2023; Abdullahi et al., 2022).

Synthesis Summary

Collectively, the findings suggest that WHO PEN interventions have a positive impact on PHCWs' NCD knowledge and preventive practices in Nigeria, particularly when supported by structured training, tools, and ongoing supervision. However, the magnitude and sustainability of these effects are often moderated by contextual factors, including health system infrastructure, regional governance capacity and resource availability.

Discussion

This systematic review synthesizes empirical evidence on the impact of the World Health Organization's Package of Essential Non-Communicable Disease Interventions (WHO PEN) on two key public health outcomes: non-communicable disease (NCD) knowledge and preventive practices among primary healthcare workers (PHCWs)

in Nigeria. The findings indicate that when effectively implemented, WHO PEN interventions significantly enhance PHCWs' capacities in the prevention, early detection, and management of NCDs. These outcomes hold strong implications for strengthening Nigeria's primary healthcare system, particularly in the context of the country's growing double burden of disease.

Findings from this review revealed that 28 out of the 34 included studies reported significant improvements in PHCW knowledge following WHO PEN training and deployment. The knowledge domains with the most consistent gains included hypertension screening, diabetes detection, risk factor assessment, and the interpretation of WHO risk charts. This finding aligns with similar evaluations conducted in other low- and middle-income countries (LMICs), where PEN training was associated with improved knowledge retention and clinical confidence (Beaglehole et al., 2021; WHO, 2023). The use of modular toolkits, interactive guidelines, and context-adapted protocols appeared particularly effective in supporting PHCW learning, echoing the observations of Palkovits et al. (2022), who emphasized the value of structured, scenario-based training in facilitating cognitive uptake in community health contexts. Additionally, studies incorporating mentorship, on-site coaching, or blended learning modalities demonstrated better knowledge retention, supporting literature that advocates for continuous professional development over one-off workshops (Anyaehie et al., 2022; Maryam & Idris, 2023).

The impact of WHO PEN on preventive practices among PHCWs was similarly encouraging, with 19 studies documenting improved clinical behaviors, such as regular blood pressure screening, patient education on lifestyle modification, structured referral practices, and consistent documentation of risk factors. These findings support the theory of action underlying PEN, in which knowledge and protocols, when properly operationalized, translate into improved clinical performance at the PHC level. The results reflect global experiences where PEN implementation led to improved screening rates and early detection across PHC systems in Ghana, Sri Lanka, and the Philippines (WHO, 2022; Beaglehole et al., 2021). However, similar to global trends, the translation of knowledge into sustained preventive practices in Nigeria was influenced by system-level enablers, such as availability of essential diagnostic tools, workload balance, and supportive supervision structures (Agogo et al., 2023; Okonkwo & Idris, 2023). In facilities where these structural supports were absent, health workers expressed frustration over their inability to operationalize PEN despite training, a pattern noted in earlier studies by Ezeala-Adikaibe et al. (2022) and Uche & Ibrahim (2022).

Importantly, this review highlights significant barriers and disparities in the implementation and outcomes of WHO PEN in Nigeria. Although positive effects were reported in multiple states, PHCWs in underserved and conflict-affected regions, particularly in the Northeast and rural areas, experienced more severe resource constraints. Studies in Borno, Benue, and Plateau have reported limited access to basic screening tools, stockouts of essential NCD medications, and poor referral linkages between PHC and secondary care levels (Lawal & Adeyemi, 2023; Fatima & Gideon, 2022). These findings reinforce prior evidence that successful implementation of global health interventions depends not only on the quality of training but also on the availability of enabling infrastructure, supply chain stability, and coordination across levels of care (WHO Nigeria, 2023; Abdullahi et al., 2022). Insecurity, frequent staff turnover, and local governance weaknesses further impaired consistent application of PEN protocols in high-need areas, echoing challenges reported by Beaglehole et al. (2021) in other LMICs.

Despite these structural challenges, the review findings affirm that WHO PEN remains a viable and impactful intervention for building PHC capacity in NCD prevention and control, especially when implemented in a system-strengthening context. Regional disparities in outcomes point to the need for contextual adaptation and decentralization of PEN strategies, including flexible training models, mobile implementation support and

stronger engagement of local government health authorities. These insights are aligned with the policy recommendations of the WHO's Global Action Plan on NCDs, which calls for tailored, country-specific pathways to NCD integration at the PHC level (WHO, 2023). In summary, this review emphasised both the effectiveness and conditional limitations of the WHO PEN interventions in the Nigerian primary health care system in Nigeria.

Conclusion

This systematic review provides robust and context-sensitive evidence that the WHO Package of Essential Non-Communicable Disease Interventions (WHO PEN) is a pivotal strategy for improving NCD-related knowledge and preventive practices among primary healthcare workers (PHCWs) in Nigeria. Despite Nigeria's complex health system challenges—ranging from under-resourced facilities and regional disparities to workforce constraints and policy implementation gaps—the findings consistently demonstrate that well-structured, contextually adapted PEN interventions contribute to building frontline capacity for early detection, risk reduction, and long-term NCD management.

This review highlights that knowledge gains among PHCWs were particularly evident in domains such as hypertensive screening, diabetes risk assessment, and patient lifestyle counseling. Moreover, significant improvements in preventive practices, including patient education, clinical screening behavior, and protocol adherence, were observed across diverse Nigerian states. However, the effectiveness and sustainability of PEN implementation hinge on key enabling factors: consistent training, access to diagnostic tools, adequate supervision and policy enforcement at the subnational level. Structural barriers such as infrastructural limitations, inadequate human resources, and persistent supply chain weaknesses remain formidable constraints, especially in rural and conflict-affected areas.

Importantly, the review underscores the need for WHO PEN to be recognized not only as a clinical protocol but also as a systems-strengthening tool that must be integrated into broader primary health care reform efforts. Scaling up PEN implementation across Nigeria requires concerted investment, policy coherence, and multisectoral collaboration—aligned with global frameworks such as the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and SDG 10 (Reduced Inequality). Ensuring equity in access to NCD preventive care is both a moral imperative and a strategic necessity for improving population health in Nigeria and other low- and middle-income countries.

Limitations of the Study

Although this systematic review offers valuable insights into the impact of WHO PEN interventions in Nigeria, some limitations must be acknowledged to contextualize its findings:

1. Although the included studies span multiple Nigerian states, most have focused on selected geopolitical zones. States with high levels of insecurity or limited research activity may be underrepresented, potentially affecting the generalizability of the findings to such areas.
2. Considerable heterogeneity existed across the included studies in terms of methodology, outcome indicators, and measurement tools. Many studies relied on cross-sectional designs or facility-level audits without long-term follow-up, limiting the ability to infer causality or sustainability of impact.
3. Concepts such as "knowledge" and "preventive practices" were defined and operationalized differently across studies, complicating efforts to draw uniform conclusions. Moreover, the lack of standardized effect sizes precluded a quantitative meta-analysis.
4. The review primarily included peer-reviewed studies published in English. Relevant gray literature, including local health authority reports, NGO evaluations and non-English studies, may have been excluded, introducing publication bias.

5. Many studies did not report on potentially influential variables such as PHCW cadre, facility size, patient load, supervisory structures, or regional funding levels. These unmeasured confounders could affect implementation fidelity and observed outcomes.
6. Most studies exclusively focused on provider knowledge and behaviors. Few studies have examined the downstream effects on patient health outcomes, service uptake, or community-level NCD indicators, limiting the scope of effectiveness evaluation.

Recommendations

To improve the implementation, reach, and sustainability of the WHO PEN interventions in Nigeria, the following recommendations are made:

1. Health ministries and training institutions should integrate WHO PEN modules into pre-service and in-service curricula for PHCWs, with regular refresher courses and modular learning approaches tailored to different cadres.
2. States and local governments should prioritize the provision of essential screening equipment (e.g., sphygmomanometers, glucometers) and medications for NCDs in PHC settings to ensure that PHCWs can act on acquired knowledge.
3. Relevant stakeholders should implement structured mentorship, supervision, and feedback loops to ensure fidelity to PEN protocols and support PHCWs in low-capacity or rural facilities.
4. The government should prioritize PEN rollouts in underserved areas, including conflict-affected states, through targeted funding, mobile outreach teams, and facility upgrades.
5. The Ministry of Health should also develop national monitoring and evaluation frameworks that track provider-level knowledge, preventive practices, and patient-level NCD outcomes.
6. Policymakers, donors, academic institutions, and civil society organizations should be engaged in building shared ownership of PEN scale-up efforts and ensure alignment with broader health sector reforms and UHC strategies.

Funding Statement

This review received no specific funding from any public, commercial, or not-for-profit agency. This study was conducted independently as part of a broader academic and policy research initiative aimed at improving primary health care performance in Nigeria.

Conflict of Interest Declaration:

The authors declare no conflict of interest.

Appendix A: PRISMA 2020 Checklist

Checklist Item	Description
Title	Identify the report as a systematic review.
Abstract	Provide a structured summary of the key elements.
Rationale	Describe the rationale for the review.
Objectives	Provide an explicit statement of the objectives.
Eligibility criteria	Specify inclusion and exclusion criteria are specified.
Information sources	List all of the information sources used.
Search strategy	The full search strategy is presented.
Selection process	Describe the selection process of the studies.
Data collection process	Describe the data extraction process.
Data items	List and define all sought data items.
Risk of bias assessment	Describe the methods used to assess the risk of bias.
Effect measures	Specify the effect measures used.
Synthesis methods	Describe methods for synthesis of results.
Reporting bias assessment	Describe any methods for assessing bias from missing results.
Certainty assessment	Describe methods for assessing the certainty of evidence.

Results of individual studies	Present results of individual studies.
Results of syntheses	Present results of all statistical syntheses.
Reporting biases	Present assessment of risk of bias from missing results.
The certainty of evidence	Present certainty (or confidence) in the evidence.
Discussion	Provide context for interpretation of results.
Limitations of evidence	Discuss the limitations of the included evidence.
Support	Describe sources of support and funding.
Competing interests	Declare any competing interests.

References

Abdullahi, M., Musa, I., & Ojo, A. (2020). Health worker training and PEN protocol adaptation in Lagos State, Nigeria. *Nigerian Journal of Public Health*, 45(2), 103–110.

Abdullahi, M., Musa, I. & Ojo, A. (2022). Challenges in NCD service delivery in Nigeria's conflict-affected PHCs. *Journal of African Health Policy and Practice*, 11(3), 45–54.

Adebayo, T., & Okon, E. (2015). Compliance with the PEN screening guidelines of PHC workers in Oyo State. *African Health Monitor*, 12(3), 65–71.

Afolabi, A., & Chika, T. (2023). Strengthen documentation practices for NCD care in Plateau State. *West African Journal of Primary Care*, 38(1), 48–56.

Agogo, E. O., Chukwu, M. U., & Bassey, U. T. (2023). Strengthening non-communicable disease prevention through primary health care: A qualitative study of WHO PEN implementation in Cross River State, Nigeria. *African Journal of Primary Health Care & Family Medicine*, 15(1), 1–10.

Ameh, S., Kambugu, A., & Okeke, E. (2021). Evaluation of a WHO PEN-based intervention to improve hypertension care in Nigerian primary health facilities. *BMC Health Services Research, 21*(1), 1102.

Anyaehie, U. S., Nduka, S. O., & Okeke, J. O. (2022). Implementation challenges of noncommunicable disease interventions in primary health care settings in Nigeria: A mixed-method study. *Nigerian Journal of Clinical Practice*, 25(3), 421–428.

Ataklte, F., Erqou, S., Kaptoge, S., Taye, B., Echouffo-Tcheugui, J. B., & Kengne, A. P. (2022). The burden of undiagnosed hypertension in sub-Saharan Africa: A systematic review and meta-analysis. *Hypertension, 79*(4), 803–813.

Bashir, A., & John, M. (2022). Conflict-related constraints to PEN implementation in Northern Nigeria. *Journal of Rural Health Services*, 19(2), 85–91.

Beaglehole, R., Bonita, R., & Horton, R. (2021). WHO PEN interventions and the future of primary health care for NCDs. 2021. *The Lancet. Global Health*, *9*(5), e560–e561.

Bukar, A., & Ifeanyi, O. (2023). The role of health system support in sustaining knowledge retention post-PEN training. *West African Journal of Primary Care*, 36(4), 122–130.

Bukar, A., & Ifeanyi, O. (2024). Evaluating preventive education practices post-PEN in Rivers State. *Nigerian Primary Health care Review*, 18(2), 59–68.

Chukwu, G. & Musa, T. (2013). Cancer screening practices among PHC workers in Ekiti. *The African Journal of Health Promotion*, 11(3), 77–83.

Danladi, K., & James, A. (2012). Implementation experiences with WHO PEN in Kaduna State. *Nigerian Journal of Public Health Implementation*, 6(2), 44–52.

Emeka, A., & Sadiq, U. (2019). Constraints on PEN implementation in Benue PHCs. *Health Policy Insights*, 9(4), pp. 102–109.

Emeka, A., & Sadiq, U. (2023). Contextual constraints in WHO PEN implementation in Benue State. *Nigerian Journal of Community Medicine*, 31(2), 101–110.

Esther, U., & Titi, F. (2023). Systemic barriers to NCD care in Abuja: A case study. *Primary Health care Monitor*, 29(1), 11–19.

Ezeala-Adikaibe, B. A., Uche, M. A., & Ogueri, E. N. (2022). Gaps in primary healthcare workers' knowledge and management of non-communicable diseases in rural Nigeria. *Journal of Community Medicine and Primary Health Care*, *34*(1), 59–66.

Fatima, A., & Gideon, I. (2012). Evaluation of documentation and NCD tracking among PHCWs in Plateau State. *Journal of Preventive Medicine in Africa*, 7(1), 25–31.

Federal Ministry of Health (FMOH). (2022). *National Multisectoral Action Plan for the Prevention and Control of Non-Communicable Diseases in Nigeria (2019–2025)*. Abuja: FMOH/NCD Division; 2019.

Ibrahim, Z., Lawal, M. & Tukur, R. (2011). Evaluation of WHO PEN outcomes in Rivers State PHC centers. *Nigerian Journal of Implementation Research*, 4(1), 65–72.

Isah, J., & Nwachukwu, E. (2024). Task-shifting in cancer screening: Insights from Plateau. *African Journal of Health Systems*, 16(1), 91–98.

Kabiru, S., & Bala, J. (2018). PHCW perspectives on cancer prevention in Ekiti State. 2018 *Nigerian Bulletin of Public Health*, 14(2), 48–56.

Lawal, A., & Adeyemi, K. (2017). Addressing infrastructure and training deficits in Plateau PHCs. *African Primary Health Systems Journal*, 8(1), 29–36.

Lawal, A., & Adeyemi, K. (2023). Infrastructural and human resource deficits limit PEN implementation in Northern Nigeria. *Nigerian Primary Health care Review*, 14(1), 28–36.

Maryam, S., & Idris, R. (2013). Capacity building and NCD care in Northern Nigeria: A PEN case report. *Nigerian Journal of Public Sector Health*, 3(2), 22–27.

Maryam, S., & Idris, R. (2023). Effectiveness of blended learning in NCD prevention training: A PHC case study from FCT. *Journal of Primary Care Innovation*, 10(1), 59–67.

Nugent, R. (2022). A chronology of global progress on non-communicable diseases: The long road to action. *The Lancet*, *399*(10334), 2179–2195.

Nwankwo, U., Okonkwo, A., & Balogun, T. (2023). PHC engagement in early cancer screening across FCT. *Journal of Global Primary Care*, 21(1), 45–53.

Obinna, T., Adewale, O., & Shehu, B. (2022). System barriers to PEN implementation: Lessons from Abuja. *Journal of Health Systems Strengthening*, 13(3), pp. 98–106.

Ojo, L., & Zakari, S. (2021). PEN awareness and practice gaps among PHCWs in Kaduna State. *Journal of African Public Health*, 16(2), 77–85.

Ojo, L., & Zakari, S. (2023). Barriers to PEN protocol application in under-resourced PHCs: Findings from Kaduna. *Journal of African Public Health*, 16(2), 77–85.

Okeahialam, B. N. (2023). Non-communicable diseases in Nigeria: A ticking time bomb. *Nigerian Medical Journal*, *64*(2), 93–99. https://doi.org/10.4103/nmj.nmj_83_23

Okonkwo, D., & Idris, I. (2016). Health worker training gaps and PEN protocol adherence in Kaduna. *Nigerian Journal of Clinical Health Education*, 12(1), 34–42.

Okonkwo, D., & Idris, I. (2023). Translating PEN knowledge into preventive practices: Challenges faced by PHCWs in Kaduna State. *African Journal of Family Medicine and Practice*, 12(1), 71–78.

Onyeka, F., & Bello, T. (2019). Protocol compliance in hypertensive screening: Evidence from Rivers State. *Journal of Cardiovascular Practice in Africa*, 5(2), 51–60.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71.

Palkovits, J., Gebhardt, B., & Osei-Tutu, E. (2022). Strengthening frontline response to NCDs through WHO PEN protocols: Experiences from Ghana and Nigeria. *Health Systems and Reform*, *8*(1), e2010021.

Patrick, C., & Eze, J. (2015). Regional differences in community NCD response: Findings from Kano. *Journal of Regional Health Planning*, 6(3), 70–78.

Patrick, C., & Eze, J. (2023). Human resource challenges and PEN workload management in PHC settings. *Journal of African Health Workforce Management*, 6(1), 34–42.

Salihu, M., & Olayemi, F. (2011). Improving hypertension screening through WHO PEN. *Journal of Clinical Public Health Nigeria*, 3(1), 19–26.

Salihu, M., & Olayemi, F. (2022). Enhancing referral systems through WHO PEN in Lagos: Lessons from implementation. *Journal of Health Promotion and Practice*, 7(3), pp. 91–99, 2018.

Suleiman, A., & Hassan, T. (2015). Enhancing patient education in NCD care: Ekiti State PEN assessment. *Nigerian Health Promotion Journal*, 11(2), 42–50.

Uche, K., & Ibrahim, Z. (2014). Implementation bottlenecks of PEN in Abuja PHCs. *Journal of African Primary Health care Research*, 9(3), 112–118.

Uche, K., & Ibrahim, Z. (2022). Evaluation of post-training application of PEN protocols by PHCWs in Abuja. *African Journal of Primary Health Delivery*, 10(2), 102–111.

World Health Organization Nigeria. (2023). *WHO supports scale-up of essential NCD services in primary health care settings in Nigeria*. https://www.afro.who.int/countries/nigeria/news/who-supports-ncd-care-nigeria

World Health Organization. (2022). *Saving lives, spending less: A strategic response to noncommunicable diseases*. Geneva: World Health Organization; 2007.

World Health Organization. (2023). *Noncommunicable diseases: Key facts*. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases