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Enhancing intergenerational HeAlth in Nigeria: peripartum as Critical life stage for CardioVascular Health (ENHANCE-CVH) study: findings from pre-implementation using the updated consolidated framework for implementation research (CFIR 2.0)

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Abstract

Background Pregnancy is a crucial period to improve cardiovascular health (CVH) for mothers and their families. The current study emphasizes framework-guided factors that influence the adaptation of an evidence-based intervention (Parents as Teachers and Healthy Eating Active Living Taught at Home [PAT + HEALTH]) to support healthy gestational weight gain and postpartum weight management among pregnant women with obesity and their infants in Nigeria.

Methods From May to June 2023, 43 in-depth interviews were conducted with 11 parents, 15 community health extension workers (CHEWs)/health educators, and 17 policymakers/healthcare supervisors in the Federal Capital Territory, Nigeria. Additionally, nine focus groups were conducted with 75 participants. Interviews were recorded, de-identified, and transcribed. The updated Consolidated Framework for Implementation Research (CFIR 2.0) informed the development of the interview guides and the thematic analysis. Transcripts were double-coded using Dedoose.

Results We identified assessing context, tailoring strategies, local attitudes, and sustainability as constructs to consider when adapting and implementing the PAT + HEALTH intervention successfully within the Nigerian primary care context. For example, policymakers and healthcare supervisors emphasized the feasibility of the intervention, including raising community awareness, planning for hard-to-reach areas, and ensuring supportive supervision of CHEWs delivering the intervention. Additional factors included customizing educational content and delivery methods to fit the cultural, socioeconomic, and environmental contexts of Nigerian families. CHEWs highlighted the importance of public education on locally available foods for better nutrition. Potential barriers to the PAT + HEALTH intervention included local attitudes influenced by sociocultural factors, such as food taboos, and structural factors,

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including limited financial support for the long-term sustainability of some components of the home visiting program.

Conclusions Building on these formative activities, the ENHANCE CVH trial will advance dissemination and implementation science by adapting, testing, and evaluating the effectiveness and implementation of the PAT + HEALTH intervention among pregnant women with obesity and their infants in Nigeria in a cluster randomized trial.

Trial registration ClinicalTrials.gov/NCT06773299, Registration Date: January 14, 2025.

Keywords Pre-implementation process, Pregnant women, Obesity, Cardiovascular health, Home visiting program, Parents as Teachers, Consolidated Framework for Implementation Research, Nigeria

Contributions to the literature

- The use of the updated Consolidated Framework for Implementation Research (CFIR 2.0) in this study demonstrates its effective application in developing interview questions and assessing the perspectives of multiple stakeholders.
- This study provides practical, evidence-based recommendations that bridge theory and practice. It supports the adaptation of an evidence-based home visiting program to meet contextually relevant needs among pregnant women with obesity and their infants in Nigeria.
- Our findings emphasize the importance of culturally and economically tailored strategies to support sustainable health outcomes within the Nigerian context.

Background

Pregnancy is a key window to optimize maternal cardiovascular health (CVH) and to influence lifelong CVH for pregnant women and their families [1]. Adverse pregnancy outcomes, characterized by pregnancy-related complications (e.g., high blood pressure, gestational diabetes, preeclampsia), lead to an increased risk of future cardiovascular disease [2]. The 2023 World Health Organization Report for Africa revealed Nigeria's maternal mortality rate is the third-highest globally, with about 1,047 deaths per 100,000 live births [3]. In comparison, Ghana, with similar economic conditions, reported roughly 310 deaths per 100,000 [3]. Because of this high mortality rate and its large population of approximately 227 million people [4], Nigeria accounts for 23% of all maternal deaths worldwide [5]. Hypertensive disorders of pregnancy are among the leading causes of maternal death in Nigeria, which far exceeds the United Nations Sustainable Development Target 3.1: <70 maternal deaths per 100,000 live births by 2030 [5]. Nigeria also has a large and rising burden of noncommunicable diseases (NCDs), including overweight/obesity, hypertension, diabetes mellitus, and cardiovascular diseases [6]. Specifically, a study by Ogu et al. found that women with gestational diabetes mellitus (GDM) had significantly

higher rates of hypertensive disorders and adverse cardiovascular outcomes during pregnancy, with GDM prevalence estimated at 13.9%, emphasizing the need for early screening and management to reduce maternal and fetal complications [7].

In 2019, Nigeria's National Multisectoral Action Plan for the Prevention and Control of Non-Communicable Diseases (NCDs) was published and focused on strengthening reproductive, maternal, newborn, and child health services while expanding NCD prevention and care for women and girls as part of the Integrated Maternal, Newborn, and Child Health strategy by the Family Health Department of Federal Ministry of Health [8]. The Action Plan emphasizes exclusive breastfeeding and healthy infant feeding as foundations for lifelong healthy eating and reducing metabolic risks, aligning with the National Strategic Plan of Action for Nutrition (2014–2019) developed by the Nutrition Division of the Federal Ministry of Health [8]. These existing policies demonstrate an established environment in Nigeria for the adaptation and implementation of evidence-based interventions, which are urgently needed to reduce the burden of maternal morbidity and mortality and improve maternal health in Nigeria.

The Parents as Teachers and Healthy Eating Active Living Taught at Home (PAT + HEALTH) intervention is an evidence-based, strength-based, solution-focused model that utilizes social cognitive theory (e.g., modeling, reinforcement) and a socioecological approach (e.g., a supportive home environment). It recognizes protective and interactive influences on mothers and their children across multiple levels [9–11]. The intervention includes content focused on four phases: prenatal (6 months), postpartum/early infancy (6 months), mother/infant (6 months), and mother/toddler (18 months) [9]. In addition to the foundational PAT curriculum, it incorporates CVH self-assessment (e.g., self-weighing, physical activity), goal setting related to CVH (e.g., gestational weight gain, healthy eating, blood pressure control), and intergenerational supports for child CVH development (e.g., responsive feeding, soothing, parental modeling of healthy behaviors [9]). The core elements of the original

model include using the PAT home visiting framework, a structured HEALTH curriculum focused on nutrition and physical activity, health and developmental screenings, group events that connect families, resource links to community services, individualized goal-setting, and integration within ongoing home visits. Adaptable components for the Nigerian context include adjustments to curriculum content (such as incorporating local foods and cultural norms), utilizing community health extension workers as delivery personnel, and implementing local strategies like a train-the-trainer approach and the use of tablets with the curriculum pre-loaded. In a study conducted in the United States, the integration of HEALTH into the existing PAT model demonstrated a -2.8 kg between-group difference in body weight at 12 months among mothers with overweight or obesity and a preschool child compared with standard PAT implementation. HEALTH emphasized reductions in ultra-processed food intake, sedentary time, and increased physical activity [11]. Data on HEALTH also show effects on postpartum weight loss, which informed our sample size and power calculation [12].

In the context of Nigeria, rapid urbanization exacerbates the double burden, where undernutrition and overnutrition coexist within the same population [13, 14]. Vulnerable groups, such as children and pregnant women, who lack access to affordable, nutritious food and spaces for physical activity, are also increasingly exposed to processed foods and sedentary lifestyles [13, 14]. Moreover, there is a rising consumption of ultra-processed foods in infant and young child feeding, with nearly 55% of children aged 6 to 24 months eating ultra-processed starchy foods and a general trend toward ultra-processed foods among younger generations. [15, 16]. Therefore, there is an opportunity to adapt an evidence-based home visiting program to meet contextually relevant needs among pregnant women with obesity and their infants in Nigeria. The Enhancing Intergenerational HeAlth in Nigeria: Peripartum as Critical Life StagE for CardioVascular Health (ENHANCE CVH) trial will test the effect of an adapted PAT+HEALTH intervention delivered by community health extension workers (CHEWs) to promote healthy maternal weight at 18 months postpartum using a cluster randomized (1:1) trial design in the Federal Capital Territory, Nigeria ($n=40$ clusters, $n=1000$ mother-child dyads). The formative phase of the ENHANCE CVH trial aims to identify the necessary adaptations to effectively deliver the PAT+HEALTH curriculum, promoting healthy gestational weight gain and postpartum weight management among pregnant women with obesity and their infants in Nigeria. Based on the outcomes of this

pre-implementation phase, an adapted PAT+HEALTH intervention will be integrated and tested in the Nigerian primary healthcare context to evaluate its effectiveness, implementation, and promote sustainability.

Using the updated Consolidated Framework for Implementation Research (CFIR 2.0) [17, 18], we present pre-implementation qualitative findings on stakeholder-identified contextual factors relevant to adapting and implementing the PAT+HEALTH intervention in the Federal Capital Territory, Nigeria. An implementation determinant framework with an outcomes addendum, the CFIR 2.0, is most useful for identifying contextual determinants of implementation (i.e., barriers and facilitators) that may impact implementation outcomes [18]. This paper demonstrates how we applied CFIR 2.0 to develop interview questions and assess the perspectives of multiple constituent groups in the ENHANCE CVH trial. More importantly, we report on the CFIR 2.0 identified determinants that implementation stakeholders highlighted as potential influencers for adapting and implementing the intervention in Nigeria.

Methods

Design and setting

For the qualitative study, recruitment, consenting, and interviews took place in the Federal Capital Territory of Nigeria, either in person at primary health clinics or virtually. All participants were approached through existing contacts, networks, and at local primary health clinics using purposive sampling to gather a diverse range of perspectives. Specifically, parents were approached while attending primary health clinic appointments by interviewers who were briefed about the study and selected based on their willingness, availability, and accessibility. The in-depth interviews (IDIs) and focus group discussions (FGDs) were conducted simultaneously, with separate groups of participants. IDIs involved key informants such as policymakers, CHEWs, health educators, and healthcare supervisors who are highly engaged. FGDs primarily included mothers and fathers, but if a parent found it easier to engage in an IDI, that was also offered. These complementary methods improved the efficiency of data collection.

The interviewers included experienced research dietitians, nutritionists, and public health professionals who were appropriately trained about PAT+HEALTH. Additionally, they received a series of training sessions on the original intervention, study protocols, and procedures for conducting IDIs and FGDs. Interviewers also provided CHEWs, health educators, policymakers, and healthcare supervisors with an explanation of the original model during the interviews, offering participants an

opportunity to consider ways to adapt and implement the intervention in Nigeria.

All interview guides were informed by CFIR 2.0, and the various stakeholder groups were assigned different guides [18] (Additional files 1 through 4). CFIR 2.0 comprises 48 constructs and 19 subconstructs across five domains, which help capture the salient themes of intervention implementation [18]. Across the interview guides, questions included constructs such as local attitudes, acceptability, and tailoring strategies for adapting and implementing the HEALTH intervention, which embeds healthy eating and activity content within the PAT curriculum and is based on health behavior theories [19]. Participants consented, and the study was approved by the Institutional Review Boards at Washington University in St. Louis and the University of Abuja Teaching Hospital.

Data collection

From May to June 2023, 43 in-depth interviews were conducted with 11 parents, 15 CHEWs and health educators, and 17 policymakers (i.e., administrative officers for budget and planning, directors of nutrition and food safety divisions) and healthcare supervisors (i.e., chief nursing officers, directors of primary healthcare clinics) in the Federal Capital Territory of Nigeria. Additionally, nine FGDs were conducted with 75 participants, ranging in size from six to ten participants. Eligibility criteria included being older than 18 years and being a member of the stakeholder groups (i.e., mothers, fathers, community health extension workers, healthcare supervisors, administrators, and policymakers). A combination of purposive and snowball sampling was used to achieve thematic saturation.

Data analysis

All recordings of completed IDIs and FGDs were de-identified, transcribed, and used to create the codebook. Transcripts were double-coded using Dedoose [20] and reviewed by a third coder, involving a total of nine coders. A framework-guided rapid qualitative analysis approach was employed to code the transcripts of the recorded interviews. This analysis method enables adaptation and responsiveness, thereby capturing the contextual factors that influence intervention implementation more effectively. Consequently, a combination of coding and the theoretical framework of CFIR 2.0 produces a matrix of information that provides a practical snapshot when implementing a time-sensitive intervention and helps determine the final codebook. Both deductive and inductive thematic analyses informed the factors essential

to the PAT+HEALTH intervention among pregnant women in Nigeria and their families.

Results

Participant characteristics

The age range of participants who completed the IDIs and FGDs was 23 to 72 years old, with 69.5% ($n=82$) identifying as female. More than 85% ($n=101$) reported attending or completing university. Approximately 90% ($n=106$) stated they were married, and approximately 90% ($n=107$) reported having gainful employment (Table 1).

Salient CFIR 2.0 themes

During the formative IDIs and FGDs, which took place from May to June 2023, four main CFIR 2.0 themes and five constructs within these themes emerged as crucial components to understanding the adaptation needed for the PAT+HEALTH intervention before implementation. The four CFIR 2.0 themes were: 1) antecedent assessments, 2) implementation process, 3) outer setting, and 4) implementation outcomes. A sample of quotes were abstracted and are available in Table 2.

Table 1 Participant characteristics

Participants Characteristics ($N=118$)	n (%)
Biological sex	
Female	82 (69.5)
Male	36 (30.5)
Age range, years	23—72
Marital Status	
Single	8 (6.8)
Married	106 (89.8)
Divorced/separated	2 (1.7)
Widowed	2 (1.7)
Education	
Primary	3 (2.5)
Secondary	14 (11.9)
Tertiary	101 (85.6)
Religion	
Christianity	89 (75.4)
Islam	28 (23.7)
Traditionalist	1 (0.8)
Occupation	
Employed	90 (76.3)
Farmer	1 (0.8)
Petty Trader	12 (10.2)
Retired	1 (0.8)
Self employed	3 (2.5)
Unemployed	11 (9.3)

Table 2 Key themes established from the formative interviews

CFIR 2.0 Themes and Constructs	Example Quote
<p>Antecedent Assessments</p> <p><i>Acceptability: involved overall thoughts on the principles of the PAT + HEALTH intervention and the home visiting component</i></p>	<p>"Awareness, with proper comprehensive counseling, gives health and reasons; I think they [pregnant mothers] will immediately accept."</p> <p>"I think that [the intervention] would still help because it is not everybody that has the opportunity to come to the hospital. Like some are pregnant but they don't have money to come for antenatal. So, with the help of home visiting, you can still help those that do not have the privilege to come to the hospital; they will also get the information from them [the CHEWs]."</p>
<p>Implementation Process</p> <p><i>Assessing Context: included focus on training for CHEWs and acknowledging financial stress for families</i></p> <p><i>Tailoring Strategies: highlighted the importance of customizing educational content and delivery methods to align with Nigerian families' cultural, socio-economic, and environmental contexts</i></p>	<p>"... [CHEWs] should be able to have competent monitors and supervisors if they do not have them already; they should be able to engage and train the people who are implementing this program."</p> <p>"Some people do not have the money; it's not that they do not know what to do to help their body, but if they want to go to the market to buy [food]; they do not have the money and for other things."</p> <p>"We have to educate the public, create more awareness on using our local available food diversity so that our immunity and also our normal nutritious food will be utilized in the body and prepare the body to its work and also come against any challenges or diseases that will come."</p> <p>"When you are doing the coaching or anything, you should do something more practical. Something that when they see, they will not forget. If you have pictures of us bringing things together. You can use easy things from the community, but it's what is obtainable in their community. What is obtainable? It is the use of information or pictures of those [topical] things to talk to them [parents], so they don't have to think far."</p>
<p>Outer Setting</p> <p><i>Local Attitudes: focused on barriers and facilitators to behavioral change or adopting the intervention's strategies</i></p>	<p>"So some of these things are food taboos, they already believe that they know, and by the time they grow up like that, it's always difficult for them to change..."</p> <p>"...it's always difficult for them to change [the food consumption]...except with serious sensitization and counseling for them to know that it doesn't happen [the impact of food consumption] like that."</p>
<p>Implementation Outcomes</p> <p><i>Sustainability: considered the importance of engagement from social support networks and the potential for economic pressures that may impede families to continue the intervention</i></p>	<p>"Health education and probably social mobilization will go a long way."</p> <p>"...one of the obstacles again could be, shall I say, financial constraints; yeah, financial constraints because, like we earlier said, education... that they should be educated on what they eat. They should eat good food; they should eat nutritious food, and by the time she goes to primary health care to access the facility or the services, she is advised to go and eat good food and all that. She has the knowledge that she's supposed to eat this, but she doesn't have the finance, so how does she get it?"</p>

Antecedent assessment: acceptability of PAT + HEALTH

The overall acceptability of the intervention emerged, particularly as it pertained to the use of home visits by CHEWs for pregnant mothers with CVH needs. As part of PAT + HEALTH, CHEWs will offer continuous care during and after pregnancy, tailor the intervention to individuals' needs, and ensure regular monitoring and support to improve health outcomes for pregnant mothers and their children. Interviewees positively viewed these areas of support by CHEWs. One policy-maker stated, "Awareness, with proper comprehensive counseling, gives health and reasons; I think they [pregnant mothers] will immediately accept."

Additionally, interviewees noted the importance of accessibility that the home visits promote by meeting pregnant women at their point of need for antenatal care. One parent stated, "I think that [the intervention] would still help because it is not everybody that has the opportunity to come to the hospital. Like some are pregnant but they don't have money to come for antenatal. So, with the help of home visiting, you can still help those that do not have the privilege to come to the hospital; they will also get the information from them [the CHEWs]."

On the other hand, some parents discussed overall concern about feeling safe to bring the intervention into the home, with one parent stating, "Considering the nature of the country. You don't know who [is

who] for safety reasons.” This suggests the importance of having strong ties and trust with CHEWs and researchers with community members, having an open dialogue about the intervention and its intended purpose, and discussing alternate avenues from home visits when needed.

The routine role of CHEWs in providing crucial health education, which enables pregnant women to make informed decisions about their health, was seen as an acceptable component of the intervention. Interview responses generally noted that trust and open communication fostered through regular interactions create a supportive network and learning environment for pregnant women. For example, one CHEW stated, “*The women’s standard of living will improve by the introduction of the program. They will be well enlightened to know their health status, you understand. You know that some women don’t even know their health status. But as you explain through this program, it will help them very well.*”

Implementation process: assessing context

Within this construct, policymakers and healthcare supervisors focused on contextual factors to make the PAT + HEALTH intervention more feasible locally. Areas of consideration included raising public awareness campaigns among communities, training and having suitable healthcare supervisors to support the CHEWs in delivering the intervention, and recognizing the impact of financial stress within families. One healthcare supervisor noted, “*... [CHEWs] should be able to have competent monitors and supervisors if they do not have them already; they should be able to engage and train the people who are implementing this program.*” Additionally, recognizing the financial barriers of families was a highlighted topic among CHEWs, with one stating, “*Some people do not have the money; it’s not that they do not know what to do to help their body, but if they want to go to the market to buy [food]; they do not have the money and for other things.*” Further considerations should be given to families to engage in the intervention in a way that does not increase the financial burden.

Implementation process: tailoring strategies

Another theme from the interviewees related to customizing educational content and delivery methods to align with Nigerian families’ cultural, socio-economic, and environmental contexts. Specifically, CHEWs highlighted the importance of cultural meals and ways to consider adapting them for the HEALTH intervention. One CHEW stated, “*We have to educate the public, create more awareness on using our local available food diversity so that our immunity and also our normal nutritious food will be utilized in the body and prepare the body*

to its work and also come against any challenges or diseases that will come.” Additional strategies to adapt the PAT + HEALTH intervention include materials distributed to various participant needs and accessibility efforts, ranging from language to literacy. One parent stated, “*When you are doing the coaching or anything, you should do something more practical. Something that when they see, they will not forget. If you have pictures of us bringing things together. You can use easy things from the community, but it’s what is obtainable in their community. What is obtainable? It is the use of information or pictures of those [topical] things to talk to them [parents], so they don’t have to think far.*”

Furthermore, for CHEWs, engagement in the antenatal stage is a critical point of contact with pregnant mothers, and they felt that at this intersection of connection, there is an opportunity to encourage fathers to learn more about pregnancy and practices that benefit the mother and child. One CHEW stated, “*...involving religious leaders, traditional leaders, community leaders, the husbands, in fact, encouraging men involvement in antenatal sessions, so that they will know the reasons [for care].*” For the CHEWs, the engagement at the point of antenatal care also offers the opportunity to integrate the intervention within antenatal care services and can help support general acceptability for better implementation.

Outer setting: local attitudes towards health behaviors

For policymakers and CHEWs, local attitudes were a common thematic construct considered both a barrier and facilitator to behavioral change or adopting the intervention’s strategies. Respondents’ comments drew on sociocultural factors such as food taboos that may hinder heart-healthy behavioral changes, such as salt and seasoning practices, unhealthy fats, and oils. A CHEW interviewee noted, “*So some of these things are food taboos, they already believe that they know, and by the time they grow up like that, it’s always difficult for them to change...*” One health educator stated that awareness and lifestyle changes would be optimal facilitators to address this challenge: “*...it’s always difficult for them to change [the food consumption]...except with serious sensitization and counseling for them to know that [the impact of food consumption] doesn’t happen like that.*”

Policymakers and healthcare supervisors similarly spoke on the cultural attitudes of pregnant women, which may limit intervention adoption and acceptability. One participant detailed, “*And then the attitude of some pregnant women. Some, like most of these things, I can say it’s culture that causes it. Like for example, in the North, the very far North, some people believe that it is God that gives [a woman] pregnancy, or it is God that will deliver them. So, some of them [pregnant mothers] might not like*

to go to the hospital. So, I think these are some things that are [about] culture.” A health educator also stated, “There is some protein or meat that they believe that when a woman eats it, the woman will not be able to deliver. The way they serve their husbands, who are always given the highest portion of the food and the richest [food portions]. The woman will cook and pack the meat for the husband and the better portion of the food.”

Implementation outcome: planning for sustainability

The issue of sustainability of the PAT + HEALTH intervention came up directly and indirectly from all interviewees. Policymakers and healthcare supervisors mentioned sustaining the intervention would rely on engagement practices such as having social support from community and government entities, with one policymaker stating, “I think to me, you’ll not always be there at the home. So, there’s need for, maybe, can we say a focal person at the home level now, to be taught well, so that he’ll be the one to carry on with the teaching, after [the program period]...”. Another healthcare supervisor mentioned the importance of health education as being essential for additional engagement to sustain the intervention: “Health education and probably social mobilization will go a long way.” An effort to address this area of engagement, the program will have CHEWs completing home visits for pregnant women before and after birth to increase structure and dose around structures that already exist (e.g., health education, community support, government intervention).

CHEWs also mentioned that maintaining the intervention may become challenging without addressing families’ economic pressures. Families with limited resources may need help prioritizing health practices, particularly with competing basic needs such as food access, shelter, and education expenses. A one CHEW noted, “... one of the obstacles again could be, shall I say, financial constraints; yeah, financial constraints because, like we earlier said, education...that they should be educated on what they eat. They should eat good food; they should eat nutritious food, and by the time she goes to primary health care to access the facility or the services, she is advised to go and eat good food and all that. She has the knowledge that she’s supposed to eat this, but she doesn’t have the finance, so how does she get it?” Interviewees across the groups identified the importance of family support and health education as key engagement strategies for sustainability. Integrating financial sustainability options (e.g., food subsidies) was also noted as essential for encouraging families to consistently participate in and maintain health interventions over the long term.

Discussion

Guided by CFIR 2.0, we identified critical areas for adaptation of the PAT + HEALTH intervention to support healthy gestational weight gain and postpartum weight management among pregnant women with obesity and their infants in Nigeria. Through IDIs and FGDs with key groups such as parents, policymakers, healthcare supervisors, and CHEWs, our qualitative analysis identified implementation factors to consider when adapting an evidence-based intervention, such as the PAT + HEALTH intervention, into an LMIC setting for maternal and child health. Four key CFIR 2.0 themes were found to be most relevant to adapting the PAT + HEALTH intervention: 1) antecedent assessments, 2) implementation process, 3) outer setting, and 4) implementation outcomes. Furthermore, interview responses also highlighted salient constructs for the four themes that should be considered when adapting and implementing the intervention. Specifically, acceptability, assessing context, tailoring strategies, local attitudes, and sustainability were identified as notable constructs of consideration for adapting the intervention.

A key finding across the IDIs and FGDs was the acceptability of home visits to deliver care, particularly in the context of CHEWs completing these visits. Home-based visits providing personalized and continuous support were considered a highly acceptable approach to improving maternal and child health outcomes. This finding aligns with a cluster randomized controlled trial that also completed a formative phase, for which they found that home visits improve maternal outcomes among pregnant women in Nigeria [21, 22]; specifically, in the reduction of problems with hypertension and postpartum sepsis. Moreover, PAT structures its curriculum to meet families where they are; therefore, visit locations are decided by the family themselves [23]. Interviewees noted that not all women, especially those with limited financial resources, can easily access healthcare facilities. Thus, home visits could bridge the gap for those without hospital access. Part of the implementation will include CHEWs working in pairs, providing various points of contact and opportunities for participants involved in the intervention to feel comfortable participating.

Policymakers and healthcare supervisors emphasized the need to raise community awareness, especially in hard-to-reach areas (i.e., geographically remote with limited mobile telephone services). However, interview participants noted several barriers to intervention implementation. One in particular, the financial barrier, was identified as a challenge that could limit the feasibility of the PAT + HEALTH intervention. Interviewees stated that many families, particularly those from lower socioeconomic backgrounds, face difficulties in affording

nutritious food or accessing healthcare, which may hinder their ability to engage fully with the PAT + HEALTH intervention, given competing priorities. Other studies have also identified financial constraints as a challenge to accessing antenatal care for pregnant women in Nigeria [24, 25]. Udenigwe and colleagues surveyed the views of policymakers and healthcare workers, and they noted that despite the introduction of policy initiatives instituted by the Nigerian government to remove user fees for pregnant women, general financial challenges faced by pregnant women often led to their inability to access the necessary antenatal care [25]. However, The *Lancet* Nigeria Commission highlighted the importance of addressing maternal and child health by identifying previously successful, large-scale programs and providing estimates on how to invest in healthcare infrastructure that could save millions of maternal and neonatal lives over the next decade [6].

Interview responses also emphasized the importance of tailoring the PAT + HEALTH intervention to Nigerian families' cultural, socio-economic, and environmental contexts as a cornerstone to successful adaptation, adoption, and implementation. Specifically, CHEWs stressed the importance of using culturally relevant materials and approaches, such as promoting local, nutritious foods that are readily accessible. By leveraging culturally accepted dietary practices, the intervention can help mothers and families make healthier choices while respecting traditional beliefs and practices. Some communities may view certain dietary practices or healthcare interventions with uncertainty, underscoring the need for ongoing education to engage in conversations with community members [26].

In addition, the research study highlighted the need for accessible and practical educational tools, such as visual aids and messaging, that align with local literacy levels. This reinforces the importance of tailoring health education delivery to the community's needs, ensuring that information is relatable and actionable. Moreover, the interviewees recommended encouraging male involvement in antenatal care sessions and involving community leaders as a potentially helpful avenue for additional support for a newly introduced heart-healthy intervention. A previous study also highlighted the need to explore community participatory strategies to enhance male participation and improve the uptake of maternal health services and practices by pregnant women in Nigeria [27].

Strengths and limitations

The study has numerous strengths, including a robust qualitative design, effective recruitment and engagement, and thorough analysis. With an emphasis on applying an implementation science framework to guide both

the interviews and analyses, many diverse participants were involved in IDIs and FGDs. However, there are also limitations to consider. There can be challenges in “boxing” themes based on potential overlap across some constructs. Additionally, the sampling of interviewees based on their workplace or region may only partially represent the locations where the ENHANCE CVH trial will take place; nonetheless, concerted efforts were made to include as many voices as possible in this phase. Additionally, those invited to participate in the IDIs or FGDs may not have fully disclosed their opinions regarding the intervention due to natural power dynamics present in research settings, their general comfort level, or a combination of both.

Conclusion

The findings of this study emphasize the importance of adapting the PAT + HEALTH intervention to the specific cultural, social, and economic contexts for pregnant women and their families in Nigeria. The identified implementation determinants will play an integral role as the trial commences in 2025. These insights will inform the intervention's adaptation, implementation, and evaluation, contributing to the broader understanding of implementing maternal cardiovascular health interventions more effectively in Nigeria and beyond. To ensure successful implementation and sustainability, the intervention must address the financial barriers and cultural beliefs that may limit its reach and effectiveness. By leveraging local support systems, fostering trust, and integrating financial support measures, the PAT + HEALTH intervention has the potential to achieve long-term success in improving the health of pregnant women and their children in Nigeria.

Abbreviations

CVH	Cardiovascular health
NCDS	Noncommunicable diseases
PAT + HEALTH	Parents as Teachers and Healthy Eating Active Living Taught at Home
CHEW	Community health extension worker
IDI	In-depth interview
FGD	Focus group discussion
CFIR 2.0	Consolidated Framework for Implementation Research 2.0
HELLP	Hemolysis, Elevated Liver enzymes, and Low Platelets
HDP	Hypertensive disorders of pregnancy
ENHANCE-CVH	Enhancing Intergenerational HeAlth in Nigeria: Peripartum as Critical Life StagE for CardioVascular Health

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s43058-025-00816-8>.

- Supplementary Material 1.
- Supplementary Material 2.
- Supplementary Material 3.
- Supplementary Material 4.

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Authors' contributions

DBO, MDH, and GA conceived the idea for this study. DBO, MFH, and VDR obtained funding. CEO oversaw the data collection. DBO, MDH, TM, AK, VDR, and DHJ provided institutional knowledge and support. JDL, AA, CN, NRR, GLS, EO, UCN, KAO, NO, and COU completed the data analysis. JDL, AA, and CN wrote the first draft of the manuscript with substantial revisions from NRR, GLS, EO, UCN, KAO, NO, COU, TM, AK, KL, GA, MDH, and DBO. CN and CEO led the project administration. The authors approved this final manuscript.

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Data availability

De-identified datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Washington University in St. Louis and the University of Abuja Teaching Hospitals' applicable institutional review boards and ethics committees. Prior to data collection, written informed consent was obtained from the study patients and providers.

Consent for publication

All authors have reviewed and approved the final version of the manuscript and consent to its submission and publication.

Competing interests

MDH has received travel support from the World Heart Federation and consulting fees from PwC Switzerland. MDH has an appointment at The George Institute for Global Health, which has a patent, license, and has received investment funding with intent to commercialize fixed-dose combination therapy through its social enterprise business, George Medicines. MDH has pending patents for heart failure polypills. The other authors declare that they have no competing interests.

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