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A knowledge, attitude and practice-based integrative literature review of community health worker training on stroke and cardiovascular diseases in low-and middle-income countries

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Abstract

Background Cardiovascular disease (CVD) and stroke remain the leading causes of preventable morbidity and mortality, especially in low-and middle-income countries (LMICs). Community Health Workers (CHWs) are well-positioned to support prevention but are often inadequately trained for CVD and stroke-specific challenges. This review aimed to examine the design, content and delivery of CHW training programmes for CVD and stroke prevention using the Knowledge, Attitude and Practice (KAP) framework to identify gaps and advise future curriculum development.

Methods An Integrative Literature Review was conducted. First-level analysis used deductive coding guided by the KAP framework to organise the data on training approaches, barriers, facilitators, etc. Second-level analysis applied the Framework Analysis method by Ritchie and Spencer to identify deeper themes across the studies.

Results Twenty-two articles were included in the final analysis representing diverse settings across Africa (*n* = 11), Asia (*n* = 6), Latin America [1] and LMICs (*n* = 4) from different continents. First-level analysis revealed common themes among the studies, highlighting areas such as CHW understanding of CVD/stroke risk factors, screening activities, community education duties, and challenges like lack of supervision and ambiguity in roles. Notably missing were training on attitudes and stroke-specific materials. The second-level analysis was structured according to the five curriculum pillars and their cross-cutting themes, which revealed critical training gaps in areas such as culturally appropriate communication, initiating behaviour change, data literacy, system navigation, and support structures. While CHW confidence and motivation improved post-training, these outcomes were not explicitly addressed in the curriculum.

Conclusions Community health worker training programmes for non-communicable diseases often lack the specificity and depth required for effective stroke and CVD prevention. This review identified critical gaps across five

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curriculum pillars namely: Communication and Education, Community Engagement, Health System Navigation, Clinical Competencies and Support and Accountability. A unique finding in this review was the limited evidence focused on training CHWs' attitudes – an essential component of their role, and particularly with regard to stroke and CVD prevention. While positive shifts in CHW confidence and motivation are observed post-training, these are rarely intentional learning outcomes. Future curricula must explicitly integrate these domains to better equip CHWs for context-specific, culturally aligned, and sustainable CVD and stroke prevention in LMICs.

Keywords Cardiovascular disease, Community health workers, Community health worker training, Stroke prevention

Background

Stroke and cardiovascular disease (CVD) are among the leading causes of preventable mortality and disability worldwide [1] with low- and middle-income countries (LMICs) bearing a disproportionate share of this burden [2]. While community health workers (CHWs) are gaining recognition as integral components of primary health care systems, their specific involvement in the prevention, early detection, and referral of individuals at risk of stroke and CVD continues to be critically overlooked [3].

In recent years, increasing attention has been paid to improving CHW knowledge of non-communicable diseases (NCDs) [4–6], particularly risk factors such as hypertension, diabetes, hyperlipidaemia and smoking [7, 8]. Although CHW training on NCDs has expanded, it often remains too general, lacking the depth needed to prepare the CHWs to identify and respond to the clinical and community challenges associated with stroke and CVD specifically [9]. As a result, many CHWs lack the tools and confidence needed for stroke prevention. They also work without adequate support systems which limits their ability to respond quickly when intervention is critical [10]. In addition, placing emphasis only on knowledge acquisition, limits the development of a wider set of competencies - such as CHW attitudes, practical skills and community engagement needed for effective prevention efforts [11, 12]. A narrow focus on knowledge acquisition alone falls short of equipping CHWs with the full range of competencies required for effective stroke prevention. Sustainable impact not only depends on what CHWs know, but also on their attitudes - such as confidence, motivation and role clarification - as well as their practices, skills and ability to engage effectively with communities [12, 13]. A CHW may have the knowledge of stroke risk factors yet lack the confidence in offering behavioural counselling or be hindered from taking action owing to insufficient referral networks, mentorship and organisational support [10, 14, 15]. To fully leverage CHWs in stroke and CVD prevention, training must be more integrated and context-sensitive [16], incorporating biomedical knowledge alongside promoting attitudes and enabling practical action [11].

To effectively strengthen stroke and CVD prevention, it is essential to consider not only knowledge but also the attitudes that influence motivation and the practices that drive behaviour change [17]. The triadic Knowledge – Attitude – Practice (KAP) framework provides a valuable lens for understanding and enhancing CHW performance and its practical contributions to the prevention of stroke and CVD.

Although knowledge forms the basis for effective health promotion [18], it is the attitudinal domain, including beliefs, motivation, self-efficacy, incentives and clarity of role, that influences whether CHWs are inclined to apply that knowledge in practice [19, 20]. The practice domain, in turn, represents the translation of knowledge and attitudes into real-world action, which is often dependent on enabling factors such as supervision, equipment availability, and integration within the broader health system [21, 22]. Focusing on knowledge without equally supporting attitudes and practices may result in CHWs who understand what to do but lack the will, confidence or capacity to respond accordingly [23].

Although numerous training programmes have been developed to equip CHWs for NCDs prevention [24–30], many of these initiatives provide only the most basic knowledge, with limited or no specific focus on stroke and CVD. Given the growing burden of these conditions in LMICs [2, 31–34], there is a pressing need to examine the content and scope of existing CHW training efforts in this area. The primary interest of this Integrative Literature Review was the design, scope/content, and delivery of training programmes, rather than post-training results or effectiveness data. This review aimed at exploring the content, design and delivery of CHW training programmes for stroke and CVD prevention, using the KAP framework to identify existing gaps and guide future training development.

Methods

This Integrative Literature Review followed the five-step approach proposed by Russell (2005) [35], which includes: (1) problem formulation (2), literature search (3), evaluation of data (4), data analysis and interpretation, and (5) presentation of results. This methodology was chosen for its capacity to accommodate diverse data sources and study designs. This allowed the researchers to synthesise empirical and theoretical literature of available training programmes targeting CHWs for stroke and CVD prevention in LMICs. The review was guided by the

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework [36].

Search strategy and eligibility criteria

The literature search was conducted between December 2023 and June 2025 using the EBSCOhost platform (including CINAHL and MEDLINE), PubMed, Google Scholar, Scopus, and ScienceDirect. Keywords used included: 'training programme' OR 'screening programme' AND 'community health worker' OR 'lay worker' OR 'health extension worker'. Complementing the primary search, the authors integrated deep-learning Artificial Intelligence (AI) tools - SciSpace and Undermind. These tools were used to identify semantically related publications, track citation trails, and explore supplementary sources not retrieved during the primary search.

Studies were included if they (a) described any training aspect, (b) were aimed at CHW, (c) dealt with stroke or CVD prevention, and (d) were conducted in LMIC. Included studies comprised full-text peer-reviewed journal articles; quantitative, qualitative, and mixed-methods designs; review articles, and postgraduate theses. Non-peer-reviewed literature, books, editorials, and conference abstracts were excluded. The search was limited to studies published in English between 2005 and 2025 to ensure relevance to current CHW practices in global health systems.

Article selection

An initial number of 2657 articles were retrieved. After removing 100 duplicates using EPPI-Reviewer software, 2438 articles were excluded based on title (n = 1905) and abstract screening (n = 533). The remaining (n = 119) articles underwent full-text screening by the lead researcher and an independent research assistant and discrepancies were resolved. Of these, certain articles (n = 97) were excluded for not meeting the inclusion criteria: not focused on CVD/stroke (n = 75), not involving CHW (n = 11), missing training components (n = 6), not based on LMIC (n = 4) or not available (n = 1). A final sample of 22 (n = 22) articles was identified, with no articles excluded after quality appraisal, resulting in these being included in the final synthesis. Figure 1 (see below) displays the article selection process in a PRISMA flow chart.

Quality appraisal

The Johns Hopkins Research Evidence Appraisal Tool was used to evaluate the methodological quality of qualitative, quantitative, and mixed-methods studies [37]. Systematic reviews were assessed using the PRISMA checklist. The clarity of the research objectives, the appropriateness of the sampling, the methodological rigour, and the transparency of the reporting were evaluated. The level of evidence ranged from Level I to Level V, with the majority classified as Level III according to the Johns Hopkins Research Evidence Appraisal Tool. Three studies were rated as Level V, as they were non-research reports. Publication and reporting bias were acknowledged given the inclusion of mixed evidence sources. In order to mitigate these risks, the review followed a predefined protocol aligned with PRISMA guidelines which ensured rigour and transparency. The research question was formulated well before data collection to avoid data-driven hypothesis. All relevant sources were comprehensively searched to avoid selection bias. Two reviewers independently appraised the studies according to the Johns Hopkins critical appraisal tools to prevent selection bias. Studies were included irrespective of their findings. Only studies with ethical clearance were retained to ensure credibility. No articles were excluded due to poor methodological quality.

Data extraction and analytical approach

Data extraction and analysis were performed in two stages. The first-level analysis consisted of a deductive coding process, applying the triadic KAP framework. The framework guided the initial extraction and organisation of the data across all included studies according to the knowledge, attitude, and practice domains, as well as implementation barriers and facilitators and training approaches used. Second-level analysis employed the Framework Analysis method, initially developed by Ritchie and Spencer [5]. This involved inductive coding to capture emerging, recurring cross-study themes. This process involved five stages:

- *Familiarisation*: Engaging in the extracted data to gain understanding of key concepts and recurring patterns.
- *Identifying a thematic framework*: Developing key themes, categories or concepts that emerge from the data.
- *Indexing*: Applying the thematic framework systematically to all the data by coding sections according to themes.
- *Charting*: Summarising data into matrices or charts according to the themes.
- *Mapping and interpretation*: Drawing out patterns, relationships or connections from the data with the goal to answer the research questions.

Results

A total of 22 studies met the inclusion criteria for this Integrative Literature Review, representing diverse settings across Africa (n = 11), Asia (n = 6), Latin America [1] and LMICs (n = 4) from different continents. This

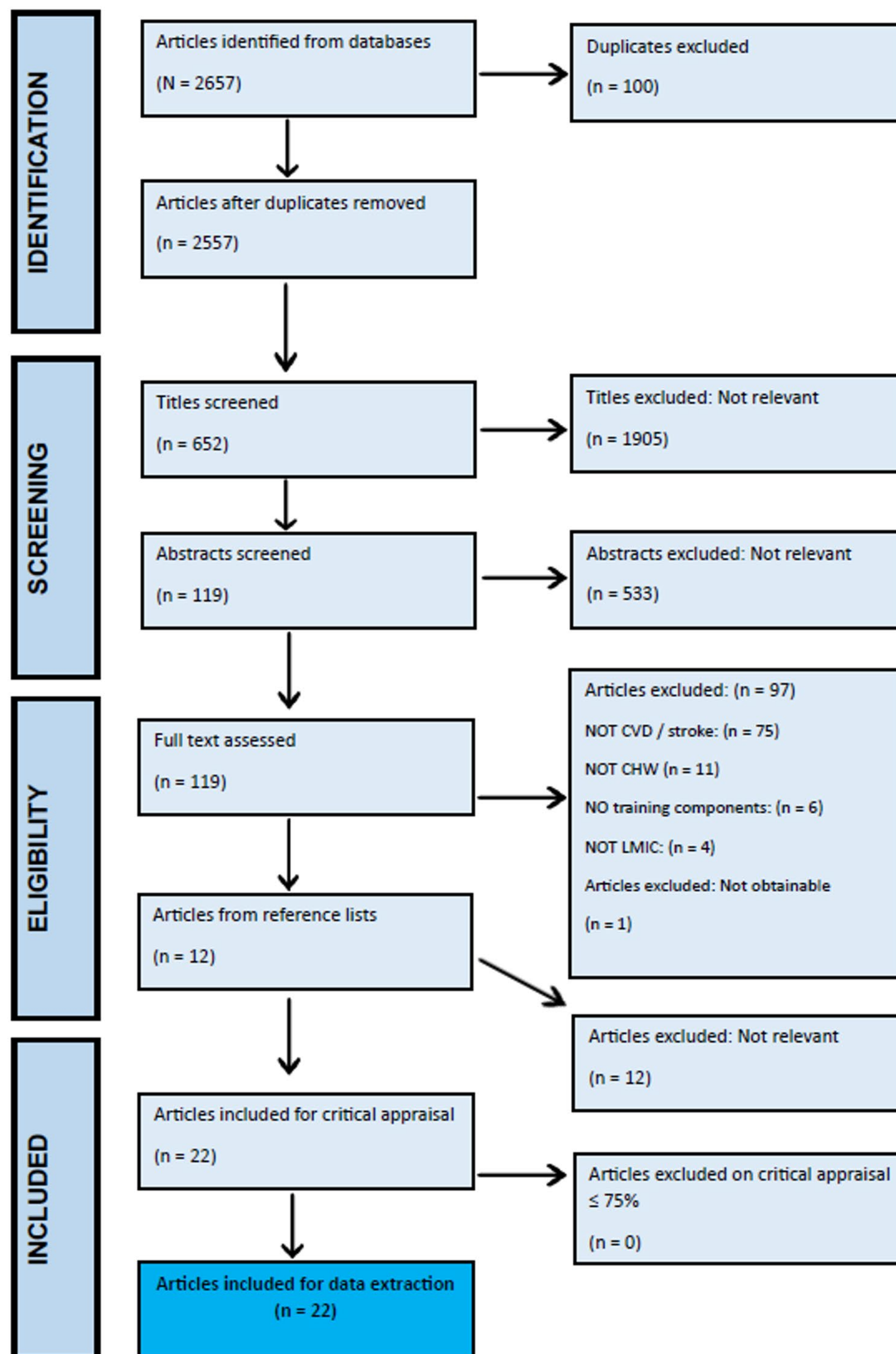

Fig. 1 PRISMA flow chart – article selection process

results section is presented in two parts: a *first-level analysis* and the *second-level analysis*. The first-level analysis is based on the data collated according to the KAP framework in the data extraction table from the Integrative Literature Review, where key domains and recurring themes were identified across the 22 included studies. The second-level analysis builds on these findings by identifying 12 cross-cutting themes that emerged across domains, which were further synthesised into five overarching curriculum pillars: *communication and education, community engagement, health system navigation, clinical competencies, and support and accountability.*

First-level analysis

Data was extracted using a pre-populated data extraction table (see Table 1). The extracted fields included author and year, country, training approach, knowledge themes, attitudinal themes, practice themes, implementation considerations (including barriers and facilitators), and recommendations for curriculum design. The first level of analysis followed a qualitative data analysis approach as proposed by Whittemore & Knafl [38]. Applying the KAP framework to organise the findings across three domains: (1) knowledge (e.g. stroke risk factors, disease mechanisms) (2), attitudes (e.g. motivation, confidence, clarity of the role), and (3) practices (e.g. screening, referral, counselling). Table 1 below discusses the data extraction and first-level analysis using the triadic KAP framework in greater detail. These domains represent the foundational components of CHW training programmes as reported across the 22 studies. Table 2 presents a detailed discussion of the results emerging from the first-level analysis, organised according to the six domains: training approaches, knowledge, attitudes, practices, and implementation considerations (barriers and facilitators).

Second-level analysis

After the initial extraction and deductive categorisation, a second-level analysis was conducted to identify recurring patterns across studies. This phase of analysis took an inductive approach, aiming to uncover cross-cutting themes that extended beyond the original KAP framework. Through repeated reading and comparison, twelve distinct cross-cutting themes were identified. These themes captured recurring gaps, inconsistencies, and innovations in the training of community health workers for stroke and CVD prevention. The twelve cross-cutting themes included: *Inclusive Communication* (the lack of tailored strategies for low-literacy and multilingual populations), *Behaviour Change* (the limited presence of behaviour change communication techniques), *Data Literacy* (insufficient training on health data collection and interpretation), *Community Dialogue* (weak integration of community engagement into training design), *Cultural Alignment* (minimal attention to integrating traditional beliefs with biomedical content), *System Navigation* (limited preparation for navigating fragmented referral systems), *Role Clarity* (uncertainty regarding CHW roles within health systems), *Screening Skills* (variable emphasis on basic screening competencies), *Knowledge Gaps* (missing context-specific content on stroke and CVD), *CHW Accountability* (limited implementation of supervisory and accountability structures), *CHW Attitudes* (insufficient training related to confidence and attitude shifts), and *Support Systems* (the absence of peer support and mentoring structures).

To effectively integrate these findings into curriculum design, the cross-cutting themes were grouped into five main categories termed as *curriculum pillars*. These pillars encompassed: *Communication and Education*, *Community Engagement*, *Health Systems Navigation*, *Clinical Competencies*, and *Support and Accountability*. Each pillar functioned as a domain, offering a conceptual framework for developing future CHW training programs. A visual map (Sankey diagram) was created to illustrate the relationships between the cross-cutting themes, and the overarching curriculum pillars, highlighting how specific thematic issues could be addressed through structured training content (see Fig. 2 below). The Sankey diagram illustrates the flow and interrelationships among the cross-cutting themes identified during the mapping and interpretation stage of the Ritchie and Spencer framework analysis, indicating how themes overlap and context. Table 3 provides a brief summary of the second-level analysis and explanation of each curriculum pillar and cross-cutting theme that emerged from the data.

Discussion

The findings from this Integrative Literature Review offer valuable insights into the current state of CHW training programmes for CVD and stroke in LMICs. Although the literature on CHWs' role in NCDs is expanding [3, 25, 60–62], it generally takes a broad approach as this analysis revealed that only few programmes provide focused, content-specific training on CVD and stroke. The discussion is structured according to the five curriculum pillars - Communication and Education, Community Engagement, Health Systems Navigation, Clinical Competencies and Support and Accountability with their corresponding cross-cutting themes.

The first pillar, *Communication and Education*, emphasises the need for a more tailored and inclusive approach to communication training. CHW training often emphasises clear, plain language use which is culturally appropriate. For instance, a United Kingdom based CHW CVD programme co-designed by CHWs trained them to use 'simple health information' to explain risk and prevention [63]. Similarly, a review on CHW training recommended that communication skills address fears and local myths in straightforward language [39]. CHWs in Pakistan effectively educated communities about CVD risk factors, demonstrating the importance of adapting communication strategies to local contexts [39]. The review identified that a critical gap exists in behaviour change techniques in CHW training. CHWs were trained on motivational interviewing and resistant management in an implementation study [63], and in a community-based CVD programme in Colorado included behaviour change counselling on diet, smoking and exercise with promising results [64]. These findings suggest that behaviour change

Table 1 Data extraction and first-level analysis using the triadic KAP framework

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Abdel-All et al. [39]	Low- and middle-income countries	Interactive sessions; Group discussions; Problem-based learning; Hands-on workshops; Local-language delivery; Demonstrations; Simulation.	CVD and related risk factors (hypertension, diabetes, obesity), Lifestyle counselling; Food and nutrition; Physical activity.	No dedicated attitudinal training or metrics reported.	Blood pressure measurement; Anthropometric measurements; BMI calculation and interpretation for nutritional status assessment; Health education; Community mobilisation/motivation; Referral initiation.	Lack of refresher training; Cultural norms; Unclear expectations; Low computer skills.	Multilingual material used for training and assessment; Supportive on-the-job supervision and feedback; On-site training.	Focus on competency-based training; Local-language instruction; Adapt to local culture and norms; Refresher sessions every 6–12 months; Computer skills training; Communication skills training.
Abdullah et al. [40]	South East Asia (Bangladesh, China, Nepal and Vietnam)	Policy-oriented training; Practical guides, and health promotion tools; Situational analysis using literature reviews; Stakeholder meetings and exploratory studies.	General NCDs risk factors; NCDs, CVDs, and CHW integration strategies; Screening, diagnosis, health education for common NCDs; Dispensing basic medication and referral to facilities.	No dedicated attitudinal training or metrics reported.	Community engagement; NCDs screening; Health promotion; Screening NCDs; Counselling, medication dispensing and patient referral.	Lack of specific NCDs guidelines; Inadequate/insufficient training; Lack of system support; Lack of supplies, excessive workload.	Social recognition boosting CHW morale; Prioritising NCDs programmes.	Clarify CHW role/scope; Adapt training to policy landscape; Include advocacy and outreach skills; Provide structured training for CHWs in order to build their capacity; Integrate CHWs into NCDs service delivery; Strengthen system-level support with non-governmental structures.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Abrahams-Gessel et al. [41]	Low- and middle-income countries	Didactic training programme (CVD pathophysiology, non-invasive screening tools); Communication/counselling techniques); Training adapted to local language and cultural context; Pre-and-post training written tests; Practical sessions and hands-on simulation exercises.	Basic CVD concepts; Non-invasive CVD screening, importance and early detection; Accurate use of measurement tools; Health education principles.	No dedicated attitudinal training or metrics reported.	Household screening visits; CVD risk assessment; Brief counselling; Follow-up visits and referral to hospitals.	Lack of supervision; Ambiguity in CHW roles and lack of support; Inadequate remuneration; No clear career progression; Environmental challenges (transport, safety); Not integrated into national health systems.	Strong social ties to the community; Contextualised training made content more understandable and relevant; Use of appropriate visual aids and tools for improved application and retention.	Training to be embedded in a culturally and linguistically acceptable manner; Theoretical and practical modules to be included; Modules on: CVD risk assessment, use of screening devices; Community-based education/behaviour change strategies; Pre-and-post assessments to be done to evaluate knowledge gain; Provide supervision, ongoing mentoring and refresher training; CHW roles to be defined clearly, offer the opportunity for career progression; CHW training to be integrated into formal national health systems to ensure sustainability.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Agarwal et al. [42]	India	Structured one-day training session; Hands-on practical skills training, CVD screening, anthropometric measurements, blood pressure measurements, random glucose testing); Use of digital tools and software; Participatory and interactive learning; Demonstrations; Problem-solving sessions and guided practice; Audio-visual aids; Use of medical expert facilitators.	Fundamentals of CVDs and public health implications; Importance of early screening and preventive strategies; Overview of the National Programme for Prevention & Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke; Risk factors and preventive counselling (including dietary practices and physical activity); Role-specific components and job responsibilities.	No dedicated attitudinal training or metrics reported.	Screening tools and practical applications; Anthropometric measurements Blood pressure measurements; Random blood glucose screening; Training implicitly encouraged health communication behaviours.	Short duration of training; Lack of attendance by eligible staff; Lack of reliable internet connectivity; Lack of functional equipment during supportive supervision sessions; Lack of ongoing support and refresher training; Delays between initial training and supportive supervision sessions.	Provision of training kits as reinforcement tools; Tailored CVD content.	Incorporate the National Strategic Plan for the Prevention and Control of Non-Communicable Diseases.
Galvez et al. [43]	Malawi	Lectures; Discussions; Demonstrations; Practice; Case studies; Skills competency checklists.	Understanding NCDs and their impact; Fundamentals of blood pressure; Escalation of care (referrals); Documentation of health information; Stroke prevention and rehabilitation strategies.	No dedicated attitudinal training or metrics reported.	BP screening, rehabilitation skills, health data recording skills; referral skills.	Differences in individual educational experiences and backgrounds.	Structured opportunities to collaborate with other healthcare professionals; Use of local language and culturally tailored training material.	Integrate rehabilitation care content; Contextually tailored and culturally relevant training material; Include training in cognitive skills; Psychomotor skills and clinical reasoning; Continuous development.
Ji et al. [17]	Brazil	Structured scripts; Practical scenarios; Shadowing experienced CHWs.	Stroke risk reduction; Warning signs; Post-stroke care roles of CHWs.	No dedicated attitudinal training or metrics reported.	Post-stroke home visits; Monitoring functional progress; Patient support.	Limited time; Large catchment areas; High family demand.	Positive CHW attitude and motivation towards NCDs prevention; Community trust; Basic NCDs knowledge.	Develop stroke-specific follow-up module; Use realistic role simulations.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Joshi et al. [44]	Low- and middle-income countries	Hands-on, demonstrative sessions; Objective, practical clinical examinations; Role-playing scenarios; Utilisation of mHealth tools and clinical decision support systems; Audio/visual tools.	CVD prevention and early detection; CVD risk factors; Use of mobile technology and clinical decision support tools; Lifestyle counselling and behavioural communication strategies; Facilitation of community engagement and self-management techniques; Use of standardised protocols.	No dedicated attitudinal training or metrics reported.	Use of mobile applications; Use of clinical decision support tools; Interpretation of blood pressure readings; Effective patient education communication; Use of standardised clinical protocols and guidelines.	Anxiety in adopting new technology; Short duration of training (2–7 days); Adapting to task-shifting (expanded roles and responsibilities); Variability in skills and capacity of CHWs; Lack of standardised training.	Contextual and community-specific training content; Integration of technology in training; Ongoing, practical on-the-job training and mentorship/supervision.	Incorporate technology and digital tools; Consider local cultural context and language needs; Expose CHWs to experienced professionals.
Kgatla [45]	South Africa	Interactive, youth-friendly formats; storytelling; Training delivered using the ADDIE instructional design model; Aimed to empower Home Based Carers (HBCs) to support community members in self-management of CVD risk factors.	CVD awareness, lifestyle risks; Stroke symptoms; CVD risk factors: poor diet, lack of exercise, smoking, stress and alcohol use (healthy lifestyle choices); Disease prevention.	No dedicated attitudinal training or metrics reported.	School talks; Community workshops; BP checks; Educational/counselling on lifestyle modification; Encouraged routine health practices (exercise); Support patients in setting goals and health tracking.	Limited materials; Limited NCDs knowledge among HBCs; Resource constraints (educational materials and transport).	Community trust in HBCs; Context-sensitive training design; Support from local health professionals and clinics.	Use youth-focused content; partner with schools for outreach. Use instructional design frameworks (ADDIE) to design training to local needs; Emphasis should be placed on practical skills, cultural sensitivity and communication skills; Ongoing mentorship and support mechanisms should be included; Incorporate regular monitoring and evaluation to monitor HBC performance and knowledge retention.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Limbani [46]	South Africa	Mentorship; Real-time application, Supportive supervision; Received structured training and ongoing supervision from professional nurses; Training was task oriented, practical of nature and designed to support clinic-based hypertension care and follow-up.	Basics in hypertension management; Chronic care pathways (booking appointments, filing and packing medication); Communication strategies; Adherence support.	No dedicated attitudinal training or metrics reported.	Pre-packing medication; Patient tracing; Appointment reminders; BP measurement; File handling; Managing clinic flow and reducing waiting times.	Challenges with clinic workflow integration; Difficulty in role boundaries between nurses and lay health workers (LHWs).	Clinic infrastructure; Nurse collaboration; Motivation variability; Strong supervision from professional nurses; LHWs locally recruited (trust); Clear task expectations and job aids ensured consistency.	Integrate with clinic workflow; Emphasise interpersonal and record-keeping skills; Training should not only include biomedical knowledge but also an emphasis on practical skills and communication; Ongoing support and supervision is needed; Curriculum should address role clarification to prevent tension with other staff; Training should include systems navigation skills (follow ups, records and appointments).

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Lourdes et al. [47]	Malaysia	Simulation exercises; Mentorship by expert supervisors; Job aids for fieldwork; Formal training; Cross sectional survey to evaluate associations between CHW performance and adequacy of training modules; Emphasis placed on pre-service training and adequacy of training module content.	CHWs trained on hypertension, diabetes, obesity, and healthy lifestyle concepts; Health screening activities related to NCDs risk factors (obesity, smoking hypertension); Importance in understanding the screening procedures and interpretation of results (BP and BMI); Community engagement.	No dedicated attitudinal training or metrics reported.	BP measurement; Basic lifestyle counselling; Referral initiation; Follow-up support;	Need for repeated practice; Time limitations; Lack of training attendance; Inadequacy (perceived) of training content.	Correlation between effective training and improved screening practices; Engagement and performance increased with satisfaction regarding the quality of the training.	Include practical drills; Embed mentorship; Focus on CHW-relevant scenarios; Provide access to standardised training for all CHWs before service; Practical training modules should be comprehensive and should include what CHWs perceive as relevant and useful; Interactive, skills-based components should be included; Periodic evaluations and updates of training materials based on CHW feedback and performance outcomes should be done.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Mandla et al. [48]	Bangladesh	Drama, songs, participatory storytelling, local-language training; Development of skill domains (knowledge and clinical skills, behaviour change, care delivery); Mapping existing evidence of CHW training materials; Training manuals; Flipcharts; PowerPoint modules; Workbooks.	CVD and NCDs risk factors, stroke awareness, prevention strategies; General NCDs knowledge and risk factors; Knowledge of CHW role, community mobilisation.	No dedicated attitudinal training or metrics reported.	Outreach education, individual counselling, stroke risk communication; Lifestyle behaviour change health education; Care delivery skills (service coordination).	CHWs lacked materials and refresher training; Training materials fragmented (lacks clarity and cohesion); Limited differentiation between CHWs and other professionals; Gaps in training with regard to behavioural and practical competencies, mostly didactic/manual based.	Community engagement was strong; Strong policy frameworks available in Bangladesh; Supported training materials and platforms; Good community trust and access.	Use locally resonant educational tools; include booster sessions for skill retention; Role-specific training packages should be developed for CHWs; Content should be expanded in behaviour change and practical delivery skills; Include interactive skills-based methods; Labelling and sequencing of modules to use materials in the correct order; Update content regularly and integrate feedback loops; Ensure mentorship, supportive supervision and ongoing learning opportunities after training.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Ndejjo et al. [49]	Uganda	Interactive workshops; Mobile health materials; Fieldwork supervision; Didactic and experiential learning; Feedback mechanisms and frequent supervision.	Basic NCDs concepts, behavioural risk factors, signs and symptoms. CVD risk factors; Healthy lifestyle education (exercise, tobacco use, nutrition); Health education tools and materials; Basic CVD knowledge.	No dedicated attitudinal training or metrics reported.	Community sensitisation, BP screening, health messaging; Community education sessions; Identification and referral of at-risk individuals; Use of screening and counselling tools; Maintaining contact with community members for follow-up.	Unclear scope of CHW roles; Need for refresher training and ongoing support; Inadequate and inconsistent training; Resource limitations; Variation in CHW experience and literacy levels.	Strong initial and refresher training increased the CHW capacity; Ongoing mentorship and on-the-job learning; Community trust; Flexibility of the training programme tailored to the CHWs' needs and contexts.	Clarify CHW roles, blend training with field exposure and regular check-ins; Training should include theoretical and practical components; Interactive methods to be incorporated (role-play, demonstrations); Refresher training and supervision should be in place; Content to be tailored to the varying educational levels and local context; Communication, motivation and basic monitoring tools should be included in the modules; Community engagement skills to be emphasised.
Nebhinani & Saini [50]	India	Step-by-step manuals; Translated materials; Peer support Groups; CHWs that previously received NCDs training (not a lot of information on design etc.).	NCDs risk and behavioural modification; Hypertension and CVD education; Early detection.	No dedicated attitudinal training or metrics reported.	Community outreach; Structured counselling; Screening; Blood pressure monitoring and blood glucose; Waist circumference measurement.	Shortage of visual tools, inadequate training duration; Inadequate and lack of refresher courses; Skills gaps in physical examination assessments; Limited time and resources.	Positive attitude and basic competency in some clinical tasks; Previous exposure to NCDs training improved knowledge and confidence.	Include translation aids; Offer group-based refresher sessions; Develop and implement refresher training on NCDs; Focus on skills-building; Emphasise behaviour change communication; Include hands-on sessions for anthropometric measurements.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Okop et al. [8]	South Africa & Cameroon	Standardised, in person training; Training is culturally contextualised; Participatory in nature and supervised practice.	Basic knowledge of CVD risk factors (hypertension, smoking, obesity); Basic physiology and NCDs prevention; Interpretation of WHO risk charts; Digital tools used for risk scoring; BP measurement; Patient communication.	No dedicated attitudinal training or metrics reported.	Correct measurements of BP, BMI and waist circumference; Good communication skills; Correct referral and documentation; Use of mobile health support tools.	Low CVD awareness in communities; Resource constraints; Infrastructure varies; Work overload for CHWs.	Stakeholder and community engagement; Integration with existing health systems; Simple mHealth support tools; Participatory design fosters local ownership.	Embed CVD screening within NCDs task-shifting; Practical training should be hands-on. Modules should include communication, health education, referral protocols; Refresher training and mentorship to be done; Local context to be incorporated.
Onagbiye et al. [51]	South Africa	Inferred - Structured classroom sessions; Inferred - Interactive practical activities; Handouts; Culturally appropriate educational text messages.	Chronic illness and wellness; Healthy lifestyles (nutrition and physical activity); Risk factors associated with NCDs (hypertension & diabetes); Motivational interviewing techniques.	No dedicated attitudinal training or metrics reported.	Motivational interviewing; Communication skills.	Absence of standardised training curriculum for CHWs in South Africa; Short duration of training (4 days); Lack of refresher training opportunities; Lack of structured follow-up mechanisms orsupervision.	Use of culturally appropriate training strategies - local language, handouts & educational text messages; Incorporation of motivational interviewing techniques; Provision of reinforcement tools and continuous learning aids (handouts and manuals).	Develop and implement regular refresher training programmes; Consult existing educational and training material; Incorporate mechanisms for ongoing mentorship and supportive supervision; Counselling techniques and patient-centred care.
Puoane and Bradley [52]	South Africa	Participatory; Hands-on training and practical demonstrations; Peer learning and interaction; Didactic lectures; Visual aids; Case studies.	Physical activity promotion; Nutrition and healthy eating practices; Early markers for NCDs; Preventive measures for NCDs; Identification of modifiable risk factors; Health promotion and behaviour modification strategies; Methods for disseminating key health messages.	No dedicated attitudinal training or metrics reported.	Anthropometric measurements; Blood pressure measurements; Assess and analyse lifestyle habits; Communication and community engagement skills; Leading community exercises.	CHW misconceptions about causes and treatment of NCDs; Socio-cultural perceptions of NCDs and risk factors.	The training facilitator was familiar with the local language and cultural norms; CHWs were trained to act as role models.	Integrate culturally appropriate methods; In-depth orientation on community-specific cultural beliefs and perceptions; Implement monitoring and evaluation frameworks.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Puoane et al. [53]	South Africa	Hands-on practice; Simple language; Local language; Peer learning; Participatory learning experiences.	CVD and related risk factors; Physiological markers; Importance of early detection and nutrition.	No dedicated attitudinal training or metrics reported.	Risk screening tool; Blood pressure measurements; Anthropometric measurements; Patient referrals; Data collection tools.	Short training duration; The language of instruction is not always understandable; Lack of standardised/organised training curriculum.	Community-based approach; CHW motivation; Supportive supervision and mentorship; Structured training programme; Screening tool deemed user friendly; CHW integrated well with the health system.	Use longer, modular training; Refresher training; Multilingual resources needed for training, assessment/and evaluation; Include referral and patient education protocols; Feedback for responsive adaptation of the curriculum.
Seneviratne et al. [24]	Low- and middle-income countries	Systematic review; Brief sessions; Multi-week courses; Face to face instruction; Blended learning; Group activities; Ongoing supervision and mentoring; Role-plays; Peer learning; Manuals; Visual aids; Mobile tools.	Basic CVD & Type 2 Diabetes Mellitus (T2DM) knowledge: causes, symptoms, prevention; Risk factors (diet, physical inactivity, obesity, smoking, hypertension); Screening protocols and interpretation of values; Health education principles.	No dedicated attitudinal training or metrics reported.	Screening (BP, BMI, BG); Health education (diet, adherence, exercise); Referral to clinics; Disease management; Behavioural counselling; Follow-up and home visits.	Inconsistencies in training duration and quality; Weak supervision and mentoring; Curriculum not standardised; Lack of incentives; Financial constraints; Decreased CHW literacy; CHW roles not integrated into the health systems.	Use of culturally relevant and interactive training methods; CHWs embedded in the communities builds trust; Use of mobile health tools; Multisectoral support; Ongoing supervision and refresher training.	Curricula should be standardised and yet adaptable; Content should include: biomedical core content on NCDs; Behaviour change communication techniques; Local relevance; Culturally appropriate; Practical skills development (counselling, referral, screening); Provide: Supportive supervision and mentorship, performance monitoring, CHW career development, initial and refresher training, training to be embedded in national health system frameworks.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Shukla et al. [54]	India	Participatory; Hands-on training and demonstrations; Peer learning; Didactic lectures; Visual aids; Case studies.	Physical activity promotion; Nutrition and healthy eating practices; Early markers for NCDs; Preventive measures for NCDs; Identification of modifiable risk factors; Health promotion and behaviour modification strategies; Methods for disseminating key health messages.	No dedicated attitudinal training or metrics reported.	Anthropometric measurements; Blood pressure measurements; Assess and analyse lifestyle habits; Communication and community engagement skills.	CHW misconceptions about causes and treatment of NCDs; Socio-cultural perceptions of NCDs and risk factors.	Positive attitude towards NCDs programmes; Community trust; Perceived importance of NCDs management.	Strengthen referral process; Reinforce supervision; Update knowledge regularly; Incorporate community-driven scenarios.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Stoutenberg et al. [55]	South Africa	Step-by-step scripts; Mentorship in client conversations; Supportive goal logs; Trained through an accredited CHW certificate programme; Included basic language and math test; Competency-based interviews; Training was practical, skills-based and context-specific.	Lifestyle interventions for CVD risk reduction, goal-setting, physical activity guidelines; Hypertension symptoms and risk factors; Benefits of exercise; Screening (use of BP monitors, waist circumference); NCDs prevention; Community engagement.	No dedicated attitudinal training or metrics reported.	Client goal-setting, motivational interviewing, behaviour tracking; Home visits; BP and waist measurements; Exercise assessments; Counselling (brief); Referral.	Behaviour change is slow and CHWs require long-term mentoring; Environmental limitations (safety); Need for supervision; Logistical resource constraints.	Accredited, standardised, formal training; Community participation; Youth employment integration; Supportive institutional framework.	Use structured MI scripts, train supervisors to support CHWs through ongoing mentoring; CHW training to be embedded within nationally recognised and accredited frameworks; Practical skills should be emphasised: (anthropometric measurements, BP measurements, counselling, community engagement strategies); Core modules: NCDs basics (hypertension & exercise) and communication & behaviour change; Refresher training to be provided; Supportive supervision to be provided; Curriculum should be tailored to environmental challenges CHWs may face during home visits.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Weir et al. [56]	Malawi	Lectures; Small group activities; Skills practice sessions; Role-play; Case studies; Interactive, hands-on and reflective learning activities	Blood pressure monitoring; Stroke education; Recognising stroke risk factors; Referral criteria; COVID-19 precautions and infection prevention.	No dedicated attitudinal training or metrics reported.	Rehabilitation care skills; Referral and decision-making skills; BP monitoring; Documentation of health data.	Equipment shortages; Transport issues.	Support from the hospital and stakeholders; Provision of training, supplies and equipment; Facilitation of peer learning and collaborative problem-solving; A holistic approach to training. Community respect; Hospital collaboration.	On-site training; Address logistics proactively; Incorporate structured feedback from CHWs to ensure the curriculum remains responsive; Integrate broader clinical reasoning, preventive care strategies, patient self-management, and rehabilitation techniques; Incorporate long-term follow-up of CHWs; Foster collaborative curriculum development and stakeholder engagement.

Table 1 (continued)

Author & Year	Country	Domain 1: Training Approaches	Domain 2: Knowledge	Domain 3: Attitudinal	Domain 4: Practice	Implementation Considerations		Recommendations for Curriculum Design
						Domain 5: Barriers	Domain 6: Facilitators	
Williams [57]	South Africa	Group discussions; Use of images; Layered information delivery; CHWs attended a 4- day training course involving chronic diseases and lifestyle related interventions; no refresher or follow-up training.	Health literacy; NCDs communication; Patient empowerment strategies; Basic knowledge of chronic diseases (hypertension & diabetes); Lifestyle related risk factors (inactivity, poor diet etc.).	No dedicated attitudinal training or metrics reported.	Counselling, use of pictorial aids, personalised risk messaging. Support groups; Home visits; Adherence monitoring; Lifestyle advice and medication.	Health literacy gaps; Short training duration; Lack of refresher courses; Curriculum not standardised; Low baseline education for CHWs; Poor support and supervision.	CHW enthusiasm; Community trust and participation; Partnerships with local hospitals; CHW willingness to learn.	Use pictorial tools; Tailor messages to literacy level; Include risk communication training; Extend training duration; Curriculum to be standardised; Training should include: risk factor education and screening, behaviour change counselling and rehabilitation and palliative care; Include refresher training; Ensure supportive (not punitive) supervision; Training and training materials should match the CHW literacy and educational levels; Using visual, scenario-based, or experiential learning methods.

counselling must be a core component of CHW training. In addition, data literacy remains underdeveloped. A global review noted that the challenge of using collected data reflects wider gaps in data literacy at the health system and community levels [65]. The use of tablets and software to conduct CVD screenings by CHWs is not a new concept [39, 66, 67], however the success hinges on effectively training the CHWs to interpret and act on the information correctly as mentioned in a Colorado study using the Framingham risk score to counsel patients [64].

The second pillar, *Community Engagement*, emphasises the need of building trust and relevance through CHW-community dialogue. The review found that community engagement is not systematically embedded in CHW training or programme design. A study conducted in Sussex [63], whereby CHWs co-designed interventions with community members, which resulted in tailored messages to local needs through participatory mapping and focus groups, proved to be successful. This approach, however, has been found to be the exception rather than the rule. It is also essential that training prepares CHWs to navigate and align interventions with cultural beliefs [8, 39, 41, 43–45, 51, 52]. In a Colorado study, CHWs worked in community venues like churches, enabling them to deliver care that was adapted to the culture of the community [64]. The literature underscores the value of CHWs as 'cultural mediators', reinforcing the need for culturally grounded training content that bridges traditional health beliefs with biomedical frameworks [68].

The third pillar, *Health Systems Framework*, explores how CHWs connect individuals to services, referrals and follow-up care. System navigation has been proved to be a

Table 2 Summary of first-level analysis

Domain	Recurring themes	Summary of results
1. Training approaches	**1.1 Structured training programmes**	Multiple studies used formal training programmes that were designed around structured curricula. These were often conducted through workshops or classroom-based sessions that included both theoretical knowledge and practical components. For example, Puoane et al. [53] described a structured programme in South Africa (SA) where CHWs were trained to use a non-invasive, validated CVD risk screening tool. Similarly, Agarwal et al. [42] and Weir et al. [56] emphasised competency-based pre-and-post training models focused on lifestyle modifications, blood pressure monitoring and correct referral protocols. In the systematic review by Abdel-All et al. [39], structured training was also acknowledged as a key feature in effective CHW interventions across LMICs.
	1.2 In-service and refresher training	Some studies reinforced continuous capacity-building through periodic refresher courses and in-service training. Abrahams-Gessel et al. [41] and Lourdes et al. [47] reported that periodic refresher training reinforces training content. In Shukla et al. [54], accredited social health activists (ASHAs) in India had previously undergone NCDs training, which was later supplemented by local, informal sessions. Stoutenberg et al. [55] used a modular format in their feasibility study, which gradually introduced concepts such as hypertension screening and exercise training. Limbani [46] conducted a realist evaluation proving that iterative training and reflective practice helped embed new skills and knowledge.
	1.3 Technology enhanced learning	While the majority of the studies were delivered in person, a few studies used mobile or digital platforms. For example, Agarwal et al. [42] included mobile based refresher modules as part of their blended learning approach which proved improved knowledge retention and scalability. The study by Abrahams-Gessel et al. [41] used handheld devices by CHWs for real-time data collection and health screening during their visits, proving promising results.
	1.4 Task-shifting and integration into PHC	Training approaches were often embedded within task-shifting strategies which aimed at enhancing CHWs responsibilities in NCDs and CVD prevention. Joshi et al. [44] presented case studies on how CHWs were trained to expand their roles in CVD risk management. In Galvez et al. [43] Malawian CHWs were trained to monitor blood pressure and provide rehabilitation support, reflecting a shift of clinical tasks to non-professionals. Mandla et al. [48] explored a collaborative skills development initiative for PHC teams in Bangladesh, enabling CHWs to support CVD prevention activities. The systematic review done by Abdullah et al. [40] also supported this approach, reinforcing how task-shifting strategies often require context-specific and targeted training for CHWs.
	1.5 Training through supervision and mentorship	Several studies reported that training was sustained through supportive supervision and mentorship. Limbani [46] pointed out how regular supervision and contextual feedback improved fidelity to the intervention. Williams [57] described the value of supervision and mentorship in improving CHW competency and retention. Ndejjo et al. [49] found by using the Consolidated Framework for Implementation Research (CFIR) that ongoing supervision contributed to the success of a community-based CVD prevention programme. Lastly, Puoane and Bradley [52] described community-based participatory training that relied on community mentorship and group learning rather than formal instruction with promising results.

Table 2 (continued)

Domain	Recurring themes	Summary of results
2. Knowledge	**2.1 Foundational knowledge of NCDs and stroke**	Across the studies, CHWs were trained to understand the underlying causes, disease mechanisms, and progression of NCDs, including hypertension, CVD and stroke. The training content in general included definitions, risk factors, warning signs and complications of the mentioned conditions [17, 50, 57]. More specifically, several studies emphasised stroke-related knowledge, including recognition of early symptoms and timely referral [41, 51]. The link between behavioural risk factors and disease development was also emphasised throughout the studies. Community health workers were taught how factors such as uncontrolled hypertension and diabetes contribute to CVDs and strokes [42, 52]. This foundational knowledge allowed for CHWs to deliver appropriate health messages and to recognise individuals at risk of CVD and stroke based on their history and symptoms[43, 47]. Some articles paired this knowledge with practical demonstrations; however, the theoretical component served to equip CHWs with a foundational knowledge of NCDs and stroke, enhancing their ability to educate their patients and communities on early warning signs and prevention of these conditions[45, 54].
	2.2. Lifestyle modification and health promotion	A large percentage of studies included content on modifiable risk factors. CHWs were trained to identify and explain how lifestyle factors such as poor diet, alcohol use, smoking, stress and lack of exercise contribute to the development and progression of NCDs [17, 42, 47, 54]. Trainings in these studies commonly included strategies for community-level health promotion, individual health education and the use of educational tools to encourage behaviour change[41, 52, 57]. For example, CHWs in India and Malaysia were trained to deliver individualised health education related to diet, exercise and smoking cessation [47, 54]. Communication strategies were also included, especially in low-literacy populations. Studies from SA especially emphasised culturally relevant health education and motivation interviewing techniques [52, 57]. Furthermore, CHWs in Brazil received training on how to deliver impactful preventive health education in a household and in group settings [17]. This component of knowledge building and training was often paired with skills in facilitation, using educational tools such as flipcharts, posters and interactive methods to improve community engagement and retention of health information.
	2.3 System navigation and referral pathways	Many studies trained CHWs to serve as critical links between the community and the health system. Training included knowledge of when and how to refer individuals at risk of CVD and stroke, what documentation to complete and how to support patients afterwards [46, 49]. Studies in Uganda and SA specifically incorporated structured referral guidelines and feedback mechanisms to ensure identified at-risk individuals were successfully linked to the appropriate healthcare services [46, 49]. CHWs in Bangladesh were taught how to complete referral forms and communicate effectively with their supervisory staff [48]. Similarly, in India, referral and reporting procedures and health system integration were emphasised to improve communication between CHWs and facility staff members [44]. Accurate documentation and record-keeping skills was another core focus area in several studies, aiming to improve and standardise referral practices [45, 58].
3. Attitudes	Across the reviewed studies, no explicit dedicated training modules addressing CHW attitudes towards NCDs and stroke prevention and management were identified. Attitudes were often inferred indirectly through qualitative findings, or as a result of the training, such as CHW motivation, responsibility and confidence, rather than being measured as a distinct outcome. Only three studies emphasised the importance of attitudinal readiness in CHW performance. Shukla et al. [54] for example, reported that ASHAs demonstrated high motivation to participate in NCDs programmes, but highlighted the absence of training aimed at developing health attitudes. Likewise, Lourdes et al. [47], found that CHW believed in the value of their role as a significant facilitator of successful screening activities within Malaysia's Komuniti Sihat Pembina Negara (KOSPEN) programme, ultimately recommending the inclusion of attitudinal content in training programmes. In the systematic review by Abdel-All et al. [39], called for comprehensive training strategies that go beyond knowledge and skill development to address attitudinal and motivational components necessary for CHW engagement. This finding underscores a critical oversight in CHW training programme design. Technical knowledge and clinical competencies are frequently highlighted, while attitudinal development remains underrepresented.	
4. Practices	**4.1 Screening and basic monitoring**	This theme emerged the most from all the studies in the review. CHWs were trained to measure blood pressure, conduct CVD risk screening and observe basic clinical signs of hypertension and diabetes. In SA and India, training ensured that CHWs could perform these procedures adequately in clinic or household settings [42, 43, 53, 56]. In other LMICs including Brazil, CHWs regularly used non-invasive screening tools which contributed to early detection efforts [17, 41].
	4.2 Health promotion	Health promotion and education was another major theme that emerged from the data. CHWs delivered health education targeted at modifiable risk factors such as smoking, poor diet, and lack of exercise. These messages were conveyed through one-on-one sessions, group counselling, or the use of educational tools such as posters and flipcharts. In India and Malaysia, CHWs championed structured educational campaigns in households and communities [47, 54], while in SA and Bangladesh, health education was culturally adapted to local contexts [48, 52].
	4.3 Referral practices	In many studies, CHWs were trained to identify individuals needing urgent care and refer them to the appropriate facilities. In SA, Uganda and India, structured pathways and supervisory support were established to guide CHWs through documentation and follow-up [44, 46, 49]. This ensured continuity of care and improved CHWs' integration with facility-based health services.
	4.4 Data collection and reporting	Collecting data and reporting information formed a critical part of CHW practice in several studies. Accurate completion of referral forms, summary reports, and registers was done in multiple training sessions. Studies in SA and India highlighted the importance of routine documentation for both supervisory feedback and monitoring CHW performance [45, 50, 58]. In some studies, CHWs used simple digital tools to facilitate real-time reporting [55, 57].

Table 2 (continued)

Domain	Recurring themes	Summary of results
5. Implementation considerations barriers	**5.1 System and resource constraints**	Several studies made specific reference to systemic limitations that hindered CHW effectiveness. Lack of basic screening tools and equipment such as blood pressure monitors was highlighted in both Ugandan and South African contexts [49, 53]. Furthermore, supply chain issues and inadequate support infrastructure made it difficult to maintain consistent service delivery [55].The systematic review by Abdullah et al. [40] furthermore reported health system fragmentation and insufficient integration of CHWs into the healthcare sector caused major bottlenecks. These systemic issues were worsened by limited financial support for programmes, as highlighted in Abrahams-Gessel et al. [41], where resource restrictions reduced the effectiveness of the CHW-led interventions.
	5.2 Training limitations	Inconsistent and inadequate training emerged as a recurring barrier in this review. Lourdes et al. [47] found that the lack of standardisation in CHW training reduced the programme effectiveness, especially if attempted on a large scale. Both systematic reviews [39, 40] pointed out that the training content was often too general or not tailored to the specific disease burden or community context. Furthermore, Ji et al. [17] reported gaps in continuing education, ultimately limiting the application and retention of knowledge. Seneviratne et al. [24] noted that a lack of mentorship and feedback undermines efforts to build sustainable CHW capacity, especially in LMICs.
	5.3 CHW-level barriers	On a CHW level, limited incentives, competing responsibilities and a lack of formal career progression pathways emerged as demotivating factors. The study by Shukla et al. [54] and Joshi et al. [44] emphasised role overload and burnout as barriers to CHW participation, particularly when NCDs and stroke responsibilities were layered onto existing health duties like maternal and child health. Limbani [46] ultimately proved that without strong supervision and motivation, CHWs were less likely to perform consistently with hypertension management tasks.
	5.4 Community- related barriers	A multitude of studies identified barriers occurring from community related dynamics. Low health literacy, resistance from community members and cultural stigma associated with NCDs negatively affected CHW outreach efforts [43, 46]. In some settings, communities expressed limited trust in CHWs, especially when the latter lacked visible ties to the formal health sector [59]. In addition, Abrahams-Gessel et al. [41] found that the community were more receptive when CHWs were familiar, locally recruited and trained to address and respect local practices and beliefs.
6. Implementation considerations - Facilitators	**6.1 Supervision and support systems**	Multiple studies proved that strong supervisory and feedback structures were key facilitators of effective implementation. Limbani [46] reported that consistent mentorship and performance monitoring increased CHW engagement and ensured cooperation with hypertension management protocols. Similarly, Agarwal et al. [42] pointed out the importance of structured support after the initial training, which ensured that CHWs reinforce their learning and manage practical challenges in real time. In the study by Shukla et al. [54], supportive supervision was positively linked to increased motivation and performance among ASHAs engaged in NCDs prevention efforts.
	6.2 Community engagement and trust	Facilitators at the community level were essential to enabling CHW effectiveness. In the study by Galvez et al. [43], CHWs who were recruited locally and trained to use culturally appropriate messaging were more readily accepted by the communities, resulting in improved uptake of screening services. Similarly, Williams [57] proved that community members were more receptive to engage with CHWs who had existing social relationships and demonstrated respect and empathy in their interactions. Trust in CHWs was further supported by the CHWs' presence in the households and their ability to offer much needed basic care and guidance in patient friendly, accessible ways [52].
	6.3 Integration into health systems	Studies that successfully embedded CHWs within existing health systems proved greater implementation success. Ndejjo et al. [49] found that aligning CHW roles and responsibilities with district-health priorities and ensuring effective referral guidelines, enhanced the collaboration between facility and community-based providers in Uganda. Similarly, Okop et al. [58] emphasised the value of participatory planning and stakeholder engagement in strengthening CHW integration, while Seneviratne et al. [24] pointed out that supportive policy and government ownership contributed to programme viability across middle and LMICs.
	6.4 Training relevance and structure	It is evident throughout the studies that the design and delivery of the training itself also influenced implementation success. The systematic review by Seneviratne et al. [24] found that when trainings were aligned with local epidemiology and included active learning strategies - including, but not limited to role-plays, motivational interviewing and case scenarios - CHWs retained information more effectively and were more confident in applying their new-found knowledge and skills. Lourdes et al. [47] pointed out that embedding accountability and emphasising CHW responsibility during training, improved both their knowledge acquisition and commitment. Interestingly, training that was modular, responded to real-life realities and that was interactive was identified as a key enabler in Agarwal et al. [42] and Shukla et al. [54].

major gap, consistent with the theme that CHWs are not adequately trained to navigate complex referral systems and fragmented services [69, 70]. CHWs in an American study screened and then referred patients to medical services, ensuring linkage of services [64]. While this model shows the potential of CHWs as navigators, similar skills are rarely emphasised in LMIC training. Role clarity remains a challenge as CHWs report role confusion, and training often lacks clarity on how they interface with other healthcare professionals [24, 40, 41, 44, 46, 48, 71]. In India, the ASHA training programme explicitly states that NCDs tasks should complement existing roles [39], while global frameworks stress the need for role definitions aligned with CHW competencies [68]. In some

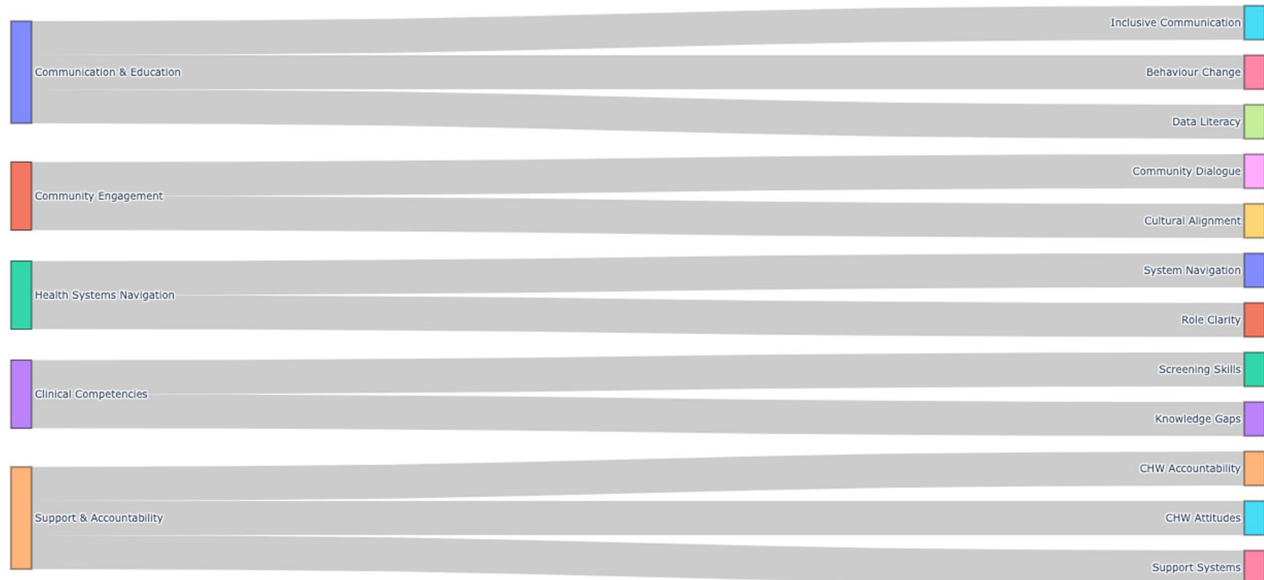

Fig. 2 Visual mapping of cross-study themes into curriculum pillars

trainings, role expectations and supervision structures are included, but most LMIC training lacks this clarity.

The fourth, *Clinical Competencies* pillar, includes the core theoretical and practical skills required for CVD and stroke screening, prevention and referral. Screening skills are dominant in most CHW programmes, although the depth of training differs [24, 40–43, 47, 49, 50, 52, 55, 58, 71]. In rural India, ASHAs were trained in blood pressure and glucose management, and after training, improved competence was measured [26]. However, significant knowledge gaps remain in CHW training. Context-specific knowledge on stroke and CVD is often lacking, especially cultural beliefs and local disease narratives. An American study created the Stroke Literacy Assessment Test (SLAT) to measure CHW knowledge, noting a lack of validated tools for assessing CHW competencies [72]. This underscores that CHW training should build foundational CVD/stroke knowledge. In India, the ASHA curriculum on NCDs significantly enhanced CHWs understanding of hypertension, diabetes and cancer screening [26]. Clearly, research exists on CHW training programmes and NCDs, however programmes that address stroke and CVD in-depth, are lacking.

The final pillar, *Support and Accountability* focus on the systems and structures that sustain CHW motivation and performance. The review found that there is limited implementation of accountability and supervisory frameworks to support CHWs, making accountability limited [24, 41, 42, 51, 55, 57]. The frontline health performance measurement framework emphasises service tracking and performance by quality indicators [65], however is not widely used. The Colorado programme's electronic system also tracked CHWs' caseloads and referral outcomes [64], which implicitly held CHWs accountable for follow-up. Explicit references on CHW accountability are sparse as few LMIC programmes have embedded these mechanisms in training or supervision.

CHW attitudes are often neglected as explicit components of CHW training as found in the review. CHW training rarely addresses confidence-building or attitude shifts essential for community interaction. Evidence from LMICs, such as India, shows that ASHAs report increased self-confidence and job satisfaction following NCDs training [26]; these positive shifts are unintended outcomes rather than a structured goal to training. Reviews emphasise the importance of fostering respectful, empathetic and responsible attitudes, yet most training does not include specific modules aimed at building these attributes. Rather, self-efficacy, motivation and improved attitudes tend to emerge as by-products of content or skill-based training, not as a result of deliberate pedagogical focus [50, 54, 73]. It is clear that CHW attitudes can indeed improve through training exposure, however, this domain is underrepresented and should be formalised in future training development efforts.

Finally, support systems have been found essential for sustainability of CHW training programmes [4, 12, 74]. However, in this review, it was found that peer support systems and supervisory structures are largely absent in CHW programmes [40–42]. Poor supervision, support and remuneration are recurring themes throughout the evidence with regard to CHW training [24, 41], while

Table 3 Summary of second-level analysis

Curriculum Pillar	Cross-cutting Theme	Full Theme Description
1. Communication & Education	**1.1 Inclusive Communication**	CHW training lacks tailored communication strategies for low-literacy and multilingual communities
	1.2 Behaviour Change	Behaviour change communication techniques are underrepresented in existing CHW training
	1.3 Data Literacy	CHWs receive limited training on collecting, interpreting, and reporting health data
2. Community Engagement	**2.1 Community Dialogue**	Community engagement is not systematically embedded in CHW training or programme design
	2.2 Cultural Alignment	Training fails to integrate traditional health beliefs with biomedical approaches to stroke and CVD
3. Health Systems Navigation	**3.1 System Navigation**	CHWs are not adequately trained to navigate complex referral systems and fragmented services
	3.2 Role Clarity	CHWs report role confusion, and training often lacks clarity on how they interface with formal providers
4. Clinical Competencies	**4.1 Screening Skills**	Basic screening skills for stroke and CVD are included in most CHW programmes, though depth varies
	4.2 Knowledge Gaps	Context-specific knowledge about stroke and CVD is often missing, especially cultural beliefs and local disease narratives
5. Support & Accountability	**5.1 CHW Accountability**	There is limited implementation of accountability and supervisory frameworks to support CHWs
	5.2 CHW Attitudes	CHW training rarely addresses confidence-building or attitude shifts essential for community interaction
	5.3 Support Systems	Peer support systems and supervisory structures are largely absent in CHW programmes

CVD programme reviews recommend peer mentoring, fair remuneration and ongoing refresher training [75, 76]. These findings reinforce the need for structured support mechanisms to enhance CHW performance and retention.

Limitations

A limitation of this review is the lack of standardisation in various terminology used across the included studies. The term 'CHW' was used inconsistently, with various country-specific terms such as 'ASHA' in India or Female Health Worker (FHW) in other contexts used to describe similar cadres. While efforts were made to include all relevant roles, the lack of the standardised term for 'CHW' posed challenges during the search and selection of the data. Furthermore, concepts within the KAP framework – particularly 'attitudes' and 'practices' were variably defined. In several studies, practices were often labelled as skills and attitudes were not clearly articulated, which may have influenced data categorisation and limited cross-study comparability.

Conclusion

This Integrative Literature Review proves that while CHWs are increasingly recognised as key role players to NCDs prevention, most training programmes remain broad in focus and do not address the specific competencies needed for stroke and CVD prevention. Using the five curriculum pillars – Communication and Education, Community Engagement, Health Systems Navigation, Clinical Competencies and Support and Accountability, this review found critical gaps in CHW training, particularly related to CHW attitudes. CHW motivation and confidence often improved after training, however these attitudinal shifts are incidental and not explicitly taught. There is a need for training programmes focussing on attitudes and behavioural counselling techniques, which are culturally appropriate and context-specific to support CHWs in their roles. This will improve community health outcomes and strengthen the sustainability of CHW-led interventions for CVD and stroke prevention in LMICs.

Abbreviations

ADDIE	Analysis, Design, Development, Implementation and Evaluation
ASHA	Accredited Social Health Activists
CHWs	Community Health Workers
CFR	Consolidated Framework for Implementation Research
CVD	Cardiovascular Disease
FHWs	Female Health Workers
HBCs	Home based carers
HREC	Health Research Ethics Committee
KAP	Knowledge-Attitude-Practice
KOSPEN	Komuniti Sihat Pembina Negara
LHWs	Lay health workers
LMIC	Low-Middle-Income Country
NCDs	Non-Communicable Diseases
NuMIQ	Quality in Nursing and Midwifery
NWU	North-West University
PHC	Primary Health Care
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SLAT	Stroke Literacy Assessment Test
T2DM	Type 2 Diabetes Mellitus

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Authors' contributions
SB, LK, TR and KF conceptualized and discussed the scope and design of the research. SB and LK conducted the searches and discussed the strategy used with TR and KF. LK oversaw the methods of analysis. SB and LK led the writing of the paper, and SB, LK, TR and KF critically reviewed the article. All authors approved the final version of the manuscript.

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Data availability
Additional data and materials are not available as the results of the data synthesis are fully referenced within the article however matrices used in critical appraisal can be provided on request.

Declarations

Ethics approval and consent to participate
The author obtained approval from the Quality in Nursing and Midwifery (NuMIQ) scientific committee and the NWU Health Research Ethics Committee (HREC), with ethics number NWU-00003-23-A1.

Consent for publication
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Competing interests
The authors declare no competing interests.

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