





BMJ Open Implementation of a large-scale hypertension program in primary health centres in the Federal Capital Territory, Nigeria: an explanatory, sequential mixed-methods study

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ABSTRACT

Introduction To optimise hypertension care cascade, the multilevel Hypertension Treatment in Nigeria (HTN) Program, adapted from the WHO HEARTS package, was implemented within 60 primary healthcare centres (PHCs) in the Federal Capital Territory, Nigeria, from January 2020 to December 2023.

Methods We conducted an explanatory sequential mixed-methods study, guided by the RE-AIM QuEST (Reach, Effectiveness, Adoption, Implementation, and Maintenance - Qualitative Evaluation for Systematic Translation) framework, to examine the factors influencing reach, effectiveness, adoption, implementation, acceptability and maintenance of the program. We conducted 13 focus group discussions in a subset of PHCs with patients (n=17), community health workers (n=35), pharmacy technicians (n=18) and PHC directors (n=5). Eighteen sites were purposively selected based on facility performance, targeting sites in the top and bottom 12% of blood pressure (BP) control at the end of the HTN Program. Qualitative data were coded, and subthemes were generated using directed content analysis.

Results Program reach was facilitated by community education, peer influence and decentralisation of hypertension services. Patients perceived the program to be effective, citing successful BP control, fewer medication side effects and support for improving health behaviours. Adoption and fidelity were supported through training and supportive supervision strategies. Multiple outcomes, including reach, acceptability and maintenance, were facilitated by improved affordability of BP-lowering medication through a drug revolving fund scheme which led to minimal stockouts, although medication affordability remained a challenge for some patients. Health workers and directors identified needs for program sustainment, including maintaining their motivation and commitment, strengthening the medication supply chain and advocating for the inclusion of BP-lowering medications in the national health insurance scheme.

Conclusion Our findings provide an understanding of the implementation strategies and program components that

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The mixed-methods design provided a deeper understanding of implementation processes and outcomes, helping explain variability in program results.
- ⇒ The study captured diverse perspectives from multilevel program staff (directors, community health extension workers, community health officers, pharmacists) and patients, reflecting a range of implementation experiences.
- ⇒ Our application of the RE-AIM QuEST framework generated actionable insights to support learning and guide future adaptations for scaling HEARTS-based programs across Nigeria and other low-income and middle-income countries.
- ⇒ Limitations in the sex distribution of focus group patients were noted, which may affect the generalisability of patient perspectives.

led to effective implementation of a primary care-based hypertension control program in Nigeria. These insights can support sustainment and nationwide scaling up of the program and inform similar programs in other low-income and middle-income countries.

INTRODUCTION

Hypertension is the leading preventable risk factor for cardiovascular diseases worldwide, accounting for over 10 million deaths annually.¹ Low-income and middle-income countries (LMICs) contribute a greater share to the global burden of hypertension, where rates of uncontrolled hypertension and premature mortality are much higher, compared with high-income countries.² Despite the availability of effective prevention and treatment therapies, blood pressure (BP) is controlled in <10% of people with hypertension across LMICs.³ In Nigeria, as of 2020,



over 19.1 million adults aged 30–79 years had hypertension, yet only 27% of those diagnosed were treated, and 11% had their BP controlled.⁴

In 2020, our team launched the Hypertension Treatment in Nigeria (HTN) Program to address the pressing issue of uncontrolled hypertension and improve hypertension care cascade in Nigeria.⁵ The HTN Program implemented and evaluated an adapted WHO HEARTS package through a hybrid type II effectiveness-implementation trial across 60 public, primary healthcare centres (PHCs) in the Federal Capital Territory, Nigeria. Components of the program included (1) health coaching, including health behaviour counselling and home BP monitoring; (2) simplified treatment protocol; (3) access to essential medications, including fixed-dose combinations (FDCs); (4) team-based care and task sharing; (5) performance and quality reporting through supportive supervision and (6) community awareness campaign.^{6–8}

While the HTN Program increased rates of hypertension control and treatment and reached 21922 patients,^{6,9} understanding the processes and factors associated with implementation success is a crucial next step. Findings from such inquiries will be useful in maximising public health benefits and contribute to the broader literature on implementing, sustaining and scaling up HEARTS-based programs in primary healthcare settings. The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) Qualitative Evaluation for Systematic Translation (QuEST) framework provides a mixed-method approach that supplements quantitative data with qualitative evaluation to explain and explore how multilevel contextual factors and implementation strategies influenced implementation and effectiveness outcomes.¹⁰ Guided by the RE-AIM QuEST framework, the primary aim of this explanatory sequential mixed-method study was to understand multilevel contextual factors and accompanying implementation strategies associated with study outcomes in the HTN Program.

METHODS

Study design and context

The present study was embedded within the HTN Program, which was a single-arm, type II hybrid implementation-effectiveness study (ClinicalTrials.gov registration: NCT04158154). The methods of the HTN Program have been described in detail.⁷ In brief, the program aimed to evaluate the effectiveness and implementation of a large-scale, multilevel hypertension treatment and control program within 60 PHCs in the Federal Capital Territory of Nigeria from January 2020 to December 2023 using an interrupted time-series design.

Nigeria's primary healthcare system operates at the community level and accounts for approximately 88% of all health facilities in the country, serving as the primary source of care for the majority of the population.^{10 11} Within the Federal Capital Territory, the HTN Program

was carried out in 60 of the 243 PHCs, spanning six local government area (LGA) councils.^{6 10}

In addition to conventional HEARTS components, the HTN Program included team-based care led by community health extension workers (CHEWs), quarterly supervision visits to PHCs and provision of free or reduced-cost BP-lowering medications. We conducted initial centralised in-person training for healthcare workers provided by the study team, followed by on-site and online refresher sessions.¹² Supportive supervision visits were carried out quarterly by trained study team members, who reviewed BP measurement techniques (ie, 5 min rest period and duplicate measurements), availability of functioning equipment and BP-lowering medications, accuracy of data capture and performance and quality reports to support continuous improvement in care delivery.¹³ From January 2021 to May 2022, BP-lowering medications were centrally distributed to PHCs and made freely available to patients. To sustain medication accessibility, a drug revolving fund (DRF) scheme was introduced in April 2022, requiring patients to pay a reduced fee to cover procurement and administrative costs. Quarterly community awareness outreach events by local health educators were conducted to raise awareness for hypertension services from March 2020 to October 2022. The co-primary effectiveness outcomes were hypertension treatment and control compared between the preimplementation and implementation periods. The co-primary implementation outcomes included reach, adoption, implementation fidelity, maintenance and acceptability.

The HTN Program data and effectiveness and implementation outcomes (table 1) were used to inform the subsequent qualitative data collection carried out between November 2023 and January 2024.^{13 14} The Good Reporting of a Mixed Methods Study and Consolidated Criteria for Reporting Qualitative Research guidelines were followed for reporting results (see online supplemental file 2).^{15 16}

Quantitative outcomes

Table 1 illustrates how each of the RE-AIM outcomes was assessed, including the level and source of quantitative data for each outcome.

Qualitative study setting and participants

Participants in the current study were recruited from the participating PHCs. Eighteen PHCs were selected based on facility-level performance measures, specifically those in the top and bottom 12% of BP control rates assessed at the end of the HTN Program. To comprehensively assess implementation from multiple perspectives and levels across PHCs, we conducted focus group discussions (FGDs) with patients, healthcare workers (HCW) and PHC directors involved in the HTN Program, reflecting its team-based approach to care. Healthcare workers in the target population included CHEWs, community health officers (CHOs), pharmacy technicians and directors.

Table 1 RE-AIM outcomes definitions and quantitative outcomes from multiple data sources in the HTN Program

RE-AIM domain	Level	Indicator	Pre-Implementation (February 2020)	Endline (December 2023)	Data source
Reach The number, proportion and representativeness of individuals enrolled in the HTN Program	Patient	Number of patients with hypertension who met the inclusion criteria (adults aged ≥18 years with BP ≥140/90 mm Hg on two occasions or a history of hypertension) and were enrolled in the study	21,922 (47.8% of whom were previously diagnosed with hypertension)		Effectiveness outcome data
	Patient	Proportion of patients enrolled by sex, %	Female: 68.2 Male: 31.8		Effectiveness outcome data
	Patient	Number of clinic visits among patients enrolled across the 60 PHCs		142,493	Effectiveness outcome data
Effectiveness The program's impact on BP control and treatment rates	Patient	BP control rates (6-month rolling average), %	21.7	55.9	Effectiveness outcome data
	Patient	BP treatment rates (6-month rolling average), %	86.2	96.4	Effectiveness outcome data
Adoption The number and proportion of healthcare workers actively implementing the Program	Healthcare worker	Number of healthcare workers trained on HTN Program protocol at baseline	240		Program and administrative data
	Healthcare worker	Proportion % (n/N) of visits with BP checks for all patients in the last three working days*	78.4 (138/176)	84.4 (135/160)	Program and administrative data
	Health system	Proportion % (n/N) of PHCs with at least two staff available and able to perform BP measurement and treatment*	56.7 (34/60)	98.3 (59/60)	Program and administrative data
Implementation Includes how consistently the HTN Program was delivered as intended, including fidelity to key components such as BP measurement and treatment protocols	Patient	Number % (n/N) of walk-in patients treated during their first clinic visit	55.4 (3,049/5,506)	39.0 (6,408/16,416)	Effectiveness outcome data
	Healthcare worker	Number of healthcare workers trained on HTN program protocol at baseline	240		Program and administrative data
	Healthcare worker	Proportion % (n/N) of supervision visits with observed BP measurement performed per protocol*	91.5 (193/211)	86.5 (147/170)	Program and administrative data
	Community	Total number of community awareness events conducted		307	Program and administrative data
	Community	Total number of participants engaged at the community awareness events		6,477	Program and administrative data
Maintenance The proportion of patients who completed at least two follow-up clinic visits and the degree to which the HTN Program became institutionalised as part of routine PHC practices	Patient	Patients with 2+ visits, % (n/N)		66.7 (14,619/21,922)	Effectiveness outcome data
	Health system	Proportion % (n/N) of PHCs with steps 1 and 2 medication stock available during all supervision visits*	0 (0/60)	68.3 (41/60)	Program and administrative data

*Assessed at quarterly PHC supportive supervision visits.

BP, blood pressure; HTN, Hypertension Treatment in Nigeria; PHC, primary health centre; RE-AIM, Reach, Effectiveness, Adoption, Implementation, and Maintenance .



Directors are those staff who oversee operations and manage and supervise staff within each PHC. Hypertension care is delivered by trained, salaried CHEWs, who are supported and supervised by CHOs.¹⁷

We aimed to recruit at least 15 participants per healthcare worker category (CHEWs, CHOs and pharmacy technicians), with 5–6 HCWs per FGD. Using stratified, purposeful sampling,¹⁸ we selected HCWs from eligible PHCs to ensure diverse perspectives across the constituent groups. All PHC directors from eligible clinics were invited to participate. Healthcare workers who had been in their roles for at least 1 year at the selected PHC and were actively involved in the HTN Program were invited to participate by a study team member via phone.

For patients, we targeted at least 15 participants, recruited through convenience sampling from these same facilities. Patients were eligible if they had been receiving care through the HTN Program at the PHC for at least 1 year and did not have cognitive impairment that would prevent their participation in the FGD. During their routine clinic visits, eligible patients were informed about the opportunity to participate in FGDs and asked about their willingness to be interviewed.

Qualitative data collection

Semi-structured interview guides were developed for each participant group and included open-ended questions and probes informed by RE-AIM QuEST. The interview guides explored participants' experiences with the HTN Program the implementation strategies employed and contextual factors influencing the RE-AIM outcomes. Additionally, acceptability was assessed based on how well the program met the needs of patients and healthcare workers, including satisfaction and affordability. It also sought to explain reasons for variability in program outcomes identified in the quantitative data, lessons learnt and recommendations for sustaining and scaling up the program.

Experienced qualitative researchers conducted and moderated FGDs. Prior to data collection, interview guides were pilot-tested for comprehensibility and readability. FGDs were held in private clinic rooms, conducted in English, audio-recorded and lasted approximately 60 min. Participants were briefed on study objectives and confidentiality, then provided demographic information (age and sex) at the end. Modest compensation was given for their time. Interviews were transcribed verbatim and reviewed for accuracy.

Qualitative data analysis

For the qualitative data, two members of the research team (CO-U and NRK) with expertise in qualitative and mixed-methods research conducted the directed content analysis using RE-AIM QuEST framework. All coding processes were performed using Dedoose software (V.9.2.5). First, each researcher independently read four transcripts (one per constituent group), double-coded the same subset of transcripts and identified preliminary

codes. Through a series of meetings, the researchers compared their coding, aligned definitions and interpretations of the initial codes, and resolved disagreements through discussions with a third team member (LRH) to achieve consensus. Subsequently, one researcher (CO-U) coded the remaining transcripts using the established coding framework. Once all the transcripts were coded, the main coder generated the code report, transferred into matrix displays in Microsoft Excel and categorised the findings into themes, specifying barrier (–), facilitator (+) or both (–/+). Finally, data were organised by RE-AIM dimensions to further explain and expand our understanding of the implementation outcomes.

Mixed-methods data integration and analysis

Mixed-method analysis was performed to identify determinants that facilitated or hindered implementation and effectiveness of the HTN Program. Data integration occurred at several points. First, findings from the quantitative study informed the development of the qualitative interview guide and the selection of sites for the qualitative interviews. Second, we used qualitative data to help explain and explore outcomes and variability among sites. Third, quantitative and qualitative data were then reviewed side-by-side across the RE-AIM dimensions to assess confirmation, expansion or discordance of findings.¹⁹

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

RE-AIM quantitative outcomes

Quantitative RE-AIM outcomes are shown in table 1. The HTN Program had wide reach, including among individuals without formal education, although most patients enrolled were female (68%). The program had high effectiveness with substantial increases in hypertension treatment and control from baseline to the study's end. Adoption of program's protocols (ie, BP measurement and treatment) was high overall, although with variability across study sites. Maintenance was strong with evidence of integration into PHCs at the end of the study, but lower at the patient level with moderate retention in care.

Qualitative study participants

We conducted 13 FGDs, including 3 with patients (n=17), 1 with directors (n=5), 3 with CHOs (n=17), 3 with CHEWs (n=18) and 3 with pharmacy technicians (n=18). Participants' characteristics are presented in online supplemental table 1. Most CHOs, CHEWs and pharmacy technicians were female (70%, 60% and 60%, respectively). Most directors and patients were male (80% and 70%, respectively). Participants represented all six LGAs

in the Federal Capital Territory and 18 PHCs (see online supplemental table 2).

Multilevel contextual factors influencing RE-AIM outcomes

We present the identified themes mapped to one or more of the five RE-AIM outcomes, highlighting the contextual factors that facilitated or hindered the achievement of these outcomes across different levels of influence (patient, healthcare worker, health system and community).

Patient-level factors

Themes and illustrative quotes are presented in [table 2](#).

Peer influence (+) (reach, acceptability)

The proportion of patients who were not on BP-lowering treatment at the start of their first clinic visit (ie, 'walk-in' treatment) decreased from baseline to the end of the implementation period (55.4% vs 39.0%), suggesting that the program increasingly reached patients who were not on baseline BP-lowering treatment. Treatment at the end of each clinic visit (ie, 'walk-out' treatment) increased from 86.2% at baseline to 96.4% at the end of the study period. Patients in the FGD noted that when they shared their personal experience in the HTN Program with their families and communities, it positively shaped community perceptions of the HTN Program. In particular, they shared information about the quality of drugs and positive healthcare experiences at the local PHCs. By sharing this information with family and friends, participants encouraged others to seek care at nearby PHCs. This peer influence expanded the program's reach and acceptance, enabling more individuals to benefit from its services.

Cultural beliefs and gender norms related to care-seeking behaviour (–) (reach)

Of the patients enrolled in the HTN Program, we observed that a lower proportion of males (n=6,980; 31.8%) were enrolled compared with females (n=14,942; 68.2%). FGD participants attributed the lower participation of men to cultural beliefs and norms surrounding masculinity. They further explained that men's perceptions of gender roles, particularly the expectation of being the family breadwinner, left them with 'limited time' to seek hypertension treatment, often resulting in delays in care, self-medication or reliance on complementary medicine. Additionally, participants noted that men's desire to appear strong and avoid perceptions of weakness or vulnerability further contributed to their lower engagement in the HTN Program. They also observed that men often equated the absence of symptoms with good health, reinforcing the belief that seeking care for hypertension and related services was unnecessary to maintain their health.

In contrast, HCWs reported that the social role of women as primary care givers meant they routinely visited PHCs for maternal healthcare, family planning or children's immunisations. These visits provided more opportunities for BP screening, diagnosis and management.

Patient autonomy and competence (+) (effectiveness, acceptability) HCWs in the FGD further described how the program fostered patient autonomy and competency. They noted that lifestyle counselling—and, in some cases, home BP monitoring—empowered patients, motivating them to take control of their health by recognising the value of self-management and lifestyle changes for long-term BP control.

Financial constraints (–) (reach, acceptability, maintenance)

Patients reported experiencing substantial financial constraints due to national economic meltdown, which limited the affordability of BP-lowering medications as well as time spent on PHC visits. These financial barriers significantly impacted medication adherence and retention in care, posing challenges to achieving sustained hypertension control.

Minimal side effects and reduced pill burden (+) (effectiveness, acceptability, maintenance)

There was a significant improvement in the hypertension control (6-month rolling average) from 21.7% at baseline to 55.9% at the end of the study period. Healthcare workers in the FGD reported that most patients experienced no side effects from the BP-lowering medication, supporting effectiveness, although a few had minimal to moderate side effects that hindered their adherence and negatively impacted hypertension control. Participants highlighted that more conventional FDCs reduced medication burden and dosing frequency, enhancing the acceptability and maintenance of BP-lowering medications. They also described the benefits of FDC among patients with comorbid conditions, highlighting that it simplified treatment for those taking multiple medications by reducing BP-lowering medication to a single pill.

Support in modifying health behaviours (–/+) (effectiveness, maintenance)

Many FGD participants reported that the counselling and patient education provided through the HTN Program—such as reducing excess dietary sodium and alcohol consumption, adhering to medication regimens and increasing physical activity—helped them adopt healthier behaviours which contributed to better BP control. However, some healthcare workers noted that a few patients were resistant or non-adherent to lifestyle modifications and dietary recommendations, believing that medication alone would be sufficient to control their hypertension without behavioural changes.

Supporting treatment adherence (+) (effectiveness, maintenance)

Patients reported that support in the form of reminder appointment cards, pill counts and calls/text messages facilitated adherence to their BP-lowering medications and follow-up clinic visits. Additionally, a few patients mentioned that peer or spousal influence played an important role in encouraging adherence to their medication regimen.

**Table 2** Themes and illustrative quotes on patient-level factors

Themes	Valence	Outcome(s)	Illustrative quotes
Peer influence	+	Reach; acceptability	“When our patients started taking the drugs and they observed that their BP is getting controlled, they tell their neighbors that they went to the hospital. And this is what they are doing for me and what they are doing is okay and their clinic days are Thursdays. When you go there, they will not waste your time; they allow you rest, they check your BP and give you drugs. And your BP will be controlled; he will also invite his neighbor to go and check his BP.” (PHA, group 7)
Cultural beliefs and gender norms related to care-seeking behaviour	-	Reach	“When I was giving awareness, I even met more men than women, but more females responded than the men. They will be telling you that they are not feeling anything, so what is the need of checking [BP], they don't have headaches, nothing at all. I asked them how they know; they should come to the facility to check their BP to know if it's okay or not and sometimes they feel that they do not have time and they are healthy.” (CHEW, group 6)
Patient autonomy and competence	+	Effectiveness; acceptability	“Because of our home BP monitoring, some of the clients have been taught how to even take care of themselves. And they can now take BP, so they are contributing to taking care of themselves.” (CHO, group 4)
Financial constraints	-	Reach; acceptability; maintenance	<p>“The reason why some patients might not come the way they are supposed to come to the facility could be as a result of the cost of the drug. Because, based on my interaction with the patients, those that have defaulted, most at times they tell me that it's because of financial problem, coupled with the current situation of the country.” (CHEW, group 4)</p> <p>“Some of them they say this it is money issue. They don't want the drugs to finish in time because they know it's one-to-onemonth drug that we are giving them. So, they are skipping their drugs so that it will take some time.” (CHEW, group 5)</p>
Minimal side effects and reduced pill burden	+	Effectiveness; acceptability; maintenance	<p>“For instance, the hypertension drugs they were taking before there are side effects. Even my mum is experiencing it. Some can begin to cough as a result and regardless of the drugs you take for it, it will not subside. The side effect is minimal, and I can say nobody has even complained. The only complain they made, when they started is, some say their legs are a bit swollen, and with counselling, they became okay.” (CHO, group 1)</p> <p>“The combination makes it easier for the patients to take because the tablets might not be the only tablet that they are taking, for some that are diabetic and other conditions that they are having. So, if their meds are many, they feel somehow to take it but since it's just one, it makes it easier for them to take.” (CHEW, group 6)</p>
Support in modifying health behaviours	-/+	Effectiveness; maintenance	<p>“The program has taught me that you don't just go to the market and lay your hand on any groundnut oil. You look for the one that is cholesterol free, that has omega 3. When I used to eat meat before, I would like that place that has fat because that one is very sweet but as I went to the health clinic when the matron was giving us a lecture that we should avoid in short meets, just take it small and avoid that part. So, alcohol, I don't take it and all these carbonated drinks, I don't like them but once in a while I take, but since I'm doing and the kind of work I do has to even do with exercise in the class.” (Patient, group 6)</p> <p>“The food I will advise them not to take; all this alcohol, smoking, and all these fast foods, some don't stop, they continue taking it. And that can also make their BP to be high sometimes.” (CHO, group 4)</p>
Supporting treatment adherence	+	Effectiveness; maintenance	<p>“Thank God for my wife who is always reminding of the day for my check up and so it has been easy for me.” (Patient, group 9)</p> <p>“The tablets inside are thirty, so I take every day one. If I get to five days left, I go to the hospital to check my BP.” (Patient, group 7)</p>

Continued

Table 2 Continued

Themes	Valence	Outcome(s)	Illustrative quotes
Competing priorities among patients	–	Maintenance	“Like particularly in my own facility, time is something to some of my people. Like the rural areas, period of farming and sometimes that they may not be engaged with much farm activities. So, sometimes when they come, we’ll ask them, we didn’t see you last month, what happened? They’ll say we went to the farm, or we went somewhere. I think that has been a barrier as to why some of them don’t come for follow up.” (CHO, group 1)
Patient mobility	–	Maintenance	“Our challenge in our facility is that for some people like the nomads who can relocate themselves at will for grazing and only return once in a while.” (CHEW, group 6)
Role of traditional medicine	–	Effectiveness; maintenance	“Most people, especially the Northerners, believe in herbal medicine. So, once they are told that this herb cures hypertension, they’ll just go for it, whereas hypertension has no cure for now. So, they believe that once they take that herbal medicine, they don’t need any other medicine again” (CHEW, group 6)
Perception of illness	–	Maintenance	“Some of them stopped taking their drugs, some people don’t take their drugs, and some believe that because their BP is normal; I will hold on small before taking it, I should just give a gap. That’s what some people say because my blood pressure is normal; there is no need to be taking it. I will hold on, when the thing looks like it’s going high; I will start taking it again.” (PHA, group 3)

CHEW, community health extension worker; CHO, community health officer; PHA, pharmacy technician.

Competing priorities among patients (–) (maintenance)

Of the patients enrolled, two-thirds (66.7%; n=14619) reported two or more visits at PHCs. Patients who had started taking the medications as directed later missed doses or follow-up appointments due to competing priorities such as busy work schedules and other daily activities. Most HCWs also cited forgetfulness caused by patients being busy with other commitments, disruptions to routines (such as travel) or feelings of inconvenience as reasons for poor retention, medication adherence and persistence.

Patient mobility (–) (maintenance)

Healthcare workers identified relocation, whether to another municipality or out of state, as another factor influencing patients’ retention in care and adherence to hypertension treatment. For instance, a healthcare worker noted that this issue was particularly prevalent among the nomadic population, who are commonly known to undergo seasonal migration with their livestock and families.

Role of traditional medicine (–) (effectiveness, maintenance)

Non-adherence to BP-lowering medications was partly associated with patients opting for alternative forms of medicine, such as herbal remedies. Respondents noted that patients who sought traditional remedies often mentioned the high out-of-pocket costs of prescription medications or their inability to continue affording them, asserting that herbal remedies were more accessible and affordable. Furthermore, some patients believed that herbal medicine could effectively cure their hypertension.

Perception of illness (–) (maintenance)

HCWs emphasised that patients’ attitudes toward BP-lowering medications were often shaped by the asymptomatic nature of hypertension and a general reluctance to commit to lifelong treatment. Patients reported missing doses because they did not experience symptoms, such as headaches, and believed their hypertension had been cured.

Healthcare worker-level factors

Themes and illustrative quotes are presented in [table 3](#).

Enhanced healthcare workers’ knowledge and skills (+) (adoption)

Over 240 CHEWs, CHOs and pharmacists across 60 PHCs were trained on the HTN Program protocol. The high proportion of visits with BP checks for all patients in the last three working days (84.4%) and the high proportion of patients who initiated treatment (ie, walk-out treatment) reflected healthcare workers’ strong commitment to hypertension care. HCWs in the FGD unanimously reported an improvement in their knowledge of hypertension and its management, noting their increased capability and confidence in adopting hypertension screening and treatment protocols. They attributed these gains to the training and supportive supervision provided through the HTN Program. Additionally, HCWs highlighted that using a simplified hypertension treatment protocol helped overcome treatment inertia as most reported that were able to follow the steps for treatment intensification.

Ongoing motivation and commitment of healthcare workers (+) (adoption, maintenance)

HCWs emphasised that motivation through recognition and rewards was crucial for ensuring staff satisfaction,

**Table 3** Themes and illustrative quotes on healthcare worker-level factors

Themes	Valence	Outcome(s)	Illustrative quotes
Enhanced healthcare workers' knowledge and skills	+	Adoption	"The training, they gave us, some of us didn't have much knowledge about it. We were even told in school that at community level, you are not supposed to treat a hypertensive patient. The moment you see a patient you refer immediately. But now, they [HTN Program] have given us the confidence that when you have a patient that is hypertensive, you can treat at the primary health care level. When the patient is no longer responding, then you can now refer. So, we are very happy with the program." (CHO, group 8)
Ongoing motivation and commitment of healthcare workers	+	Adoption; maintenance	"We have learnt from other facilities that those best performing facilities were given awards of performance. So, we that were not given had to put in our own best to make sure that all the patients we had in our own facility come for their own drugs by following them up." "Quarterly supervision visit has been helpful, because, when they come for supervision, it's to come and look at the areas where you are doing well and encourage you. Where you are not doing well, they'll correct you and still encourage you. That is where you'll now learn more. So, it has been helpful, and I have gained a lot from it." (CHEW, group 2)
Practice facilitation to support implementation	+	Adoption; Implementation (fidelity)	"It's a way of evaluating our performances at our level and it's really helping us because sometimes when they [HTN implementation team] visit us quarterly, we are always having something new to learn from their coming which is really helping us. Sometimes you might even be battling with a challenge, so when they are available you can easily discuss your challenges with them; you will be put through and it's really helping a lot." (PHA, group 2)
Characteristics of healthcare workers	+	Acceptability	"I went there when my BP was almost 170 and now my BP has dropped down to 137/77. I give credit to the staff, when we go there, they receive us with two hands. They provide the drugs for us then they advise us on the right time to take our drugs so that it will be useful to our health." (Patient, group 9) "The community health workers are based in the community there. They are familiar with them. So, there's a synergy, there's a rapport between the healthcare workers and the patients." (Director, group 1)

CHEW, community health extension worker; CHO, community health officer; PHA, pharmacy technician.

commitment and ongoing adoption of the program. For instance, better-performing PHCs, characterised by higher treatment and control, received recognition and accolades at team meetings, which in turn motivated HCWs at other facilities to enhance their performance. Additionally, the importance of quarterly supportive supervision was highlighted as it provided opportunities for recognition and encouragement, contributing to HCWs' professional growth, satisfaction and motivation.

Practice facilitation to support implementation (+) (adoption, implementation fidelity)

Fidelity to the treatment protocol remained high despite a modest decrease, starting at 91.5% at baseline and ending at 86.5%. This decline was largely explained by incomplete implementation of supervision visits at one out of six LGAs. HCWs described the technical support and simplified protocol provided by the core HTN Program team as highly beneficial for improving performance, supporting adoption and ensuring program fidelity. They further noted that these strategies helped

streamline implementation processes, provided valuable feedback and fostered collaboration to troubleshoot and address real-time implementation challenges and reduce unwarranted clinical variability and therapeutic inertia.

Characteristics of healthcare workers (+) (acceptability)

Characteristics of healthcare workers were cited as a key facilitator in promoting program acceptability. CHEWs, in particular, were perceived by patients and PHC directors as going above and beyond to deliver patient-centred care. They understood the community's culture and built meaningful connections that were both therapeutic and impactful for patients. Patients highlighted that their ability to identify with and relate to the CHEWs encouraged their engagement and active participation in the HTN Program.

Health system-level factors

Themes and illustrative quotes are presented in [table 4](#).

Table 4 Themes and illustrative quotes on health system-level factors

Themes	Valence	Outcome(s)	Illustrative quotes
Quality of BP-lowering medication	+	Effectiveness; acceptability; maintenance	“I think the quality of drugs that they've been given, has improved outcome in the long run. The next time they go, they see that the blood pressure is being controlled. It serves as an incentive to that patient so that he sees that yes, the blood pressure is going down and then with drugs that are not as expensive as those that probably they would have gone to get from elsewhere with query quality of those particular drugs, they might have been spending so much without the blood pressure being controlled well.” (Director, group 1)
Minimal medication stockouts	+	Maintenance	“The program has met the needs of our patients in our facility. Firstly, because the drugs are always available in the facility, so there is not a time when we tell them to come, we say, no, there is no drug. They have drugs all the time. Anytime we measure their BP, when they come for their checkup, the drugs are available for them.” (PHA, group 2)
Cost of medication	-/+	Acceptability; maintenance	<p>“When it was free, we had a large population, then we told them that we wanted to start selling the drugs at a subsidized rate and we had a setback at the initial time ... Some of them that went for market survey, when they compared the cost [in the HTN Program] to the one that they are selling outside, they started coming back. They realized that the market price is higher than the one we are giving them.” (PHA, group 7)</p> <p>“When we were collecting the drugs for free, we were happy and now that we are buying; we are still happy. Because when they earlier prescribed the drugs for me, it was expensive at the private hospital; so, I'm excited that I can buy the drugs for a cheaper amount.” (Patient, group 9)</p>
Health facility – capacity	–	Adoption; Implementation (fidelity)	“It has to do with the number and the mix of staff in the various facilities. The Primary Health care centers are bigger, have more staff and have the right mix. In the center you can find the community health officer, a nurse midwife, a pharmacy technician, you understand a lab scientist or a lab attendant. Whereas in some facilities you just see one staff offering all the services, family planning antenatal, immunization. So, for such facility we have just a staff or two. They will certainly not perform very well because when client or patient go, there are times that the facility is closed or there are a lot of activities, many partners competing for staff attention, trainings here and there. So, in a week, you may discover that the facility is closed twice or even three times in a five day working week. You know, so, when clients come on days that staff have gone for training.” (Director, group 1)
Trust and confidence in public health facilities	-/+	Acceptability	<p>“Location of the PHC matters a lot, especially in [LGA]. If you look at some of our semi urban clinics, most of the elite, they look down on the PHC, they just go to private facilities. They don't believe that you are doing anything good at the PHC ... They just believe that those in the private hospitals are more superior, you know more quality, than the PHC facilities.” (Director, group 1)</p> <p>“Because of this program now, the clinic flow has been high, and it has really helped very well in service provision to the community. I believe the clients now have confidence in the health workers who are providing services.” (CHO, group 1)</p>

BP, blood pressure; CHO, community health officers; PHA, pharmacy technician.

Quality of BP-lowering medication (+) (effectiveness, acceptability, maintenance)

FGD discussants noted that the quality of medication and overall treatment led to significant BP control, thereby facilitating the program's effectiveness. HCWs observed well-controlled BP during follow-up visits, which motivated them to continue treatment. Patients also reported positive outcomes, such as better sleep and normalised BP, attributing these improvements to the effectiveness of the medication.

Minimal medication stockouts (+) (effectiveness, maintenance)

The proportion of PHCs with BP-lowering medications in stock at all quarterly supportive supervision visits increased from 0% at baseline to 68.3% by the end of the study. PHC directors and HCWs commended the HTN Program for the consistent availability and supply of medications at the facilities through the drug revolving fund scheme implementation, ensuring that BP-lowering medications were made available at the clinic visits for patients.

Cost of medication (-/+ (acceptability, maintenance)

Participants noted that the initial implementation of free drugs helped increase accessibility and affordability of hypertension treatment. However, the transition from free medications to subsidised drugs under a drug revolving fund scheme reduced affordability for some patients, negatively impacting the program's acceptability and patient retention and effectiveness. Despite these challenges, several participants expressed satisfaction with the introduction of the DRF scheme due to its advantages, such as reduced costs compared with other surrounding healthcare facilities, along with ongoing free consultation and BP checks, effectiveness and quality of the medications and care provided within the HTN Program. Most PHC directors believed that subsidising medication costs—either through the DRF or integration into the national insurance scheme—is a promising and necessary approach to ensure a continuous supply of essential, quality BP-lowering medications.

Health facility capacity (-) (adoption, implementation fidelity)

The proportion of PHCs with at least two staff available and able to perform BP measurement and treatment varied initially but improved significantly over time across the area councils (from 56.7% at baseline to 98.3% at the end of the study). Furthermore, subgroup analyses showed higher hypertension control rates in sites with a higher patient-to-permanent-staff ratio.¹⁴ FGD participants attributed these variations to the differences in the size and staff composition of the PHCs. One director further explained that larger PHCs, with more diverse and permanent staff—including CHOs, CHEWs and pharmacy technicians—were perceived to perform better in terms of program implementation. Smaller clinics were more likely to face implementation challenges due to reduced operational hours, inconsistent service delivery, healthcare worker shortages and competing priorities.

Trust and confidence in public health facilities (-/+ (acceptability)

A few healthcare workers emphasised how the nature of health facilities influences public trust and acceptability of hypertension services, with PHCs perceived differently from private health facilities. They further explained that individuals with higher socioeconomic status often preferred private hospitals over public PHCs due to their perception of better quality of care in the private sector. However, participants reported a positive shift in patients' perceptions, highlighting high satisfaction and increased confidence in the quality of hypertension care and the expertise of healthcare workers, particularly CHEWs, at PHCs since the commencement of the HTN Program.

Community-level factors

Themes and illustrative quotes are presented in [table 5](#).

Hypertension care closer to communities (+) (reach, acceptability)

Since the launch of the HTN Program, 21,922 patients with hypertension were reached (including 47.8% of whom were previously diagnosed) and who received care

during 142,493 visits across 60 PHCs during the study period. Participants across all groups commended the HTN Program for decentralising services to local PHCs, bringing hypertension treatment closer to communities and greatly improving access to hypertension care. Many reported that this approach not only made treatment more accessible but also helped patients to save on time and transportation costs, explaining the high program reach. Both HCWs and patients noted that the introduction of the HTN Program at the PHCs marked a substantial shift from previous care models, where patients were required to seek hypertension treatment at larger, tertiary hospitals—often perceived as intimidating and unwelcoming. HCWs further highlighted that the program enabled them to reach remote or rural populations who might not have otherwise checked their BP or received treatment.

Community awareness and buy-in (+) (reach, acceptability)

A total of 307 community awareness events were conducted, reaching 6,477 participants, to raise awareness about hypertension services in Nigeria. FGD participants consistently emphasised that the community awareness events led to greater awareness of hypertension, its severity and how and where to access hypertension services locally. It also fostered community buy-in, which was essential for enhancing reach, acceptability and accessibility of the HTN Program.

Political climate and insecurity (-) (reach)

Healthcare workers identified the broader national political climate as a significant barrier to the program's reach. They reported that insecurity and political instability in certain areas disrupted patients' access to hypertension services and interfered with HCWs' workflows and operational hours at affected PHCs.

Environmental conditions (-) (effectiveness)

Seasonal variations and temperature changes were reported by a few FGD participants to significantly affect BP control. They observed fluctuations in BP levels associated with weather changes, particularly during the wet (with generally lower temperatures) and dry seasons (with higher temperatures).

Perception of community-wide effectiveness (+) (reach, effectiveness, acceptability)

The robust evidence base demonstrating the HTN Program's effectiveness played a crucial role in facilitating community acceptability, buy-in and program reach. Several PHC directors noted significant reductions in hypertension-related complications within the community, attributing these improvements to increased access to treatment for those previously unable to afford it and better BP control since the program's inception.

Table 5 Themes and illustrative quotes on community-level factors

Themes	Valence	Outcome(s)	Illustrative quotes
Hypertension care closer to communities	+	Reach; acceptability	<p>“The decentralization of the program at the PHC level has helped our patients. Because, most times a patient comes to your facility, and you tell the patient to go to a secondary facility, they get discouraged. But with this in the PHC level now, and with the awareness, most of our patients are more comfortable, they feel more comfortable with this program, and they are doing well, because it is at their doorsteps. They don’t have to go far from their own community to seek medical assistance.” (CHEW, group 4)</p> <p>“The decentralization, because of accessibility. You know, people in the community, if they have to travel all the way, use transport money to move to secondary health facilities or tertiary health facilities before they access this quality care, you know, it becomes difficult to lose the opportunity of actually picking them early before complications set in.” (Director, group 1)</p>
Community awareness and buy-in	+	Reach; acceptability	<p>“Because we got the [stakeholder group] involved and the community leaders. So, they helped to create the awareness for people to come to the facility and check their BP and see if they are eligible to enroll. So many people came, people trooped in to enroll for the hypertension program.” (CHO, group 8)</p>
Political climate and insecurity	–	Reach	<p>“The issue of the hardship that is being faced by Nigerians these days, some of the facilities ... For some of them to leave those areas to come to our place, there is security challenge. So, they don’t normally have it easy to come to my facility.” (CHO, group 4)</p>
Environmental conditions	–	Effectiveness	<p>“I think the weather. In my own facility, do you know that during harmattan, the rainy season, you will see that almost all of them have controlled BP’s. but when it’s the heat season, you will see that all their BP’s have become something else. Because [LGA] is hot, when you ask them; they will say I didn’t sleep and the more you are giving them the drugs they are coming back with a high BP because of the weather. But when it is harmattan or rainy season, it is usually excellent.” (PHA, group 3)</p>
Perception of community-wide effectiveness	+	Reach, effectiveness, acceptability	<p>“I will say it has been a game changer as far as the management of hypertension at the community level. Prior to the commencement of the intervention, we were seeing so many cases of hypertension and you know, due to the poverty rate, many couldn’t access the medications but with this intervention; we’ve seen accessibility being increased and many who didn’t really have the opportunity to access the medications are now accessing the medications and we are seeing less of the complications of hypertension.” (Director, group 1)</p> <p>“The data we are getting from the field periodically have shown that we are not having complications, and more people have been accessing it. So, by and large, we are able to impact lives, prolong life, and reduce complications due to hypertension.” (Director, group 1)</p>

CHEW, community health extension worker; CHO, community health officer; PHA, pharmacy technician.

DISCUSSION

This explanatory mixed-methods study evaluated implementation, effectiveness and context of the HTN Program within public primary health systems in the Federal Capital Territory of Nigeria. Our findings add to the limited but growing literature on HEARTS-based programs in low-resource primary care settings, which operate within a unique set of structural constraints and challenges,

including healthcare worker shortages, limited access to essential medicines and low financing.^{20–24}

Several lessons have been learnt throughout the implementation process of the HTN Program. Foremost, decentralising hypertension care to primary care settings holds great potential by shifting services away from large, tertiary institutions, thereby improving reach, enhancing access and bringing care closer to local communities.²⁵



Consistent with prior research in other African countries,^{26 27} this study particularly highlighted that the HTN Program increased community awareness about hypertension, expanded access to treatment and availability of BP-lowering medications at primary care centres. Additionally, it fostered greater community buy-in due to the proximity of hypertension care, coupled with savings in time and transportation costs, allowing the program to reach populations who might not have otherwise checked their BP or received treatment. As a result, the program successfully reached 21 922 patients with hypertension, making it one of the largest and most effective of its kind in Africa.

A central practice in decentralised systems is task-shifting care practices to community health workers. CHEW-delivered hypertension programs have demonstrated a significant return on investment by leveraging pre-existing resources to provide widespread benefits and bridge the gap between health systems and communities.²⁸ Supported by Nigeria's Task Shifting and Task Sharing Policy for the prevention and control of non-communicable diseases, and through training and supportive supervision, CHEWs in the HTN Program prescribed BP-lowering medications using simplified treatment protocols and administered lifestyle counselling.^{29 30} Several participants in our study highlighted the critical role of CHEWs, emphasising their contributions to the program's acceptability among patients. Their ability to connect with individuals and their understanding of the community's culture were particularly valuable in fostering trust and continued engagement. Creating an environment that boosted the skills, self-efficacy, motivation and commitment of healthcare workers was identified in our study as a key driver of adoption and implementation fidelity. While many PHCs in this study had low staff attrition, previous literature suggests that underinvestment and lack of secure funding for CHEW programs can threaten fidelity and maintenance of programs.^{28 31–33}

Prior research has shown that inconsistent access to quality healthcare services can foster mistrust within communities.³⁴ In the current study, we found that the nature and location of the PHCs influenced the acceptability of services and confidence in the quality of hypertension treatment. Previous studies suggest that government-owned health facilities are often undervalued, with individuals opting for private facilities when financially viable, due to the common perception that private facilities offer better quality care with less wait time.^{35 36} However, we observed a positive shift in patients' perceptions following the commencement of the HTN Program. Patients reported high satisfaction with their experience and increased confidence in the quality of hypertension treatment and expertise of trained and supervised HCWs, particularly CHEWs, at the PHCs. Additionally, FGD participants highlighted that the differences in PHC capacities (ie, staff volume) across LGAs contributed to variations in clinic performance, though booster training and supportive supervision led to improvements

over time. Subgroup analysis of quantitative data further indicated that patients receiving care from PHCs with higher patient visits per permanent healthcare staff had better control rates, underscoring the importance of quality care over staff volume.

The observed gains in hypertension treatment and control were strongly facilitated by the availability and quality of BP-lowering medication. Unlike earlier studies across LMICs,^{20 37} we observed minimal medication stock-outs across the PHCs, largely due to the implementation of a drug revolving fund scheme, along with robust quality control measures, to ensure sustained availability and affordability of quality medications. Patients expressed high satisfaction with the cost and quality of the medications, particularly FDCs, which they considered superior to substandard alternatives due to the perceived benefits, including minimal side effects and lower pill burden. However, financial constraints still posed a barrier to medication affordability in some cases, affecting patient acceptability and retention in care. To sustain these gains, integrating the drug revolving fund into broader health financing mechanisms while maintaining healthcare worker motivation and program efficiency will be critical.

Despite the positive impact of targeted community awareness efforts, a major barrier to reaching men was the cultural beliefs and gender norms surrounding care-seeking behaviour. In line with current literature,³ participants noted that men's gender roles, such as being the family breadwinner, limited time for seeking hypertension treatment, leading to delays in care, self-medication or reliance on traditional medicine. Additionally, the desire to avoid appearing weak and the belief that no symptoms meant good health further affected their engagement in the HTN Program. In contrast, the strong historical focus on maternal and child health in primary healthcare services may explain the higher participation among women. These findings underscore the importance of addressing the nuanced barriers faced by different population groups and call for innovative strategies to engage men throughout the hypertension care cascade, thereby helping prevent further widening of the gender gap in life expectancy.³ Studies have shown promise in reaching and engaging men through non-traditional settings such as faith-based organisations, barbershops, sporting events and workplaces, and by leveraging trusted male community leaders.^{38–41} Future HEARTS-based programs should therefore consider integrating these strategies to improve access and engagement among men.

This study should be interpreted in light of both its strengths and limitations. A limitation of the study is that we included 18 of the 60 PHCs implementing the HTN Program. The primary objective was to describe the implementation experience in depth and help explain the RE-AIM outcomes. To achieve this, we selected PHCs based on performance measures, focusing on sites in and around the top and bottom 12% of BP control rates, to capture a range of implementation experiences. Another limitation is the potential for selection bias,

which may have introduced differences between those who participated in the interviews and those who did not. For example, patients who agreed to participate may have been more engaged or satisfied with the program compared with the typical patient. Lastly, the sex distribution of patients in the focus group was not representative of the participant sample in the parent trial, which may limit the generalisability of patient perspectives. However, men were purposively oversampled due to their lower representation in the parent trial, to better understand their experiences and barriers to care.

Despite these limitations, the mixed-methods design, leveraging multiple data sources, provided a comprehensive understanding of the implementation process and RE-AIM outcomes, allowing us to explore areas of convergence and expansion. Additionally, the RE-AIM QuEST framework enabled us to examine both the ‘what’ and the ‘why’ behind each outcome. Moreover, our study captured the perspectives of multilevel program staff—directors, CHEWs, CHOs and pharmacists—as well as patients from 18 PHCs across 6 LGAs, offering valuable insights into the HEARTS-based program implementation within Nigeria’s public primary care system. Finally, the use of RE-AIM generated actionable findings at various levels, facilitating learning and guiding future adaptations to scale up HEARTS-based program in other primary care settings across Nigeria and LMICs.

CONCLUSION

Using an implementation science approach to examine HEARTS implementation in Nigeria enabled us to identify multilevel contextual factors, processes and strategies that facilitate the successful integration of evidence-based interventions into routine PHC practices. The strong reach, effectiveness, adoption, implementation, acceptability and maintenance observed in this study highlight the program’s potential to strengthen primary health-care systems across Nigeria, enhancing their capacity to respond effectively and with quality to the growing burden of hypertension.

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