

RESEARCH

Open Access



A stakeholder engagement method to inform adaptation of a multicomponent hypertension control program in Ghana: A mixed methods study

Olutobi A. Sanuade^{1,2,3*}, Leonard Baatiema⁴, Irene A. Kretchy⁵, Alicia N. Velazquez³, Okpawura Yaw W. Kpolar⁴, Olamide C. Ogundare³, Fridaus A. Samed⁴, Richard P. Yalley⁴, Allison J. Carroll⁶ and Justin D. Smith³

Abstract

Background Hypertension prevalence in Ghana is high, yet diagnosis, treatment, and control rates remain low. The Kaiser Permanente hypertension control program (“Kaiser bundle”) has demonstrated success in high-income settings and has been implemented in some low-resource contexts but not in Ghana. This study describes a community-engaged, mixed-methods process to plan the equitable implementation of the Kaiser bundle for hypertension control in Ghanaian primary healthcare centers (PHCs).

Methods We conducted five iterative workgroup meetings over 9 months with 46 participants, including 15 adults with hypertension, 16 healthcare providers, 6 policymakers, and 9 community leaders and Civil Society Organization representatives. Using semi-structured discussions, human-centered design activities, and surveys. Workgroup transcripts were analyzed using framework-guided rapid turnaround qualitative analysis, applying the Consolidated Framework for Implementation Research and the Expert Recommendations for Implementing Change compilation, and the to identify determinants and generate and specify strategies. Survey ratings informed prioritization of strategies. The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework was applied to define and organize implementation outcomes, while the Implementation Research Logic Model (IRLM) was used to organize the determinants/strategies and link them to hypothesized mechanisms and outcomes.

Results The Stakeholder groups identified 45 implementation determinants across individual, organizational, and community levels, with barriers such as limited access to care, provider shortages, fragmented health systems, and financial constraints, while facilitators included community partnerships and existing BP screening initiatives. Based on these determinants, the stakeholder groups co-developed 29 discrete implementation strategies targeting the Kaiser bundle components. Strategies emphasized infrastructure strengthening, provider training, community engagement, telemedicine integration, and culturally responsive approaches. The finalized IRLM mapped and linked determinants, strategies, mechanisms, and anticipated outcomes, providing a transparent and equity-focused implementation plan.

Conclusions Combining community engagement with established implementation science frameworks enabled the development of an implementation plan for adapting the Kaiser bundle in Ghana. This approach offers

*Correspondence:
Olutobi A. Sanuade
oasanuad@central.uh.edu
Full list of author information is available at the end of the article



© The Author(s) 2026. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

a replicable model for planning and reporting implementation efforts in low-resource settings and highlights the importance of equity-focused strategies for improving hypertension outcomes.

Keywords Community engagement, Implementation science, Hypertension control, Kaiser bundle, Primary healthcare, Low-resource settings

Contributions to the literature

- Implementation planning for evidence-based interventions in low-resource settings often lacks structured approaches that integrate community engagement with theory-driven frameworks.
- Combining community engagement with multiple implementation science frameworks can produce an equity-focused adaptation process for the Kaiser Permanente Hypertension Control Program.
- This study illustrates the practical use of the Implementation Research Logic Model (IRLM) to organize determinants, strategies, mechanisms and outcomes with community stakeholder groups.
- Findings contribute to understanding how diverse community stakeholder group input can strengthen implementation planning for chronic disease interventions in global health contexts.

Background

Hypertension is a leading modifiable risk factor for cardiovascular disease (CVD) morbidity and mortality, affecting ~1.4 billion people globally, of whom over 75% residing in low- and middle-income countries (LMICs) [1]. In Ghana, a systematic review estimated the pooled hypertension prevalence among adults at 27%, yet rates of diagnosis (35%), treatment (22%), and control (6%) remain low [2], reflecting major gaps in the hypertension care cascade. While Ghana has committed to reducing pre-mature mortality from non-communicable diseases (NCDs) by one-third by 2030, achieving this goal will require significant improvements in blood pressure (BP) control [3]. To meet BP control targets, national policies need to prioritize large-scale implementation of evidence-based interventions for hypertension prevention and control [4].

Several evidence-based interventions have demonstrated effectiveness in improving BP control, including team-based care [5], task-shifting to non-physician health workers [6], standardized treatment protocols such as the WHO HEARTS package [7], and community-based BP screening with linkage-to-care [8]. One of the most successful multicomponent interventions is the Kaiser Permanente hypertension control program, which achieved an increase in BP control rates from 44 to 80% between

2001 and 2009 using a multi-level bundle [9]. The KPNC bundle (“Kaiser bundle”) includes five core components: (1) hypertension patient registries, (2) clinical performance feedback reports, (3) standardized evidence-based treatment protocols, (4) medical assistant–led BP follow-up visits under supervision, and (5) promotion of single-pill combination therapy. The Kaiser bundle has not been tested or adapted for use in Ghana.

Implementation research has shown that even the most effective interventions often fail to reach populations that need them the most due to systemic health infrastructure gaps and socio-economic disadvantages that limit equitable application across settings [10]. This inequity is exacerbated when implementation strategies are designed without input from relevant clinical or community partners [11]. Community engagement throughout all phases—from pre-implementation through implementation and sustainment—is essential for identifying context-specific barriers, facilitators and strategies, while also fostering trust, supporting adoption, and promoting sustainment of an intervention [12, 13]. Thus, engaging diverse stakeholder groups in Ghana can enhance the adaptation of the Kaiser bundle implementation efforts by aligning strategies with local needs and capacities.

This study presents a community-engaged approach to planning the implementation of the Kaiser bundle in primary healthcare centers (PHCs) in Ghana. Using a method that includes a modified Delphi process and user-centered design methods, coupled with the Implementation Research Logic Model (IRLM) [14], that has previously been used in U.S. settings [15, 16], we worked with healthcare providers, policymakers, community leaders and Civil Society Organizations (CSOs), and adults with hypertension to identify contextual determinants, co-develop and specify implementation strategies, and organize these to plan for the implementation of the Kaiser bundle. This case example illustrates how integrating multi-level, diverse perspectives can support equitable, context-sensitive implementation planning in global health settings [17].

Methods

Study design

This implementation planning study used a mixed-methods, community-engaged approach, previously used in

two studies [15, 16]. The design integrated qualitative and quantitative components to identify determinants, generate and specify implementation strategies, and develop an IRLM for adapting the Kaiser hypertension control bundle to Ghanaian PHCs. The study was embedded within existing community and health system structures and leveraged partnerships with CSOs, the Ghana Health Service, Ministry of Health, and a local academic institution (University of Ghana) to ensure contextual relevance and potential for future implementation and scale-up. This manuscript follows the Standards for Reporting Qualitative Research (SRQR) [18] to ensure comprehensive and transparent reporting of our methods and findings (Supplemental Table 1).

Conceptual frameworks

This study was guided by four complementary implementation science models/frameworks. The Consolidated Framework for Implementation Research (CFIR) Version 2.0 [19] was used to identify multi-level determinants of implementation across individual, organizational, and system contexts. The Expert Recommendations for Implementing Change (ERIC) [20] compilation informed the generation and categorization of implementation strategies. The Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework [21–23] was applied to define and organize implementation outcomes, ensuring a comprehensive plan for evaluating reach, effectiveness, adoption, implementation, and maintenance. The IRLM [14] provided a structured approach for mapping strategies to determinants, hypothesized mechanisms, and targeted outcomes.

Setting and participants

This study was conducted in Ghana, a lower-middle-income country in West Africa with an increasing burden of NCDs, particularly hypertension and CVD [24]. The health system in Ghana is structured around a three-tiered delivery model comprising primary, secondary, and tertiary care, with primary health care serving as the first point of contact for most patients [25]. Ghana Health Service is the largest public health care service delivery agency in the country [24]. Community engagement occurred in Greater Accra Region, across urban (Madina) and peri-urban (Amasaman and Ashaiman) settings, reflecting diverse health system contexts and community experiences. Each community included a PHC facility integrated within the Ghana Health Service network. Despite national commitments to strengthen NCD prevention and control, challenges such as workforce shortages, fragmented referral systems, and financial barriers

persist, making these settings representative of broader implementation challenges in Ghana [26, 27].

The implementation planning activities for this study were conducted in collaboration with four groups of stakeholders representing different key sectors. These included (1) healthcare providers such as medical doctors, pharmacists, nurses, (2) adults with hypertension, (3) community leaders and CSO representatives (i.e., non-governmental groups that advocate for community interests, provide education, and mobilize resources to support public health initiatives), and (4) policymakers at the national and district levels.

Participants were recruited through established institutional and community channels. We initiated contact with the PHC leadership in the three participating communities through the Ghana Health Service, and the PHC leadership facilitated identification of eligible healthcare providers. Community leaders and CSO representatives were identified through prior collaborations with the study team. Adults with hypertension were identified with support from community leaders in each community and coordinated by trained research assistants.

Recruitment was purposive and role-based to ensure representation across key stakeholder groups relevant to hypertension care and implementation planning. Target numbers for each stakeholder group were established in advance to support balanced representation and manageable group discussions. Invitations were extended in person at PHCs or via phone by trained research assistants, who explained the study purpose, participation expectations, and meeting logistics. All participants were aged 18 years or older and provided informed consent.

Community engagement process

We conducted five iterative workgroup meetings with the stakeholder groups (Table 1) using semi-structured discussions, human-centered design activities, and rating surveys. All meetings were held separately by stakeholder group, except for Meeting 4, which was a combined in-person meeting involving all the participants. Meetings were conducted either in person at the University of Ghana or virtually via video conferencing. Meetings 1–3 and 5 lasted approximately 2 h and were held in person, except for Meeting 3 with healthcare providers, which was conducted via video conferencing. Meeting 4 was held in person and lasted 5 h. In total, all stakeholder groups were engaged for approximately 13 h. All sessions were audio-recorded to support transcription and analysis. Semi-structured guides used to facilitate these sessions are provided in Supplemental Table 2, and detailed

Table 1 Overview of workgroup meetings and research team activities

Procedure	Health care professionals	Community and CSO leaders	Policymakers	Adults with hypertension
Meeting 1	Introduction to the Kaiser bundle and identification of multi-level barriers and facilitators related to the Kaiser bundle components	Introduction to the Kaiser bundle and identification of multi-level barriers and facilitators related to the Kaiser bundle components	Introduction to the Kaiser bundle and identification of multi-level barriers and facilitators related to the Kaiser bundle components	Introduction to the Kaiser bundle and identification of multi-level barriers and facilitators related to the Kaiser bundle components
Meeting 2	Workflow analysis of clinic visits and identification of strategies for addressing barriers and facilitators for the Kaiser bundle components	Identification of strategies for addressing barriers and facilitators for the Kaiser bundle components	Identification of strategies for addressing barriers and facilitators for the Kaiser bundle components	Identification of strategies for addressing barriers and facilitators for the Kaiser bundle components
<i>Matrix Development</i>	<i>(1) Determinants X Strategies</i>			
Meeting 3	Determinant-Strategy Linkages	Determinant-Strategy Linkages	Determinant-Strategy Linkage	Determinant-Strategy Linkages
<i>Strategy optimization</i>	<i>Consolidate, optimize, and group the list of identified barriers and facilitators by collapsing and pruning as conceptually and practically applicable</i>			
Meeting 4	Combined, in-person workgroup meeting to review full list of strategies and conduct specification: Actor, Action, Temporality, Dosage, Health Equity			
Survey	(1) Rate determinants as barriers/facilitators, (2) Rate feasibility and effectiveness of specified strategies, (3) Rank-order specified strategies, and (4) Link strategies to determinants			
<i>Populate IRLM</i>	<i>Link determinants, strategies, hypothesized mechanisms and planned outcomes sections of the IRLM</i>			
Meeting 5	Review and offer final thoughts on the IRLM	Review and offer final thoughts on the IRLM	Review and offer final thoughts on the IRLM	Review and offer final thoughts on the IRLM
<i>Finalize IRLM</i>	<i>Integrate workgroup feedback to finalize the IRLM</i>			

Procedures in italics are research team tasks. Workgroup members were engaged for approximately 13 h over 9 months. IRLM: Implementation Research Logic Model

Table 2 Participants Characteristics

Characteristics	Total (N = 46)	Adults with hypertension (n = 15)	Community leaders/ CSOs (n = 9)	Healthcare Providers (n = 16)	Policymakers (n = 6)
	N (%)	n (%)	n (%)	n (%)	n (%)
Age (<i>mean, SD</i>)	44.0 (12.9)	56.7 (11.6)	41.7 (12.0)	34.6 (5.9)	41.2 (3.0)
Sex					
Female	30 (65.2)	13 (86.7)	1 (11.1)	13 (81.2)	3 (50.0)
Male	16 (34.8)	2 (13.3)	8 (88.9)	3 (18.8)	3 (50.0)
Education					
< High School	9 (19.6)	9 (60.0)	0 (0.0)	0 (0.0)	0 (0.0)
≥ High School	37 (80.4)	6 (40.0)	9 (100.0)	16 (100.0)	6 (100.0)
Marital status					
Single	17 (37.0)	7 (46.7)	4 (44.4)	4 (25.0)	2 (33.3)
Married	29 (63.0)	8 (53.3)	5 (55.6)	12 (75.0)	4 (66.7)
Religion					
Christian	43 (93.5)	15 (100.0)	9 (100.0)	15 (93.8)	4 (66.7)
Islam	3 (6.5)	0 (0.0)	0 (0.0)	1 (6.3)	2 (33.3)
Community^a					
Amasaman	15 (32.6)	6 (40.0)	2 (22.2)	7 (43.8)	-
Ashaiman	9 (19.6)	4 (26.7)	1 (11.1)	4 (25.0)	-
Madina	16 (34.8)	5 (33.3)	6 (66.7)	5 (31.2)	-

^a This is only for the first three groups since the policymakers were national level representatives

CSO– Civil Society Organization

descriptions of activities conducted in each Meeting are presented below.

Meeting 1: identifying barriers to and facilitators of hypertension care and implementation of the Kaiser bundle

Stakeholder groups were introduced to the project, meeting logistics, and study objectives by reviewing the implementation consent. In their individual workgroups, participants engaged in semi-structured discussions about multi-level contextual factors (i.e., barriers and facilitators) related to implementing the Kaiser bundle (Table 1).

Meeting 2: understanding the context and generating implementation strategies

Stakeholder groups participated in user-centered design sessions tailored to their specific roles. Healthcare providers, for example, were asked to outline their current patient visit workflow and to consider how components of the Kaiser bundle could be integrated into their clinical practice. Additionally, they discussed strategies to overcome the barriers identified in the first meeting. Community and CSO leaders, policymakers and adults with hypertension identified key strategies to address the contextual factors identified in Meeting 1.

Determinant-strategy linkages

Following the strategy generation activities, the research team compiled and refined the proposed strategies. The refined list of strategies was then entered into a matrix linking identified determinants to strategies. The goal was to check whether the selected strategies matched the identified barriers and to identify where coverage was still needed.

Meeting 3: reviewing and confirming determinant-strategy linkages

Each stakeholder group reviewed the determinant–strategy matrix to confirm or refine the definitions of key determinants and strategies, while also assessing the appropriateness of the linkages. New strategies and missing determinants were added where needed. Following the meetings, the research team consolidated the matrix by removing redundancies and ensuring conceptual clarity across domains (Supplemental Table 3).

Meeting 4: specifying the implementation strategies

During the combined, in-person workgroup meeting, participants collaboratively specified each strategy using Proctor et al.'s framework [28]. For each strategy, they identified the actor(s) responsible, the specific actions to be taken, the temporality (timing), and dosage (frequency and intensity) (Supplemental Table 4). This specification

Table 3 Stakeholder groups' ratings of determinants used in logic model

Kaiser bundle Components	Determinants (barriers, facilitators)	Mean (SD)
Hypertension patient registries	Geographic and logistics constraints: distance, work, facility crowding	−0.90 (1.31)
	Shortage of skilled providers for screening	−0.83 (1.25)
	Financial barrier to care and follow-up	−0.78 (1.55)
	Lack of screening logistics at community level	−0.78 (1.49)
	Low hypertension awareness	−0.75 (1.52)
	Staff shortages for screening and registry data entry	−0.69 (1.39)
	Limited government funding for BP screening	−0.69 (1.47)
	Inadequate healthcare provider training	−0.56 (1.34)
	Health system's focus on infectious diseases	−0.56 (1.38)
	Poor provider communication	−0.56 (1.36)
	Socio-cultural beliefs and misinformation about hypertension	−0.56 (1.70)
	Availability of community/church partnerships for BP screening	1.03 (1.48)
Clinical performance feedback reports*	Poor data quality or missing data	−0.74 (1.51)
	Lack of timely feedback on BP control	−0.56 (1.53)
	Infrequent feedback for timely adjustments	−0.56 (1.31)
	Uncoordinated data management systems	−0.52 (1.37)
	Lack of leadership support	−0.48 (1.34)
	BP control report feedback constitutes administrative burden	−0.44 (1.25)
	Lack of performance incentives for healthcare providers	−0.41 (1.39)
	Insufficient training on BP control feedback report	−0.33 (1.54)
	Poor integration into clinic workflow	−0.30 (1.23)
	Limited availability of recommended medications	−0.70 (1.27)
	Not enough time during visits for protocol steps	−0.70 (1.46)
	Fragmented health systems coordination/poor care coordination	−0.67 (1.44)
Standardized evidence-based treatment protocols*	Protocols are too complex or unfriendly	−0.56 (1.22)
	Provider resistance to standardized protocols	−0.52 (1.37)
	Inconsistent BP measurement practices	−0.52 (1.34)
	Inadequate supervision and accountability	−0.44 (1.40)
	Low provider awareness or training on guidelines	−0.41 (1.37)
	No extra compensation for CHNs	−0.41 (1.47)
	Poor systems for visit documentation and feedback from supervising clinicians	−0.37 (1.62)
	CHN antihypertensive medication prescribing limitations	−0.37 (1.50)
	Inadequate CHN training or confidence	−0.33 (1.47)
	Poor integration into care workflows	−0.30 (1.38)
	High workload and time constraints	−0.19 (1.49)
	High cost	−0.67 (1.59)
Promotion of single pill combination therapy*	Supply chain constraints	−0.59 (1.47)
	Insufficient systems and infrastructure to enable single-pill combination therapy adoption	−0.48 (1.52)
	Lack of insurance coverage for single pill combination	−0.44 (1.63)
	Limited availability of single pill combination drugs	−0.41 (1.53)
	Misuse or misinterpretation of single pill combination use	−0.41 (1.37)
	Low demand for some single pill combinations	−0.41 (1.45)
	Combining drug classes complicates prescribing decisions	−0.41 (1.34)
	Risk of side effects and interactions from combining multiple ingredients in one pill	−0.37 (1.42)
	Limited provider understanding of how single-pill combination medications works	−0.22 (1.25)
	Increased provider workload when prescribing single pill combination medications	−0.04 (1.18)
	Patients may abandon other medications if single pill is introduced	−0.04 (1.26)

BP– Blood Pressure; CHN– Community Health Nurses. The scores range from −2 to +2; *Only healthcare providers and policymakers were included in analyses

Table 4 Stakeholder groups' ratings of strategy effectiveness, feasibility and priority

Kaiser Bundle	Discrete Strategy	Feasibility Mean (SD)	Effectiveness Mean (SD)	Priority Mean (SD)
Hypertension patient registries	Support clinicians with staffing and training	3.44 (0.81)	3.44 (0.81)	3.47 (0.70)
	Strengthen provider training programs	3.47 (0.74)	3.44 (0.73)	3.36 (0.87)
	Fund provider recruitment and retention	3.36 (0.72)	3.19 (0.79)	3.39 (0.69)
	Strengthen community-based blood pressure screening	3.33 (0.86)	3.44 (0.73)	3.19 (0.92)
	Provide routine blood pressure screening at the PHC	3.36 (0.96)	3.13 (0.96)	3.11 (1.01)
	Expand CHPS compound and PHCs	3.25 (0.87)	3.33 (0.79)	3.17 (0.91)
	Redistribute care responsibilities	3.28 (0.81)	3.19 (0.79)	3.17 (0.88)
	Use telemedicine for remote care	3.27 (0.81)	3.17 (0.85)	3.17 (0.94)
	Integrate traditional healers into the formal health system	3.11 (0.85)	2.94 (0.95)	2.94 (0.98)
Clinical performance feedback reports*	Align feedback with clinic workflows	2.87 (0.35)	2.82 (0.39)	2.65 (0.49)
	Integrate BP feedback into leadership	2.67 (0.49)	2.80 (0.41)	2.81 (0.40)
	Enhance blood pressure control report via automation	2.64 (0.50)	2.63 (0.50)	2.59 (0.51)
	Review BP report in clinic staff meetings	2.57 (0.51)	2.60 (0.51)	2.57 (0.51)
Standardized evidence-based treatment protocols*	Advocate policy for essential hypertension drug coverage	2.87 (0.35)	2.63 (0.50)	2.79 (0.53)
	Foster providers' buy-in via champions	2.81 (0.40)	2.73 (0.46)	2.67 (0.49)
	Optimize clinic workflow through task-shifting	2.69 (0.48)	2.60 (0.51)	2.69 (0.48)
	Enhance adherence through audits, feedback and supervision	2.62 (0.51)	2.79 (0.43)	2.67 (0.49)
	Strengthen protocol adherence via training	2.60 (0.52)	2.78 (0.44)	2.75 (0.45)
	Integrate hypertension care into existing chronic disease and referral systems	2.80 (0.41)	2.64 (0.50)	2.58 (0.51)
	Simplify clinical protocols using flowcharts	2.77 (0.44)	2.63 (0.50)	2.60 (0.51)
	Standardize care with clear protocols	2.54 (0.52)	2.75 (0.45)	2.58 (0.51)
	Streamline workflows by task shifting	2.72 (0.47)	2.75 (0.45)	2.81 (0.40)
Medical assistant-led BP follow-up visits under supervision*	Build CHN capacity through training	2.67 (0.50)	2.83 (0.41)	2.78 (0.44)
	Integrate CHN follow-ups in care	2.83 (0.39)	2.58 (0.51)	2.73 (0.46)
	Incentivize CHN role expansion	2.78 (0.43)	2.69 (0.48)	2.63 (0.50)
	Authorize CHN hypertension medication prescriptions	2.53 (0.52)	2.63 (0.50)	2.63 (0.50)
	Strengthen supply chain coordination	2.71 (0.47)	2.75 (0.44)	2.82 (0.39)
	Expand NHIS coverage and incentivize providers	2.72 (0.46)	2.72 (0.46)	2.72 (0.46)
Promotion of single pill combination therapy*	Promote safe combination therapy use	2.54 (0.52)	2.67 (0.49)	2.50 (0.52)

CHN– Community Health Nurses; CHPS– Community-Based Health Planning and Services; PHC– Primary Healthcare Centers; NHIS– National Health Insurance Scheme. The scores range from 1–4; *Only healthcare providers and policymakers were included in analyses

process allowed all stakeholder groups to collaboratively and equitably contextualize and refine strategies for implementation of the Kaiser bundle in Ghana's PHCs.

Meeting 4 differed from prior meetings in that it was a combined, in-person session involving participants from all stakeholder groups and from each participating community. This meeting was intentionally designed to facilitate cross-community discussion and collaborative refinement of implementation strategies during the specification phase.

Survey of strategy and determinant ratings to inform prioritization and final selection

Following the specification of implementation strategies, participants were invited to complete a structured survey (~35 min) to assess the relative importance and relevance of the identified determinants and strategies. First, respondents rated each determinant on a scale from −2 to +2, where −2 indicated a strong barrier (i.e., strong negative impact on implementation), 0 indicated a neutral impact, and +2 indicated a strong facilitator (i.e., strong positive impact on implementation). Second,

participants rated each implementation strategy across three dimensions: perceived feasibility, effectiveness, and priority for their community or policy context. Each dimension was scored on a 4-point Likert scale (1=low, 4=high), consistent with the ERIC protocol [29–31]. Third, participants rank-ordered the full list of strategies to indicate which they believed should be prioritized for implementation. Thereafter, the research team drafted the IRLM to create a context-specific plan for implementing the Kaiser bundle in Ghana.

Although engagement activities were conducted across three communities, stakeholder groups identified largely shared determinants and strategies across sites. Given the shared PHC structure under the Ghana Health Service, a single IRLM and adapted strategy package were developed while allowing for community-level tailoring during future implementation.

Meeting 5: build consensus on the prioritization of strategy package using IRLM

Meeting 5 was conducted in separate stakeholder workgroups to support role-specific consensus building. During this meeting, the draft IRLM and strategy specifications were presented to each stakeholder group for final review and feedback. Conducting these discussions separately allowed participants to reflect on the proposed implementation plan within the context of their distinct roles and lived experiences, and to openly assess feasibility, acceptability and alignment with their priorities. In contrast to Meeting 4, which emphasized cross-group dialogue, this session focused on confirming stakeholder group-specific alignment and readiness for implementation. Each stakeholder group reviewed the IRLM in its entirety including determinants, strategies, hypothesized mechanisms of action, outcomes, and their own defined roles within the implementation trial. This approach ensured that the finalized IRLM (the basis of the implementation plan) was transparent, aligned with priorities, and had buy-in for implementation of the Kaiser hypertension control bundle, reinforcing commitment to ongoing engagement.

Data analysis

We used a mixed-methods analytic approach guided by implementation science frameworks to analyze the qualitative and quantitative data collected throughout the engagement process. All workgroup meetings were audio-recorded and transcribed verbatim. Transcripts and facilitator notes were analyzed using rapid qualitative analysis techniques [32]. A deductive coding framework based on the updated Consolidated Framework for Implementation Research (CFIR) was applied to identify implementation determinants. Coding was conducted by

five trained members of the research team (WYK, ANV, OCO, FAS and RAY), and discrepancies were resolved through discussion with the lead investigator (OAS). Data from discussions were summarized into analytic matrices by group and mapped to relevant CFIR constructs.

Strategy data were captured using the ERIC compilation (Supplemental Table 5) [20], with each strategy categorized by ERIC domains and constructs. Planned implementation outcomes were pre-determined by the study team using RE-AIM [21], a common practice in implementation science [33]. The IRLM was used to organize and visualize the relationships between identified determinants, selected strategies, hypothesized mechanisms, and planned outcomes. To ensure comprehensiveness, we reviewed prior studies on the adaptation of the Kaiser bundle [34, 35] to identify additional determinants, strategies, mechanisms and RE-AIM outcomes, and we incorporated these into the IRLM. While developing the IRLM, some of the strategies were further thematized to enhance conceptual clarity.

The survey data were analyzed descriptively using Stata® version 18.0 [36]. Mean ratings and standard deviations were calculated for each determinant. We calculated mean scores for each dimension (feasibility, effectiveness, and priority) and rank-ordered strategies based on composite priority scores. For ratings of implementation determinants and strategy feasibility, effectiveness, and priority related to Kaiser bundle internal health system processes—including clinical performance feedback reports, standardized evidence-based treatment protocols, medical assistant-led BP follow-up visits under supervision, and promotion of single-pill combination therapy—only healthcare providers and policymakers were included in the analyses. Adults with hypertension and community leaders/CSOs were excluded from these analyses because these Kaiser bundle components primarily involve internal health system processes.

Results

Participants characteristics

A total of 46 participants were included in the study, comprising 15 adults with hypertension, 9 community leaders and CSO representatives, 16 healthcare providers, and 6 policymakers (Table 2). The average age across all participants was 44.0 years (SD=12.9); adults living with hypertension were the oldest group (mean=56.7 years) and healthcare providers were the youngest (mean=34.6 years). More of the participants were female (65.2%), with most adults with hypertension (86.7%) and healthcare providers (81.2%) identifying as female, while most of the community leaders/CSO representatives (88.9%) were male. Most participants (80.4%) had at least a high school education, although a

high proportion of patients (60.0%) had not completed high school. Over half of the participants were married (63.0%), and the predominant religion was Christianity (93.5%). Adults with hypertension, community leaders/CSO representatives, and healthcare providers distributed across the three communities of Amasaman (32.6%), Ashaiman (19.6%), and Madina (34.8%); policymakers represented national-level stakeholder group.

Identified implementation determinants

Across the five workgroup meetings, a total of 45 determinants were identified across the five components of the Kaiser bundle (Table 3). The mean ratings of determinant strength ranged from -0.90 (moderate barrier) to $+1.03$ (moderate facilitator). Key barriers were present across all components, with the greatest concentration in hypertension patient registries and standardized evidence-based treatment protocols, reflecting provider shortages, limited training, fragmented health systems, and financial constraints. In contrast, supervised medical assistant-led BP follow-up visits and clinical performance feedback reports exhibited comparatively weaker barriers, such as poor workflow integration, incomplete data, and delays in feedback. The promotion of single-pill combination therapy showed mixed ratings, with moderate barriers related to high drug costs and limited availability of formulations in health facilities. The stakeholder groups also identified some facilitators, particularly within the patient registry component, including the availability of community pharmacies offering BP screening, existing BP screening initiatives organized by PHCs and CSOs, and strong community and church partnerships supporting hypertension care.

Selected implementation strategies

The stakeholder groups co-developed 29 discrete implementation strategies across the five Kaiser bundle components (Supplemental Table 4) and rated each for priority, effectiveness, and feasibility (Table 4), with scores ranging from 1–4. Adults with hypertension and community leaders/CSOs only provided ratings for strategies targeting hypertension patient registries while healthcare providers and policymakers provided ratings for all the Kaiser bundle components. Strategies generally emphasized multi-sector collaboration, cultural tailoring, and system-level adaptations to optimize feasibility, fidelity, and sustainability of the Kaiser bundle. Strategies targeting hypertension patient registries received the highest ratings overall; the top priorities included focused on provider training, strengthening community-based BP screening, expanding CHPS compound and PHCs, and strategies to strengthen staffing and recruitment. Strategies focused on clinical performance

feedback reports and standardized evidence-based treatment protocols were rated comparatively lower; the top priorities included aligning BP feedback with clinic workflows, integrating feedback into leadership structures, and strengthening protocol adherence through provider training and supportive supervision. Strategies related to supervised medical assistant-led BP follow-up visits and promotion of single-pill combination therapy received moderate ratings, with task shifting, workflow integration, supply chain coordination, and expanded insurance coverage emerging as top priorities. These ratings informed the final strategy package and its placement within the IRLM, ensuring alignment with stakeholder groups priorities and contextual feasibility.

Finalized implementation research logic model

The final IRLM is shown in Fig. 1. A draft of the IRLM was presented to the workgroups, who then added additional facilitators, recommended a few changes to the strategy specifications, and otherwise confirmed the content for accuracy and completeness.

Discussion

This study demonstrates a structured, community-engaged approach to adapting the Kaiser bundle for hypertension control within Ghana's PHC context. By embedding community engagement within implementation science frameworks, we developed a contextually grounded implementation plan that can lead to greater adoption and sustainability [12, 13], which are critical priorities for low-resource settings. Our findings contribute to global implementation science by offering a practical, equity-focused model for adapting evidence-based interventions to diverse health systems.

Our work advances implementation science in three ways. First, it shows how community engagement can move beyond consultation to become a systematic, theory-informed process for adaptation and implementation planning, using established frameworks [14, 19–23]. Rather than applying frameworks in isolation, we integrated CFIR [19], ERIC [20], RE-AIM [21–23], and the IRLM [14] to ensure coherence across determinants, strategies, mechanisms, and outcomes. This integration provides a replicable structure for planning and reporting implementation efforts and enhances rigor in global implementation research.

Second, this study highlights the importance of adaptation of evidence-based interventions in implementation planning [37, 38]. The determinants identified in our study—such as provider shortages, fragmented health systems, medication supply challenges, and financial barriers—mirror those reported in a qualitative study of adapting the Kaiser bundle and the World

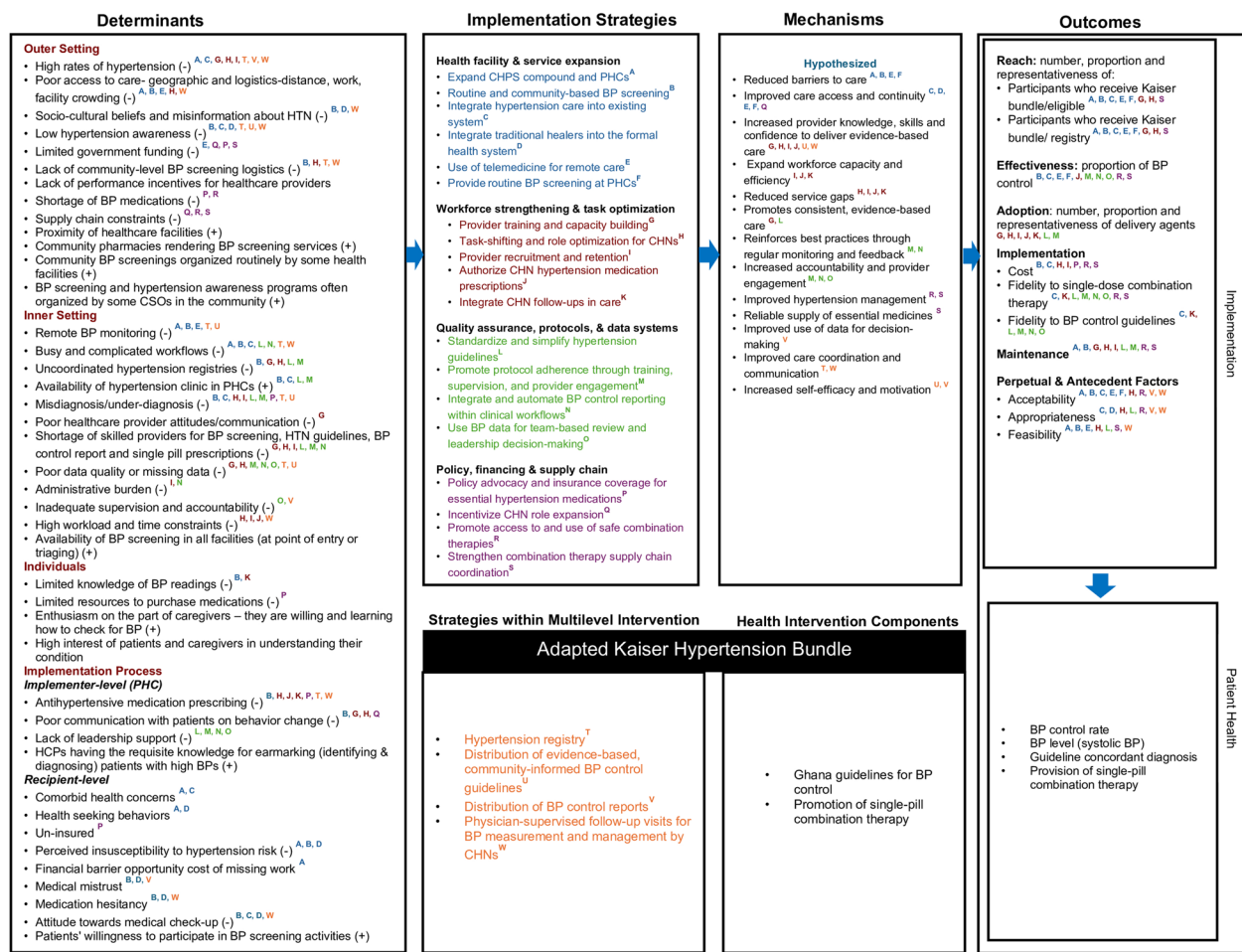


Fig. 1 Implementation Research Logic Model (IRLM) for the Kaiser Bundle multilevel intervention in Ghana

Health Organization's HEARTS technical package in Nigerian PHCs [34], where similar structural constraints hindered hypertension control and adoption of the Kaiser bundle. This cross-context consistency suggests that these barriers reflect systemic challenges across LMICs, reinforcing the need for strategies that address health system gaps rather than isolated site-level issues.

Informed by these determinants, our strategy package emphasized intersectoral collaboration, cultural responsiveness, and system-level changes needed to enhance implementation success of the Kaiser bundle in Ghana [39–42]. Notably, prioritized strategies such as workforce training and supervision, strengthening patient registries, task-shifting to non-physician health workers, and leveraging community networks, align with recommendations from the Nigeria study [34], which highlighted reliable drug supply, robust information systems to track patients and medication supply chain, and community engagement as critical enablers of implementation

success. This convergence reinforces the relevance of our strategy package and signals opportunities for harmonizing implementation strategies across similar settings to advance equity-focused hypertension care globally [43].

Finally, specifying strategies based on stakeholder group ratings of feasibility, effectiveness, and priority adds rigor to the adaptation process. Clear specifications of actors, actions, temporality and dosage promote replicability and provide a foundation for testing mechanisms of action [28, 33, 44, 45]. The minimal revisions to the IRLM after each stakeholder group review further validate the robustness of this co-design approach.

Strengths and limitations

A major strength of this study was the use of sequential, iterative community engagement process across five structured meetings, which enabled the stakeholder groups to identify and refine determinants and strategies. Early sessions revealed that most determinants identified by the stakeholder groups were barriers rather than

facilitators. Recognizing this pattern, we adapted our approach in subsequent sessions to explicitly prompt each stakeholder group to identify facilitators, ensuring a more balanced understanding of the implementation context. This iterative responsiveness enabled dynamic learning and deeper engagement. Additional strengths include the diversity of stakeholder groups engaged and the geographic distribution across urban and peri-urban settings, which enhanced contextual relevance. The mixed-methods design, combining qualitative and quantitative approaches, strengthened the rigor and comprehensiveness of the planning process. Another notable strength was use of the IRLM as both a conceptual framework and visual tool to systematically link determinants, strategies, mechanisms and outcomes. The mapping process helped assess whether proposed strategies sufficiently addressed identified barriers and would lead to the planned outcomes. Moreover, the visual presentation of the IRLM prompted the stakeholder groups to identify two additional strategies during the final review session, demonstrating its utility in fostering iterative refinement and shared ownership.

This study also has some limitations. First, stakeholder group engagement was limited to three PHC sites within one region in Ghana (i.e., the Greater Accra region), potentially affecting generalization to other regions. Second, although adults with hypertension and community leaders/CSOs contributed to identifying determinants and co-developing strategies across all Kaiser bundle components, their input was limited for components related to clinical performance feedback reports and standardized evidence-based treatment protocol, due to unfamiliarity with internal health system processes. Nevertheless, our study included a broad range of stakeholder groups which helped capture a comprehensive set of determinants and strategies. Third, national-level decision-makers from the Ghana National Health Insurance Authority were not represented, which may limit alignment with health financing and policy priorities. To address this, we will engage these actors in future studies to enhance integration with national health financing structures. Finally, although we reported a range of participant sociodemographic characteristics, these variables were not analytically linked to implementation determinants or strategy prioritization. Education level was included to describe the professional background of healthcare providers and policymakers and to provide context on how adults with hypertension and community leaders/CSO representatives may engage in implementation planning activities. However, characteristics such as marital status and religion should be interpreted as descriptive context rather than as factors shaping participants' contributions.

Conclusion

This study shows how integrating community engagement with multiple implementation science frameworks can produce a rigorous, equity-focused plan for adapting evidence-based interventions in low-resource settings. By co-developing strategies linked to determinants, mechanisms, and outcomes through CFIR, ERIC, RE-AIM, and IRLM, we advance prior work using these procedures [15, 16] and offer a replicable model for transparent and context-sensitive implementation planning for the Kaiser bundle. Future evaluation through a hybrid type 3 effectiveness-implementation study [46] will generate evidence on effective implementation strategies to enhance adoption, fidelity, scale-up and sustainability of the Kaiser bundle in Ghana. Beyond informing the implementation of the Kaiser bundle in Ghana, our approach provides practical guidance for researchers and policymakers seeking scalable strategies to strengthen chronic disease care globally.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s43058-026-00908-z>.

Supplementary Material 1.

Acknowledgements

The authors wish to thank the participants for their contributions to this study.

Authors' contribution

OAS, LB, AJC and JDS conceptualized the study. OAS and JDS obtained funding for this study. OAS, LB, IAK, ANV, WYK, OCO, FAS, and RPY oversaw project administration. OAS, ANV, WYK, OCO, FAS and RPY contributed to data curation and analyses. OAS drafted the original manuscript, and all authors reviewed and revised the paper for important intellectual content. All authors read and approved the final manuscript.

Funding

This study was supported by the University of Utah School of Medicine and the Office of the Vice President for Research through the FY24 Seed Grant Program (Award No. 10072710).

Data availability

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the University of Utah Institutional Review Board and the Ghana Health Service Ethics Review Committee. All participants provided written informed consent before the commencement of the study.

Consent for publication

All participants provided consent to publish the findings from this study.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Health Systems and Population Health Sciences, Tilman J Fertitta Family College of Medicine, University of Houston, Houston, TX, USA. ²Humana Integrated Health Systems Sciences Institute, University

of Houston, Houston, TX, USA. ³Department of Population Health Sciences, Division of Health System Innovation and Research, Spencer Fox Eccles School of Medicine at The University of Utah, Salt Lake City, Utah, USA. ⁴Department of Health Policy, Planning and Management, School of Public Health, University of Ghana, Legon, Accra, Ghana. ⁵Department of Pharmacy Practice and Clinical Pharmacy, University of Ghana School of Pharmacy, College of Health Sciences, Legon, Ghana. ⁶Department of Psychiatry and Behavioral Sciences, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA.

Received: 17 November 2025 Accepted: 23 March 2026

Published online: 01 April 2026

References

- Zhou B, Carrillo-Larco R, Danaei G, Riley LM, Paciorek C, Stevens G, et al. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *The Lancet*. 2021;398(10304):957–80.
- Bosu W, Bosu D. Prevalence, awareness and control of hypertension in Ghana: a systematic review and meta-analysis. *PLoS ONE*. 2021;16(3):e0248137.
- Ministry of Health (Ghana). National Policy for the Prevention and Control of Chronic Non-Communicable Diseases in Ghana. Ghana; 2022.
- Abdalla M, Bolen S, Brettler J, Egan B, Ferdinand K, Ford C, et al. Implementation strategies to improve blood pressure control in the United States: a scientific statement from the American Heart Association and American Medical Association. *Hypertension*. 2023;80(10):e143–57.
- Hinneht T, Boakye H, Metlock F, Ogungbe O, Kruahong S, Byiringiro S, et al. Effectiveness of team-based care interventions in improving blood pressure outcomes among adults with hypertension in Africa: a systematic review and meta-analysis. *BMJ Open*. 2024;14(7):e080987.
- Joshi R, Alim M, Kengne A, Jan S, Maulik P, Peiris D, et al. Task shifting for non-communicable disease management in low and middle income countries—a systematic review. *PLoS ONE*. 2014;9(8):e103754.
- Moran A, Gupta R, Pathni A, Osi K, Dessie G, Zhang X, et al. Implementation of global hearts hypertension control programs in 32 low-and middle-income countries: JACC international. *J Am Coll Cardiol*. 2023;82(19):1868–84.
- Mengesha E, Tesfaye T, Boltena M, Birhanu Z, Sudhakar M, Hassen K, et al. Effectiveness of community-based interventions for prevention and control of hypertension in sub-Saharan Africa: a systematic review. *PLoS Glob Public Health*. 2024;4(7):e0003459.
- Jaffe M, Lee G, Young J, Sidney S, Go A. Improved blood pressure control associated with a large-scale hypertension program. *JAMA*. 2013;310(7):699–705.
- Brownson R, Kumanyika S, Kreuter M, Haire-Joshu D. Implementation science should give higher priority to health equity. *Implement Sci*. 2021;16:1–16.
- Shelton R, Brownson R. Enhancing impact: a call to action for equitable implementation science. *Prev Sci*. 2024;25(1):174–89.
- Cooper C, Watson K, Alvarado F, Carroll A, Carson S, Donenberg G, et al. Community engagement in implementation science: the impact of community engagement activities in the DECIPHER Alliance. *Ethn Dis*. 2023;1:52–9.
- Wallerstein N, Duran B, Oetzel J, Minkler M. Community-based participatory research for health: Advancing social and health equity. Hoboken, New Jersey, USA: John Wiley & Sons.; 2017.
- Smith J, Li D, Rafferty M. The implementation research logic model: a method for planning, executing, reporting, and synthesizing implementation projects. *Implement Sci*. 2020;15(1):84.
- Carroll A, Knapp A, Villamar J, Mohanty N, Coldren E, Hossain T, et al. Engaging primary care clinicians in the selection of implementation strategies for toddler social-emotional health promotion in community health centers. *Fam Syst Health*. 2024;42(1):50.
- Knapp A, Carroll A, Mohanty N, Fu E, Powell B, Hamilton A, et al. A stakeholder-driven method for selecting implementation strategies: a case example of pediatric hypertension clinical practice guideline implementation. *Implementation Science Communications*. 2022;3(1):25.
- Nagy G, Rivera-Segarra E, Cabassa L. Equity-grounded implementation science: comparative case analysis of three studies. *Psychol Serv*. 2025;22(3):531–45.
- O'Brien B, Harris I, Beckman T, Reed D, Cook D. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med*. 2014;89(9):1245–51.
- Damschroder LJ, Reardon CM, Widerquist MAO, J L. The updated consolidated framework for implementation research based on user feedback. *Implement Sci*. 2022;17(1):1–16.
- Yakovchenko V, Chinman M, Lamorte C, Powell B, Waltz T, Merante M, et al. Refining Expert Recommendations for Implementing Change (ERIC) strategy surveys using cognitive interviews with frontline providers. *Implementation Science Communications*. 2023;4(1):42.
- Glasgow R, Harden S, Gaglio B, Rabin B, Smith M, Porter G, et al. RE-AIM planning and evaluation framework: adapting to new science and practice with a 20-year review. *Front Public Health*. 2019;7:64.
- Holtrop J, Estabrooks P, Gaglio B, Harden S, Kessler R, King D, et al. Understanding and applying the RE-AIM framework: clarifications and resources. *Journal of Clinical and Translational Science*. 2021;5(1):e126.
- Kwan B, McGinnes H, Ory M, Estabrooks P, Waxmonsky J, Glasgow R. RE-AIM in the real world: use of the RE-AIM framework for program planning and evaluation in clinical and community settings. *Front Public Health*. 2019;7:345.
- Doku A, Tetteh J, Edzeame J, Peters R, Agyemang C, Otchi E, et al. The Ghana heart initiative—a health system strengthening approach as index intervention model to solving Ghana's cardiovascular disease burden. *Front Public Health*. 2024;12:1330708.
- Kumah A. The future of patient safety in Ghana: challenges and opportunities. *Frontiers in Health Services*. 2025;5:1581468.
- Baatiema L, Sanuade O, Kretschy I, Oboibhole L, Kushitor S, Haghparsat-Bidgoli H, et al. Implementation of national policies and interventions (WHO best buys) for non-communicable disease prevention and control in Ghana: a mixed methods analysis. *Health Research Policy and Systems*. 2024;22(1):154.
- Nyaaba G, Stronks K, Masana L, Larrea-Killinger C, Agyemang C. Implementing a national non-communicable disease policy in sub-Saharan Africa: experiences of key stakeholders in Ghana. *Health Policy Open*. 2020;1:100009.
- Proctor E, Powell B, McMillen J. Implementation strategies: recommendations for specifying and reporting. *Implement Sci*. 2013;8(1):1–11.
- Go V, Morales G, Mai N, Brownson R, Ha T, Wc M. Finding what works: identification of implementation strategies for the integration of methadone maintenance therapy and HIV services in Vietnam. *Implement Sci*. 2016;11(1):54.
- Powell B, Waltz T, Chinman M, Damschroder L, Smith J, Matthieu M, et al. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. *Implement Sci*. 2015;10(1):21.
- Waltz T, Powell B, Matthieu M, Damschroder L, Chinman M, Ji S, et al. Use of concept mapping to characterize relationships among implementation strategies and assess their feasibility and importance: results from the Expert Recommendations for Implementing Change (ERIC) study. *Implement Sci*. 2015;10(1):109.
- Kowalski C, Nevedal A, Finley E, Young J, Lewinski A, Midboe A, et al. Planning for and Assessing Rigor in Rapid Qualitative Analysis (PARRQA): a consensus-based framework for designing, conducting, and reporting. *Implement Sci*. 2024;19(1):71.
- Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Adm Policy Ment Health*. 2011;38(2):65–76.
- Okoli R, Shedul G, Hirschhorn L, Orji I, Ojo T, Egenti N, et al. Stakeholder perspectives to inform adaptation of a hypertension treatment program in primary healthcare centers in the Federal Capital Territory, Nigeria: a qualitative study. *Implementation Science Communications*. 2021;2(1):97.
- Smith J, Carroll A, Sanuade O, Johnson R, Abramssohn E, Abbas H, et al. Process of engaging community and scientific partners in the development of the CIRCL-Chicago Study Protocol. *Ethnicity and Disease*. 2023;DECIPHER(Spec Issue)(18–26).
- StataCorp. Stata Statistical Software: Release 19. College Station, TX: StataCorp LLC; 2025.

37. Baumann A, Cabassa L. Reframing implementation science to address inequities in healthcare delivery. *BMC Health Serv Res.* 2020;20(1):190.
38. Escoffery C, Lebow-Skelley E, Haardoefer R, Boing E, Udelson H, Wood R, et al. A systematic review of adaptations of evidence-based public health interventions globally. *Implement Sci.* 2018;13(1):125.
39. Hanson K, Briki N, Erlangga D, Alebachew A, De Allegri M, Balabanova D, et al. The Lancet Global Health Commission on financing primary health care: putting people at the centre. *Lancet Glob Health.* 2022;10(5):e715–72.
40. Matos R, Nascimento G, Campos Fernandes A, Matos C. Health and Social Care Integration: Insights from International Implementation Cases. *Journal of Market Access & Health Policy.* 2025;13(2):28.
41. Najafi M, Mosadeghrad A, Arab M. Mechanisms of intersectoral collaboration in the health system: a scoping review. *Iran J Public Health.* 2023;52(11):2299.
42. Ndumbe-Eyoh S, Moffatt H. Intersectoral action for health equity: a rapid systematic review. *BMC Public Health.* 2013;13(1):1056.
43. Eslava-Schmalbach J, Garzón-Orjuela N, Elias V, Reveiz L, Tran N, Langlois E. Conceptual framework of equity-focused implementation research for health programs (EquiR). *International Journal for Equity in Health.* 2019;18(1):80.
44. Miller C, Barnett M, Baumann A, Gutner C, Wiltsey-Stirman S. The FRAME-IS: a framework for documenting modifications to implementation strategies in healthcare. *Implement Sci.* 2021;16(1):36.
45. Rogal S, Yakovchenko V, Morgan T, Bajaj J, Gonzalez R, Park A. Getting to implementation: a protocol for a Hybrid III stepped wedge cluster randomized evaluation of using data-driven implementation strategies to improve cirrhosis care for Veterans. *Implement Sci.* 2020;15(1):1–10.
46. Curran GM, Landes SJ, McBain SA, Pyne JM, Smith JD, Fernandez ME, et al. Reflections on 10 Years of Effectiveness-Implementation Hybrid Studies. *Frontiers in Health Services—Implementation Science.* 2022;2:1053496.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.