

Community Health Worker Program Characteristics and Population Health Outcomes: A Scoping Review

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Abstract

Community health workers (CHWs) are crucial for strengthening primary health care and reaching underserved populations. However, variations in program implementation lead to differing outcomes. This scoping review maps evidence on CHWs program characteristics, supervision, technology use, service delivery approaches, and associated health outcomes across global contexts. A scoping review was conducted to examine the primary studies that focused on CHWs program characteristics and their relationship with population health outcomes. A systematic search was conducted across three major databases—Web of Science, Scopus, and CINAHL—guided by the framework of Arksey and O'Malley. After screening titles and abstracts, 103 full-text articles were assessed for eligibility, and 31 studies were included in the final analysis and synthesis. Thirty-one studies from sub-Saharan Africa ($n = 18$), North America ($n = 10$) and Asia ($n = 3$) were included. Six distinct supervision models were identified, with outcomes ranging from 7–9% visit completion under minimal supervision to 86% blood pressure control with real-time telehealth supervision. The training duration varied from 3 days to 100 h, with no consistent relationship between duration and effectiveness. Technology integration enhances CHW performance when combined with adequate supervision and training. Five service delivery models demonstrated differential effectiveness: home-based models achieved significant improvements in maternal-child health and chronic disease management; facility-integrated approaches showed the strongest evidence for high-utilization patients with multiple chronic conditions; hybrid telehealth models achieved superior outcomes (86% vs. 44% blood pressure control, $p < 0.001$) compared to facility-based care, community-based distribution expanded access in remote areas, and team-based integrated care improved quality of care and reduced hospitalizations by 65–69%. CHW program effectiveness depends critically on implementation quality rather than program presence alone. Enhanced supervision, competency-based training, strategic technology integration, appropriate service delivery model selection, and sustainable financing are essential for achieving positive health outcomes.

BACKGROUND

Community Health Workers (CHWs) have increasingly been viewed as a fundamental element of global health systems, particularly for the strengthening of primary health care as well as the delivery of services to populations with unmet health needs or marginalized populations. Global evidence has shown that CHWs contribute to reductions in child mortality by either managing childhood illnesses (i.e., pneumonia, malaria, and neonatal sepsis) or promoting preventive interventions such as immunization [1]. For example, in Tanzania CHW-led programming has enabled improved, timely access to curative care for children under five years of age; however, it has not demonstrated the same success in relation to the utilization of maternal and newborn services within health facilities [2]. Such differences demonstrate that the effectiveness of CHWs is contextual and can be influenced by program design, level of integration in formal health systems, and community engagement.

In addition to maternal and child health, CHWs have been shown to effectively manage chronic diseases in various settings. For example, CHW interventions in the United States have been associated with

better asthma control, fewer days of asthma symptoms, and improved quality of life in adults [3]. CHWs have also been effective in improving outcomes among individuals with diabetes and high blood pressure, leading to improved disease management and reduced overall health system costs [4]. This evidence indicates that CHWs not only improve individual health outcomes but also contribute to improvements in efficiency and sustainable public health systems across the spectrum of high-, middle-, and low-income countries.

Moreover, CHWs play a role in promoting health equity by addressing the social and structural barriers that hinder marginalized groups from receiving necessary health services. They work to change the social determinants of health for community empowerment and continuity of care [5, 6]. For example, CHW programs in South Africa have increased access to chronic care, social support, and minor acute care services in urban localities [6]. Ensuring sustained impacts requires supportive policies, supervision, and fair labor conditions to mitigate rates of attrition and burnout for CHWs [7]. Therefore, for CHW programs to be successful in achieving long-term population health objectives, institutionalization is required within the health system.

Due to the vast array of CHW models, contexts, and global impacts, it is important to conduct a scoping review that analyzes and maps the available evidence on CHW outcomes and impacts. Mapping the available evidence enables researchers and policymakers to understand the existing clusters of evidence, provides opportunities to point out knowledge gaps, and synthesizes the findings so that while situated in one context, it will inform the design of future programs and policies [8, 9]. This scoping review differed from a traditional systematic review that assessed evidence related to effectiveness in that scoping reviews will bring a broader understanding of the scope, nature, and breadth of evidence. This is highly valuable given the complexity and multifaceted contributions of CHWs, especially when health systems seek sustainable, community-based solutions for tackling global health problems [10]. As such, this study was conducted to map the available evidence related to CHWs, population outcomes, and impacts.

METHODS

The review was completed using the five-stage methodological framework described by Arksey and O'Malley (2005) and developed by Tricco et al. (2018) as well as research methodological guidance from the Joanna Briggs Institute (JBI) Scoping Review Methodology [11–13]. The review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) checklist. This process allowed a systematic mapping of evidence, without limitations on study design, to provide a full overview of the implementation, impact, and contextual factors influencing CHW interventions.

Step One: Research Question

This scoping review aimed to answer the following questions:

1. What is the scope and nature of the evidence on CHW program characteristics (e.g., implementation characteristics, supervision models, technology use, service delivery models and methods, and financing)?
2. What health outcomes have been observed in relation to CHW interventions globally?

Step Two: Identification of Relevant Studies

A systematic literature search was conducted in three phases following the JBI framework: (1) an initial limited search in PubMed to identify relevant keywords from titles, abstracts, and index terms, (2) a comprehensive search across four electronic databases, and (3) manual screening of reference lists from the included articles. A comprehensive search was performed in PubMed, Scopus, Web of Science, and CINAHL, covering publications published from January 2015 to January 2025, limited to the English language. The search strategy combined controlled vocabulary (MeSH terms where applicable) and free-text terms: ("Community Health Worker*" OR "CHW*" OR "lay health worker*" OR "village health worker*") AND ("health outcome*" OR "health status" OR "outcome assessment") AND ("community health services" OR "primary health care" OR "program evaluation"). The complete search strategy for each database is available in Supplementary File 1.

Studies were included if they met the following eligibility criteria: (1) Population: Community-dwelling populations of all ages, including priority groups (maternal and child health, individuals with communicable and non-communicable diseases, and elderly populations); (2) Concept: Interventions delivered or supported by CHWs (including health cadres, village health workers, or lay health workers) aimed at improving population-level health outcomes, encompassing health service coverage, health behaviors, treatment adherence, morbidity, mortality, or quality of life indicators; and (3) Context: Community-based settings in any geographic location, including urban, rural, and remote areas.

Studies were included regardless of the design (quantitative, qualitative, or mixed methods) if they evaluated measurable health outcomes. Studies were excluded if they (1) involved only professional health staff without CHW participation, (2) described facility-based interventions without community components, (3) were editorials, commentaries, opinion papers, or protocols without results, or (4) were case reports with fewer than 10 participants or lacked measurable population health outcomes.

Step Three: Selection of Studies and Data Management

All retrieved records were imported into the Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia), and duplicates were removed automatically by the software and supplemented by manual verification. Two independent reviewers screened the titles and abstracts using predefined eligibility criteria. Articles deemed potentially relevant by either reviewer were subjected to full-text review, and all full-text articles that met the eligibility criteria were reviewed by the first and second reviewers independently. Any differences between the reviewers were resolved through

discussion or consultation with a third reviewer. The study selection process is illustrated in the PRISMA flow diagram (Figure 1).

Step Four: Charting the Data

A standardized data extraction form was developed and pilot-tested on five randomly selected articles and then revised based on the consensus of the authorship group. Two reviewers independently extracted the following data: study characteristics (author, year, country, study design), population characteristics (number of participants, demographics, target group), CHW intervention components (type of CHW, training duration and content, supervision model, payment system, technological components, mode of service delivery), implementation context (setting, health system context), and outcome data (primary health outcomes, secondary outcomes, implementation outcomes). Disagreements in the data extraction process were resolved through discussion or through the involvement of a third party. Given the scoping review approach, a formal quality appraisal step was not performed, but the study design and reporting quality were identified descriptively.

Step Five: Collating, Summarizing, and Reporting the Results

Data were descriptively synthesized using numerical analyses and narrative synthesis. Studies were classified according to the type of intervention, target population, geographic region, and health outcome domain. Thematic analysis was used to uncover themes related to implementation characteristics, facilitators and barriers, and research gaps. Quantitative data on the distribution and characteristics of the studies are presented in tables and figures. The narrative synthesis organized findings qualitatively by thematic categories respective to the review questions and illustrated the scope, nature, and key characteristics of CHW interventions and population-level health outcomes associated with the identified interventions.

RESULTS

Overview of Included Studies

This scoping review synthesized evidence from 31 studies investigating the roles of CHW interventions and their effects on health outcomes in various global settings. The reviewed articles were published from 2015 to 2025, representing three global geographic regions: sub-Saharan Africa, North America, and Asia (Table 1). For further information about each study, including the full extraction of study characteristics, see Supplementary File 2.

Geographic Distribution and Health Focus Areas

Sub-Saharan Africa represented the largest number of studies included in the review ($n = 18$), with South Africa contributing the largest number of studies ($n = 7$) focusing on health areas, such as HIV/PMTCT,

hypertension, maternal-child health, and mental health. In addition to countries in Sub-Saharan Africa, East African countries (Kenya, Uganda, Tanzania, and Rwanda) also contributed to seven studies focusing on hypertension, HIV care, maternal-child health, integrated community case management or iCCM for children, and COVID-19 surveillance. There were also studies from West Africa that focused on severe acute malnutrition, malaria elimination, or integrated community care management from Mali, The Gambia, and Niger. Madagascar conducted a study that focused on family planning services.

North American studies (n = 10) included studies from the United States of America and Guatemala, which reported a range of health condition (e.g., asthma, diabetes, immunization, maternal-child health, cardiovascular disease prevention, and hypertension screening) interventions within rural communities. These studies took place mostly in urban contexts, serving low-socioeconomic status ethnic minority populations, and were predominantly conducted in urban settings serving low-income ethnic minority populations.

Asian studies (n = 3) included two from India, focusing on maternal health, hypertension, and newborn care, and one from Nepal, which examined cervical cancer screening. The health conditions addressed by CHW interventions spanned communicable diseases (HIV, malaria, tuberculosis, and COVID-19), non-communicable diseases (hypertension, diabetes, asthma, and cardiovascular disease), maternal and child health (antenatal care, postnatal care, immunization, and nutrition), cancer screening, and mental health.

Table 1
Included Studies by Geographic Region and Health Focus

Region	Countries	Health Focus Areas	Citations
Sub-Saharan Africa (18 studies)	South Africa (n = 7)	HIV/PMTCT, hypertension, maternal-child health, mental health	[14–20]
	Kenya/Uganda (n = 4)	Hypertension, HIV	[21–24]
	Tanzania (n = 2)	Maternal-child health, iCCM	[25, 26]
	Rwanda (n = 1)	COVID-19 screening	[27]
	Madagascar (n = 1)	Family planning	[28]
	Mali (n = 1)	Severe acute malnutrition	[29]
	The Gambia (n = 1)	Malaria elimination	[30]
	Niger (n = 1)	iCCM (malaria, pneumonia, diarrhea)	[31]
Asia (3 studies)	India (n = 2)	Maternal health, hypertension, newborn care	[32, 33]
	Nepal (n = 1)	Cervical cancer screening	[34]
North America (10 studies)	USA (n = 9)	Asthma, diabetes, immunization, maternal-child health, CVD prevention	[35–43]
	Guatemala (n = 1)	Hypertension screening	[44]

CHW Program Characteristics

The characteristics of CHW programs varied substantially across settings, encompassing differences in education requirements, selection criteria, training approaches, and skill development strategies (Table 2).

Education and Selection Criteria

CHW educational backgrounds vary considerably across settings, ranging from primary school education to university degrees. The most common pattern in low- and middle-income countries (LMICs) was secondary school completion, while high school education or higher was typical for CHWs in the United States; numerous studies highlighted adapted educational requirements that are contextualized to the region; for example, Ilozumba et al. (2018) in India reported that Accredited Social Health Activists (ASHAs) modified educational requirements due to low literacy rates in the region (52% literacy rate in the study area).

The selection criteria stressed trust in the community as well as cultural matching. The most common selection method was community voting or the selection of a trusted person within the community by consensus. Other selection requirements included literacy qualifications, age limits (typically younger than 50 years), smartphone literacy for technology-based programs, and assessment of empathy and interpersonal skills. Several studies have indicated the value of bilingual requirements in serving immigrant populations and cultural matching between CHWs and the communities they serve.

Training Approaches

Training duration exhibited considerable variation among programs, ranging from three days to 100 hours, with discernable patterns by country income level. In LMIC countries, the training duration for the initial program was typically short (3–10 days), while some programs provided moderate training (2–4 weeks-above the typical short initial program training), and comprehensive programs included intensive long-term training (ex. USA-based programmes). For instance, studies in Uganda, South Africa, Guatemala, and Nepal recounted training programs that lasted no more than five days, but in India, training was typically ten days in duration. USA-based programs provided a longer-term training duration, such as the 100-hour training duration described by Koniak-Griffin et al. (2015), the month-long intensive training reported in Kangovi et al. (2018), and the formal 9-month training program for WAJA CHWs in Tanzania, as described by Baynes et al. (2018).

The duration of training appeared to differ among programs, ranging from three days to a maximum of 100 hours, with trends noted using country income level. In LMIC countries, the training duration for the first program was typically short (3–10 days) or moderate time (2–4 weeks-above average short initial program training) for training programs included in a comprehensive program, or an intensive long-term training program (ex. USA-based Training Programs). For example, studies noted training programs that were 5 days or less in Uganda, South Africa, Guatemala, and Nepal, whereas many training programs in India were typically 10 days. Training programs in the USA identified longer-term training durations, such as the 100-hour training duration described by Koniak-Griffin et al. (2015), the month-long intensive training that was reported in Kangovi et al. (2018), and the formal 9-month training program for WAJA CHWs described by Baynes et al. (2018) in Tanzania.

The refreshment training modalities differed greatly between high- and low-resource settings. In high-resource settings (especially in the United States), refresher training occurs annually or as needed, whereas there is little or no refresher training in LMIC settings. Several studies specifically mentioned the absence of refresher training or indicated that CHWs who participated in training desired to receive training to keep pace with their current knowledge.

Training methods typically combine didactic instruction with practical skill development through hands-on exercises, shadowing, or precepted visits with experienced CHWs or clinicians, role-play scenarios, and competency-based assessments. Several studies have emphasized the importance of supervised field experience, with programs providing 1–5 days of individualized coaching until CHWs demonstrated proficiency.

Table 2
CHW Characteristics and Training Models

Characteristic	Range/Description	Most Common Pattern	Citations
Education level	Primary school to university degree	Secondary school education (most common in LMIC); High school + in USA	[14, 18, 25, 27–32, 34, 36–38, 42]
Selection criteria	Community vote, literacy requirements, age restrictions, smartphone proficiency, trust/empathy	Community-selected trusted individuals from local area	[16, 23, 25, 27, 30–32, 34, 36, 37, 42]
Training duration	3 days to 100 hours	• Short (3–10 days): Most LMIC programs • Moderate (2–4 weeks): Some comprehensive programs • Intensive (80–100 hours): USA programs	[15–17, 19, 23, 25, 26, 31, 32, 34, 36–38, 42, 44]
Training content	Disease-specific protocols to comprehensive generalist training	Core: disease management + counseling + behavior change techniques	[14, 16, 22, 23, 26, 29, 31–34, 37–41]
Refresher training	None to annual updates	Annual or as-needed in well-resourced programs; Often absent in LMIC	[16, 19, 23, 26, 28, 31, 33, 34, 36, 41, 42]
Training methods	Didactic lectures, practical exercises, shadowing, role-play, competency assessment	Combination of classroom + hands-on practice + supervised field experience	[21–23, 25, 31, 32, 36, 37, 39]

Supervision and Quality Assurance Models

Six distinct supervision models were identified across the included studies (Table 3), ranging from minimal oversight to intensive real-time clinical support.

Minimal/Standard Supervision

This model, which entailed monthly clinic reporting, no field supervision, and a paper-based recording system, did not demonstrate high levels of implementation fidelity. Rotheram-Borus et al. (2023) found that individuals receiving standard care with virtually no supervision completed 7–9% of the visits, while individuals receiving a more supervised condition exhibited a 62–77% completion rate. Compensation for community health workers (CHWs) did not differ between the two conditions. Comfort et al. (2016) found that with minimal supervision, 68% of CHWs who were supposed to submit the required monthly monitoring forms submitted three or fewer out of four required forms per month, while 17% of CHWs submitted no forms at all.

Enhanced Field Supervision

This model utilizes regular field visits (biweekly to monthly), direct CHW performance observations, performance monitoring systems, and transportation support. Studies on enhanced field supervision have demonstrated a major boost in service delivery. Rotheram-Borus et al. (2023) indicated that biweekly field drop-ins covering 4 to 6 households a day, along with remote monitoring of mobile GPS logs, and offering emergency transport boosted visit completion rates from 7 to 9% to 62 to 77%. Kangovi et al. (2018), described a robust supervision model, including assessments of fidelity through weekly audits of documentation, field observation, patient phone calls, and performance dashboards, with 91% of intervention completion.

Real-Time Telehealth Supervision

This new model, reported only in the Kenya/Uganda hypertension work conducted by Hickey et al. (2025), used study clinicians stationed at health centers who provided the CHWs with real-time consultation via phone during home visits. The clinician reviewed the data with the CHW, spoke directly to the participants, conducted clinical assessments, and prescribed medications by phone. This model has shown remarkable outcomes, with 82% of participants having at least one telehealth visit, 81% retention at one year and 79% blood pressure control in the cohort study. The pilot RCT reported even more remarkable outcomes: 86% blood pressure control in the telehealth arm compared to 44% in the clinic control arm at 48 weeks ($p < 0.001$) and 83% retention versus 50% retention, respectively ($p < 0.001$).

Continuous Quality Improvement (CQI) and Mentoring Models

Programs that used CQI methods defined quality improvement teams of community health workers (CHWs) and their supervisors, held regular data review sessions, created peer learning, and had bi-monthly mentoring. Horwood et al. (2017) found that 12 months of CQI mentoring with quarterly learning sessions led to an increase in CHW pregnancy visits from 29.0% to 75.7% ($p < 0.0001$), and an increase in postnatal visits from 30.3% to 72.6% ($p < 0.0001$). Goudge et al. (2023) found that 15 months of mentoring by a roving professional nurse increased household coverage by about 50% (adjusted OR 2.65, $p < 0.001$) as well as enabled CHWs undertake more complicated clinical tasks.

Tiered/Cascade Supervision

Multilevel supervision structures, with specialists supervising intermediate supervisors who, in turn, supervised CHWs, were implemented in several settings. Myers et al. (2019) described a tiered model with psychologists supervising registered counselors who supervised CHWs, achieving 85% completion of all three counseling sessions and 90% follow-up retention. However, Naidoo et al. (2018) noted challenges with tiered supervision in South Africa, including unclear reporting structures, where CHWs reported to both non-profit organizations and the primary healthcare re-engineering program monthly, creating confusion about accountability.

Integrated Facility-Based Supervision

This model involves CHWs supervised directly by health facility staff, with regular facility-based reporting and stock management oversight integrated into routine facility operations. Baynes et al. (2018) reported that facility and village-based supervision (two IMCI-related facility visits plus one village supervision per quarter) achieved high adherence to clinical standards, with 73% correct classification and 78% correct treatment of conditions, and 79% of CHWs maintaining complete stocks of essential drugs.

Table 3
Supervision and Quality Assurance Approaches

Supervision Model	Description	Citations
Minimal/Standard Supervision	Monthly clinic reporting, no field supervision, paper records, no visit verification	[15, 28, 31]
Enhanced Field Supervision	Regular field visits (biweekly to monthly), direct observation, performance monitoring, transport support	[15, 18, 26, 36, 37]
Real-time Telehealth Supervision	Study clinician stationed at health center provides real-time consultation via phone during CHW home visits	[21, 22]
Continuous Quality Improvement (CQI) / Mentoring Model	Regular data review, peer learning sessions, bi-monthly mentoring, quality improvement teams	[18, 19, 29]
Tiered/Cascade Supervision	Multi-level supervision structure (specialist→intermediate supervisor→CHW)	[14, 16, 27]
Integrated Facility-based Supervision	CHWs supervised by health facility staff, regular facility reporting, stock management oversight	[25, 31, 33]

Technology Integration in CHW Programs

Technology integration in CHW programs ranged from simple paper-based tools to sophisticated digital health platforms (Table 4), with clear patterns of differential access and implementation challenges across settings.

Mobile Health Applications

Mobile applications for clinical decision making, data collection, and program monitoring were introduced in the LMIC and higher-income settings. In India, Ilozumba et al. (2018) used Nokia phones and the Mobile for Mothers (MfM) app, which had voice-based text processing, alert features, GPS tracking, and multimedia functionality that improved maternal knowledge (aOR 1.19, $p < 0.05$), attended four or more ANC visits (aOR 1.38, $p < 0.05$), and delivered in facilities (OR 1.34, $p < 0.05$). The study by Zakus et al. (2019) used Samsung smartphones with CommCare with guided diagnosis and treatment protocols in French, and resulted in 3.4% higher quality of care scores than controls that used paper

records ($p = 0.009$). Rwanda's e-ASCov project (Omorou et al., 2024) documents the feasibility of using smartphone apps with Open Data Kit for screening for COVID-19 but revealed significant differences in satisfaction (urban 72.8–80.7 vs rural 61.6–64.5, $p < 0.001$) and screening volumes across urban and rural settings. The Kenya/Uganda hypertension programs incorporated smartphones with the Medic Mobile platform with two-way electronic health record sync, GPS, and automated appointment reminders to facilitate screening at the population level as well as telehealth interventions at the individual level.

Clinical Screening and Diagnostic Devices

Blood pressure monitors, glucometers, rapid malaria diagnostic tests, mid-upper arm circumference (MUAC) tapes, thermometers, timers for respiratory rate measurement, weighing scales, and height boards allowed CHWs to complete clinical assessments in community settings. Duffy et al. (2025) found that CHWs in rural Guatemala independently assessed hypertension using blood pressure monitors and a CommCare mHealth application and had a 92.8% agreement with physicians' diagnosis of hypertension ($Kappa = 0.80$). Many other studies have demonstrated that RDTs for malaria given to CHWs provided a reliable diagnosis and the correct treatment for malaria, with correct rates of malaria treatment ranging from 72–84% in Niger, Tanzania, and The Gambia studies.

Mobile Phones for Communication

Basic mobile phones and smartphones supported supervisory contact, patient follow-up, visit scheduling, and reminders. For example, Rotheram-Borus et al. (2023) conducted a South African study that utilized mobile phones with GPS capabilities to log visits for supervision and accountability. Lukyamuzi et al. (2022, 2023) used mobile phones to follow up twice a week with patients to support HIV disclosure counselling, resulting in partners disclosing HIV status to each other increasing from 0% to 74.4%. Various studies have supported the successful adaptation from in-person to virtual and phone service delivery, including enhanced mobile phone services, during the COVID-19 pandemic.

Electronic Health Records and Data Management Systems

The utilization of tablet-based case report forms, comprehensive electronic health record (EHR) systems, cloud-based data platforms, and performance dashboards has facilitated clinical documentation, care coordination and supervision monitoring, and improvement of data quality. Kangovi et al (2018) employed documentation software and performance dashboards that allowed supervisors to conduct weekly fidelity assessments, contributing to 91% of participants who completed the intervention and high rates of action plan completion (60.3%). The studies in Kenya/Uganda also achieved 90% coverage at baseline of screening for a population of patients and maintained 84% coverage at one year, using two-way EHR synchronization to enable population-level monitoring.

Specialized Clinical Tools

Specialized Clinical Tools Pre-packaged medication sets, pregnancy test kits, and transportation vouchers were all able to provide solutions for specific barriers to access and delivery of services.

Comfort et al. (2016) gave community health workers (CHWs) in Madagascar 50 pregnancy test kits at no cost, costing less than \$0.10 each. The number of new clients using hormonal contraceptives increased by 26% ($p = 0.014$), and the number of new clients using injectables increased by 29% ($p = 0.029$). CHWs overwhelmingly preferred the pregnancy test kits compared to the checklist alone, with 97%-99% preferring the test kits. Hickey et al. (2025) provided pre-packaged medication sets to community health workers developed using standardized treatment algorithms, allowing prompt delivery of medications during their home visits. They also provided CHWs with \$5 cash transport vouchers to facilitate patient linkage to clinics for those with very high blood pressure.

Paper-Based Tools

Multiple texts identified control or comparison groups using papers, job aids, counter forms, flip charts, and referral slips. These methods function as traditional ways of delivering services, audio-visual enhancements to training, and user interventions, and studies that compared paper and digital delivery mechanisms revealed the benefits and advantages of digital tools over paper strategies. However, Shrestha et al. (2022) noted that patients who used only paper-based methods (no digital technology) during home visits from female community health volunteers could have increased cervical cancer screening rates from 42.5% before the home visit to 73.2% ($RR = 1.48$, $p < 0.01$). The authors noted that relationship-based delivery of services could work with paper-based delivery without technology enhancement.

Table 4
Technology Use and Digital Health Integration

Technology Type	Specific Tools/Applications	Purpose	Citations
mHealth Applications	CommCare, e-ASCov, Open Data Kit, Mobile for Mothers (MfM) app, Medic Mobile platform	Guided clinical protocols, data collection, visit scheduling, educational content delivery, GPS tracking	[21, 27, 31, 32, 44]
Clinical Screening/Diagnostic Devices	BP monitors, glucometers, RDTs (malaria), MUAC tapes, thermometers, timers, scales, height boards	Screening, diagnosis, monitoring of clinical conditions in community settings	[18, 21, 25, 30, 31, 43, 44]
Mobile Phones for Communication	Basic mobile phones, smartphones for voice calls, SMS, WhatsApp	Supervision contact, patient follow-up, visit scheduling, appointment reminders	[15, 20, 23, 24, 30, 36, 40]
Electronic Health Records & Data Management	Tablet-based case report forms, electronic health record systems, cloud platforms, performance dashboards	Clinical documentation, care coordination, supervision monitoring, data quality, performance tracking	[21, 36, 37, 43]
Specialized Clinical Tools	Pregnancy test kits, pre-packaged medication sets, transportation vouchers	Improve diagnostic accuracy, facilitate medication delivery, reduce access barriers	[22, 28]
Paper-based Tools (Comparison/Control)	Paper records, job aids, printed forms, flip charts, referral slips	Clinical guidance, documentation, health education	[15, 25, 31, 34]

Service Delivery Models and Associated Health Outcomes

Five distinct service delivery models were identified (Table 5), each demonstrating effectiveness for different health conditions and contexts.

Home-Based Only Model

This model involved regular home visits by CHWs, with minimal or no facility integration. Seven studies predominantly implemented home-based approaches, demonstrating their effectiveness across diverse health conditions. For maternal-child health, Ilozumba et al. (2018) found significant improvements in maternal knowledge (aOR 1.19, $p < 0.05$), attendance of four or more ANC visits (aOR 1.38, $p < 0.05$), and institutional delivery rates (OR 1.34, $p < 0.05$). Tomlinson et al. (2015) showed that approximately 11 home visits from pregnancy through six months postpartum improved infant growth outcomes among children of mothers with antenatal depression, with significantly higher height-for-age z-scores ($\Delta\text{HAZ} = 0.699$, $p = 0.034$) and reduced stunting.

Home-based asthma interventions have demonstrated substantial reductions in emergency disease management. Ellis et al. (2024) compared two home-based models: the intensive Reach for Control (RFC) program with 24 planned weekly sessions reduced ED visits from 1.60 to 0.52 ($p < 0.01$, $d = 0.62$) and improved asthma management scores from 40.94 to 46.06 ($p < 0.01$), while the standard Managing Asthma Through Case Management in Homes (MATCH) program with six planned monthly visits reduced ED visits from 1.63 to 0.85 ($p < 0.05$) and improved caregiver quality of life from 5.21 to 5.69 ($p < 0.05$).

Home-based HIV services have achieved remarkable improvements in terms of partner disclosure. Lukyamuzi et al. (2022) reported that CHW home visits combined with twice-weekly phone calls for disclosure counseling increased HIV status disclosure from 0% to 74.4%, with participants receiving CHW support being 1.72 times more likely to disclose ($aHR = 1.72$, $p < 0.001$). In the context of cancer screening, Shrestha et al. (2022) reported that home visitation intervention every four months for a year, with individual counseling, increased cervical cancer screening from 42.5% to 73.2% ($RR = 1.48$, $p < 0.01$) and significantly increased knowledge (from a median score of 2 to 6).

Rotheram-Borus et al. (2023), conducted in South Africa, demonstrated the critical role of supervision intensity in home-based models of care. The study arms delivered home-based interventions and Community Health Worker (CHW) compensated in the same manner, with a biweekly field supervision arm reporting improved visit completion rates of 62–77% completion versus 7–9% in the standard care arm. Although only one of the 13 health outcomes was statistically significant, ARV adherence (SC mean 2.3 versus AC mean 2.9, $p < 0.025$), the findings showed that home-based service delivery must include adequate supervision to achieve successful health outcomes.

Facility-Integrated Model

Eight studies employed models that utilized community health workers (CHWs) that were either based at or closely affiliated with health facilities and had established referral pathways and integrated documentation protocols. This model was found to be effective, particularly for maternal-child health services and chronic disease management that require clinical supervision.

For pediatric well-child care, Coker et al. (2023) integrated CHWs as "coaches" into well-child care teams at federally qualified health centers, with previsit screening customizing visits to parent needs. This team-based approach significantly improved anticipatory guidance scores (adjusted absolute difference 11.01, $p < 0.05$), psychosocial assessment completion (66.9% vs. 49.9%, $p < 0.05$), behavioral concerns being addressed (89.2% vs. 82.0%, $p < 0.05$), and up-to-date well-child care (73.7% vs. 63.4%, $p < 0.05$), although it did not reduce emergency department utilization.

Kangovi et al. (2018) demonstrated that facility-integrated CHWs with medical record access and touchdown space at clinical sites, who coordinated with physicians on chronic disease management goals, achieved substantial reductions in hospitalization despite no changes in self-rated physical or mental health or chronic disease control measures. The intervention reduced the total hospitalization

days by 69% at six months (155 versus 345 days) and 65% at nine months (300 versus 471 days), with significant reductions in repeat hospitalizations (OR 0.4, risk difference – 0.24, $p = 0.02$) and 30-day readmissions (OR 0.3, risk difference – 0.17, $p = 0.04$). The intervention significantly improved quality of care comprehensiveness (OR 1.8, risk difference 0.12, $p < 0.001$) and supportiveness of self-management (OR 1.8, risk difference 0.12, $p < 0.001$).

For integrated community case management, Baynes et al. (2018) reported that WAJA CHWs linked to health facilities with facility-based supervision achieved high adherence to IMCI standards, with 73% correct classification and 78% correct treatment. Notably, 79% of the CHWs maintained complete stocks of essential drugs, indicating successful integration with facility-based supply chain management.

The maternal-child health facility-integrated programme showed consistent benefits. Regan et al. (2023) found that CHW integration within the public primary healthcare system in Tanzania, with structured supervision by outreach nurses and coordination with ANC clinics, increased attendance of four or more ANC visits from 6.6% to 9.3% (RR 1.42, $p = 0.02$) with a mean increase of 7.7% in total ANC visits. Horwood et al. (2017) demonstrated that a continuous quality improvement mentoring intervention with facility linkage dramatically increased CHW visits during pregnancy from 29.0% to 75.7% ($p < 0.0001$) and postnatal visits from 30.3% to 72.6% ($p < 0.0001$), while also improving maternal knowledge (49% vs. 43%, $p = 0.02$) and exclusive breastfeeding rates at six weeks (76.7% vs. 65.1%, $p = 0.02$).

Hybrid Telehealth and Home Visit Model

Two studies from Kenya and Uganda by Hickey et al. (2025) evaluated an innovative model combining CHW home visits with real-time telehealth clinical supervision for hypertension management, demonstrating superior outcomes compared with both traditional home-based and facility-based care models.

The cohort study evaluated an integrated HIV/hypertension intervention with two components: population-level multi-disease screening of adults aged 40 years and older and CHW-facilitated hypertension telehealth for those with blood pressure $\geq 160/100$ mmHg. At the population level, the prevalence of blood pressure $\geq 140/90$ mmHg decreased from 16.0% at baseline to 6.4% at one year (absolute decrease 9.6 percentage points, 60% relative reduction), while the prevalence of blood pressure $\geq 160/100$ mmHg decreased from 6.5% to 2.1%. Among the participants enrolled in the telehealth intervention, 96% received at least one antihypertensive medication, 94% had at least one follow-up visit, 82% had at least one telehealth visit, 81% were retained at one year, and 79% achieved blood pressure control. The median number of total visits was five (IQR 4–7), including three telehealth visits (IQR 1–5) and one clinic visit (IQR 1–2), demonstrating patient preference for and feasibility of home-based telehealth.

This pilot randomized controlled trial directly compared the hybrid telehealth model with facility-based care for adults with moderate-to-severe hypertension. At 48 weeks, blood pressure control was achieved

in 86% of the telehealth arm versus 44% of the clinic control arm (risk difference, 42%; $p < 0.001$), with retention rates of 83% and 50%, respectively (risk difference, 32%; $p < 0.001$). The mean systolic blood pressure was 133 mmHg in the telehealth arm versus 141 mmHg in the clinic arm (difference – 8.2 mmHg, $p < 0.001$), and the prevalence of moderate-to-severe hypertension was 2% versus 15% (risk difference – 13%, $p < 0.001$), respectively. In the subgroup of participants living with HIV ($n = 27$), retention at 48 weeks was 100% in the telehealth arm compared to 53% in the clinic arm (risk difference 47%, $p = 0.002$), suggesting a particular benefit for populations requiring multi-disease management.

The hybrid model was the most favorable among patients, with 88% of telehealth arm participants preferring home visits or a combination of home and clinic visits, compared with only 76% of clinic arm participants expressing the same preference after receiving facility-based care. While this change was somewhat expected among the telehealth group, 69% of participants in the clinic arm indicated that transportation was a barrier to accessing services, compared with only 2% in the telehealth arm reporting it was a barrier. This represents one of the key benefits of home service delivery.

Community-Based Distribution Model

Three studies explored the mechanisms by which CHWs offered health products or services at community points of support or through home visits in areas that were geographically distant from health facilities. In particular, these outreach programs have sought to address barriers to access in rural and remote contexts. Comfort et al. (2016) assessed the community-based distributive model for hormonal contraception in rural Madagascar, where 64% of women lived greater than 5 km from the nearest health center. In addition to the standard pregnancy screening checklist, CHWs received 50 free pregnancy test kits (cost less than \$0.10) to work with birth control. CHWs that received this toolkit saw a 26% increase in the number of new hormonal contraceptive clients per month (3.14 hormonal contraceptive clients per CHW per month in the sub-group with pregnancy test kits vs. 2.48 in the control group, 0.65 difference, $p = 0.014$). This effect was driven primarily by the increase in injectable clients (29% increase in the number of injectable clients per month in the pregnancy test kit group, 1.94 in the pregnancy test kit condition vs. 1.51 in the control group, $p = 0.029$), but there was a similar, albeit not statistically significant, increase in oral contraceptive clients (22.5% increase, $p = 0.133$). Notably, 97–99% of CHWs expressed a preference for using pregnancy tests over checklists alone, indicating increased confidence in serving their clientele.

Zakus et al. (2019) studied an integrated community case management model facilitated by volunteer community health workers (Relais Communautaire) in communities located 120–150 km from the capital city of Niger. Community health workers (CHWs) in the experimental arm of the study used smartphones equipped with the CommCare application to guide the diagnosis and treatment process, whereas control CHWs used the paper record-keeping method. In terms of quality of care scores, the experimental group demonstrated a significantly higher mean score (26.2 versus 25.3, with a difference of 0.83 or 3.4% and $p = 0.009$) than the control group, and 83% of the intervention CHWs achieved a quality score above 80%, whereas only 67% of the control CHWs achieved a quality score above 80%. In

addition, CHWs in the intervention group had significantly better quality of care scores for health screening (7.4 versus 6.4, $p < 0.001$), correct use of artemisinin-based combination therapy for malaria (72.3% correct use vs. 66.4% correct use, $p = 0.012$), and appropriate referrals (85% vs. 29% correct referrals, $p = 0.012$).

Naidoo et al. (2018) conducted a study in South Africa to examine a community-based HIV service delivery model using ward-based outreach teams comprising pairs of community health workers (CHWs) who covered 250–400 households per CHW pair. In qualitative findings, community members felt the value of services provided, and community leaders reported to be seeing "less death" since the CHWs started to work in the community, as well as facility nurses reported to be seeing a more manageable workload in the health facilities. Nonetheless, the study identified significant challenges associated with implementation, including high household-CHW ratios, which limited CHWs' ability to visit households daily to achieve their quota, personal safety issues for CHWs while working in the community, inadequate resources (stationery, cell phones, and equipment), and unclear reporting structures.

Team-Based/Integrated Care Model

Four studies tested models positioning CHWs as collaborating professionals with physicians, nurses, and social workers in multidisciplinary care teams, with careful attention to care coordination and service delivery comprehensiveness.

Coker et al. (2023), as mentioned in facility-integrated models, found team-based integration in pediatric well-child care produced statistically significant improvements in anticipatory guidance (adjusted absolute difference 11.01, $p < 0.05$), completion of psychosocial assessments (66.9% to 49.9%, $p < 0.05$), and up-to-date well-child care (73.7% to 63.4%, $p < 0.05$). As culturally concordant CHWs and families enhanced the intervention effects, it was concluded that culturally matched staffing enhanced team-based models.

Kangovi et al. (2018) conducted an Individualized Management for Patient-Centered Targets (IMPACT) intervention in each of three different primary care settings (VA medical centre, federally qualified health centre, and academic family practice clinic). CHWs were integrated into primary care teams, had access to medical notes, and co-located workspaces in each clinical site. The CHWs worked with primary care teams to coordinate chronic disease management plans based on the goals set by patients. Master's-level social work managers provided supervision through weekly fidelity assessments including documentation audits, field observations, patient phone calls, and performance dashboard reviews. The standardized approach to hiring, training, workflow, supervision, and documentation enabled rapid scaling across the three different institutions while maintaining high fidelity. The intervention achieved 91% completion of the full six-month program, with participants completing a mean of 5.5 action plans at a 60.3% completion rate. Although physical and mental health outcomes and chronic disease control did not improve significantly, the intervention dramatically improved the quality of care comprehensiveness (OR 1.8, risk difference 0.12, $p < 0.001$) and supportiveness of self-management (OR

1.8, risk difference 0.12, $p < 0.001$) and achieved substantial reductions in hospitalizations (69% reduction in total days at six months, 65% at nine months).

McAtee et al. (2024) described CHWs functioning within Community Health Teams under the Rhode Island Department of Health, integrated with primary care for cardiovascular disease and diabetes management. While clinical improvements in blood pressure, LDL cholesterol, and HbA1c were trend level ($p = 0.065$), the intervention significantly increased patient confidence and self-efficacy, which are important intermediate outcomes for chronic disease self-management. Some challenges in implementing the intervention were related to COVID-19, limited time of the intervention, and staff turnover.

Justvig et al. (2017) integrated CHWs into a pediatric medical home at a university hospital, with close coordination between CHWs and pediatricians. The structured home visit protocol addressed seven goal domains and 17 task areas, with CHWs providing tailored health education, appointment scheduling assistance, medication review, adherence follow-up, family record-keeping support, and connections to community resources. The program achieved 52% completion, improved adherence to pediatric care, and demonstrated high inter-rater reliability (> 0.8). Barriers to engagement included transportation challenges and language issues, while integration into the pediatric medical home facilitated care coordination.

Epidemic Response and Surveillance Model

Two studies examined the role of CHWs in mobilizing for disease screening, case detection, and contact tracing as steps in epidemics or disease elimination efforts. Omorou et al. (2024) examined e-ASCov in Rwanda, which trained and equipped CHWs with smartphone applications to perform COVID-19 screening during the pandemic. Over 7,000 people were screened, and there was considerable heterogeneity between settings, as the median number of people screened by CHWs was 152 (urban Nyarugenge), 86 (urban Gasabo), 48 (rural Kirehe), and 24 (rural Rusizi) ($p < 0.001$). Detection of positive cases was also higher in urban settings (38.9–54.8% of CHWs reported at least one positive case) than in rural settings (15.3–23.7%) ($p < 0.001$), most likely a reflection of both higher disease prevalence in the capital, where the imported cases were concentrated, and better conditions for implementing the intervention. Approximately 20% of the people who were screened were later referred to local COVID-19 testing facilities. Satisfaction was significantly higher in urban (72.8–80.7) compared than in rural districts (61.6–64.5, $p < 0.001$), with rural settings being limited by poor Internet connection, low operational knowledge of CHWs, no smartphones, shortages of equipment, and electricity in access to facilities.

Masunaga et al. (2022) reported findings from a sequential exploratory mixed-methods study nested within the Reactive Household-based Self-administered Treatment (RHOST) malaria elimination trial conducted in rural Gambian villages. Male farmers or herders with limited formal education, selected through community consensus, comprised of all village health workers. They received additional training

on malaria diagnosis, treatment, and communication, as well as a small monthly allowance (1,500 Gambian Dalasi), malaria rapid diagnostic test (RDT) kit, antimalarial drugs, and reporting forms for diagnosis, treatment, and community mobilization. The proportion of community respondents reporting that VHWs had RDTs increased from 21% to 58%, and those reporting that VHWs had antimalarials increased from 26% to 60%. Visits to VHWs when community members were ill increased from 40% to 64%. Qualitatively, VHWs gained symbolic capital and community trust as "health diplomats," with strong community trust, participatory design using Community-Led Implementation at Household level (CLIH), and VHWs' existing social and political status enhancing performance. However, barriers include contradictory expectations, limited supplies, increased workload, and concerns about unequal benefit distribution.

Table 5
Service Delivery Models and Health Outcomes

Model Type	Description	Key Outcomes
Home-based Only	Regular home visits by CHWs, minimal or no facility integration	• Ilozumba et al., 2018: ↑ maternal knowledge (aOR 1.19, $p < 0.05$), ↑ ANC ≥ 4 visits (aOR 1.38, $p < 0.05$), ↑ institutional delivery (OR 1.34, $p < 0.05$) • Rotheram-Borus et al., 2021: 62–77% mothers reported visits vs 7–9% standard care; ARV adherence improved (SC 2.3 vs AC 2.9, $p < 0.025$) • Ellis et al., 2025: ED visits 1.60→0.52 ($p < 0.01$, $d = 0.62$); asthma management improved 40.94→46.06 ($p < 0.01$) • Ellis et al., 2025: ED visits 1.63→0.85 ($p < 0.05$); caregiver QoL improved 5.21→5.69 ($p < 0.05$) • Tomlinson et al., 2015: Infants of depressed mothers: ↑ height-for-age ($\Delta\text{HAZ} = 0.699$, $p = 0.034$), reduced stunting • Shrestha et al., 2022: Screening uptake 42.5%→73.2% (RR = 1.48, $p < 0.01$); knowledge median 2→6 • Lukyamuzi et al., 2022: HIV disclosure 0%→74.4%; aHR = 1.72 ($p < 0.001$)
Facility-Integrated	CHWs based at or strongly linked to health facilities, referral pathways, integrated documentation	• Coker et al., 2023: ↑ anticipatory guidance (AAD 11.01, $p < 0.05$), ↑ psychosocial assessment (66.9% vs 49.9%, $p < 0.05$), ↑ behavioral concerns addressed (89.2% vs 82.0%, $p < 0.05$), ↑ up-to-date well-child care (73.7% vs 63.4%, $p < 0.05$) • Kangovi et al., 2018: No change in physical/mental health or chronic disease control, BUT ↑ quality of care (OR 1.8, $p < 0.001$), ↑ supportiveness of self-management (OR 1.8, $p < 0.001$); 69% reduction in hospitalization days at 6 months • Baynes et al., 2018: High IMCI adherence: correct classification 73%, correct treatment 78%; 79% had complete drug stock • (Regan et al., 2023): ANC ≥ 4 visits 6.6%→9.3% (RR 1.42, $p = 0.02$); mean ANC visits + 7.7% • Horwood et al., 2017: CHW pregnancy visits 29.0%→75.7% ($p < 0.0001$); postnatal visits 30.3%→72.6% ($p < 0.0001$); maternal knowledge improved (49% vs 43%, $p = 0.02$);

Model Type	Description	Key Outcomes
		exclusive breastfeeding at 6 weeks higher (76.7% vs 65.1%, $p = 0.02$)
Hybrid Telehealth + Home Visits	CHWs conduct home visits with real-time remote clinical supervision via phone	• Hickey et al., 2025 cohort: Population-level: BP $\geq 140/90$ decreased 16.0%→6.4% (60% relative reduction); BP $\geq 160/100$ decreased 6.5%→2.1%. Telehealth participants: 96% received antihypertensives, 94% had ≥ 1 follow-up, 82% had ≥ 1 telehealth visit, 81% retained at 1 year, 79% achieved BP control • Hickey et al., 2025 RCT: Week 48: BP control 86% telehealth vs 44% clinic (RD 42%, $p < 0.001$); moderate-severe HTN 2% vs 15% ($p < 0.001$); retention 83% vs 50% (RD 32%, $p < 0.001$); mean SBP 133 vs 141 mmHg (difference - 8.2, $p < 0.001$). Among people with HIV: retention 100% telehealth vs 53% clinic (RD 47%, $p = 0.002$). Patient preferences: 88% telehealth arm preferred home or combination; transportation barrier 69% clinic vs 2% telehealth
Community-based Distribution	CHWs provide health products/services at community posts or through home visits in areas distant from facilities	• Comfort et al., 2016: New hormonal contraceptive clients increased 26% (3.14 vs 2.48/month, $p = 0.014$); injectable clients + 29% (1.94 vs 1.51, $p = 0.029$) • Zakus et al., 2019: QoC scores: intervention 26.2 vs control 25.3 ($p = 0.009$); 83% intervention had QoC $> 80\%$ vs 67% control; correct ACT administration 72.3% vs 66.4% ($p = 0.012$); correct referrals 85% vs 29% ($p = 0.012$) • Naidoo et al., 2018: Community members generally valued services; community leaders noted "less death" since CHWs working; facility nurses reported improved workload; however challenges included: large household-to-CHW ratio, inability to achieve daily targets, safety concerns, limited resources
Team-based/Integrated Care	CHW as part of multidisciplinary team with physicians, nurses, social workers	• Coker et al., 2023: $\uparrow$ anticipatory guidance (AAD 11.01, $p < 0.05$), $\uparrow$ psychosocial assessment completion (66.9% vs 49.9%, $p < 0.05$), $\uparrow$ up-to-date well-child care (73.7% vs 63.4%, $p < 0.05$); greater effect with cultural concordance • Kangovi et al., 2018: $\uparrow$ quality of care comprehensiveness (OR 1.8, RD 0.12, $p < 0.001$), $\uparrow$ supportiveness of self-management (OR 1.8, $p < 0.001$); 69% reduction in hospital days at 6 months, 65% at 9 months

Model Type	Description	Key Outcomes
		• McAtee et al., 2024: Improvements in BP, LDL-C, HbA1c (trend-level, $p = 0.065$); significant increase in patient confidence and self-efficacy • Justvig et al., 2017: 52% program completion; improved adherence to pediatric care; inter-rater reliability > 0.8
Epidemic Response/Surveillance	CHWs mobilized for disease screening, case detection, contact tracing during outbreaks	• Omorou et al., 2024: Median people screened per CHW: urban 86–152, rural 24–48 ($p < 0.001$); ≥ 1 positive case reported: urban 38.9–54.8%, rural 15.3–23.7% ($p < 0.001$); 20% screened referred to testing. Urban had higher satisfaction (72.8–80.7) vs rural (61.6–64.5, $p < 0.001$); challenges: poor internet, low operational knowledge, lack of smartphones • Masunaga et al., 2022: Visits to VHWs when ill rose 40%→64%; respondents reporting VHWs had RDTs 21%→58%, antimalarials 26%→60%; VHWs gained trust and symbolic capital as "health diplomats"

DISCUSSION

This scoping review of 31 studies across sub-Saharan Africa, North America, and Asia identified critical variations in supervision models, service delivery approaches, training duration, and technology integration that fundamentally shape health outcomes. The results suggest that the quality of implementation matters now more than the mere presence of a program, a statement that other international literature related to CHW effectiveness strongly backs [45, 46]. While CHW research identified six types of supervision, minimal supervision resulted in only 7–9% of visits being completed for study participants, while telehealth supervision for managing blood pressure resulted in 86% blood pressure control and three full rounds of supervision being conducted. Finally, the maturation of the CHW field has moved from early discussions on whether the program works to deeper discussions on how best to program a program.

The results of the strengthened supervision models referenced above indicate that improving supervision quality is much more important than just increasing frequency [47], and the large differences in performance between the supervision models signify the WHO's emphasis on supportive supervision as a necessary foundational element of programming [48]. The 86% blood pressure control achieved in our real-time telehealth supervision model compared to the 44% control achieved in clinic-based care represents a significant shift in practice, where technically enabled supervision modes can achieve better outcomes than facility-based supervision models if thoughtfully designed [21]. The equivocal nature of study outcomes can be understood systematically using implementation science. The RE-AIM framework reported by Glasgow et al. (2019) can explain why similar clinical protocols achieved

different results. Programs that were able to maintain high fidelity to evidence-based protocols consistently obtained better outcomes related to communicable diseases, NCDs, and maternal-child health conditions [49]. This signal also reinforces the implementation outcomes framework that prioritizes implementation outcomes apart from the clinical effectiveness of interventions, suggesting that not providing an expected outcome may have resulted from the implementation process rather than a failure of the intervention [50].

The noted training duration patterns of 3–10 days in LMICs versus 80–100 hours within high-income contextualized settings represent rational counter resistances to differing complexities related to health systems, disease burdens, and the estimated educational background of CHWs, rather than an arbitrary decision. Training duration alone does not convey sufficient meaning for the effectiveness of training. Systematic reviews have not established a significant and direct relationship between training duration and improvement in health outcomes, and the review of quality found only a minority of studies to be methodologically rated as strong [51]. Perhaps more importantly, different programs added to the mixed training duration and effectiveness model are the use of competency-based education and value mastery rather than the duration to completion of the training. Programs that combined WHO's seven core competency domains with an explicit hands-on practical component and booster sessions saw impact sustaining beyond the initial follow-up [52]. For example, the finding that only 41.8% of training programs lasted one week or less, and only 2.1% exceeded one year contradicts some evidence regarding improved outcomes resulting from longer training accompanied with ongoing mentoring [53]. In summary, this suggests that pragmatic considerations outweigh the optimal recommendation of training duration. The most promising approach appears to include a moderate initial training duration, mandated quarterly boosters for implementation, and a supervision-as-training approach that hedges competency development and resource sustainability against development investment [54].

The comparative analysis of technology-enabled versus traditional CHW interventions indicates that digital technologies are more of an enhancement than a change in the CHW's role. Hybrid services appear to achieve better results than either technological or traditional methods. For example, a randomized trial of the TIME program showed significantly better HbA1c reductions for CHW-mHealth-telehealth groups in comparison to usual care [55]. However, technology effectiveness depends critically on the ability of CHWs to mediate the use of the technology; in fact, nearly half of the patients enrolled in the study required some type of technical support, which highlighted the digital literacy issues of patients [56]. The technology gap is still large, and cost, lack of connection in rural areas, and access to electricity are challenges faced when spreading technology implementation [57]. CHWs fill an important gap in bridging the digital divide. They can provide technical assistance, cultural translation, and human elements that technology alone cannot. There is some cost-effectiveness evidence for scales with technology-enabled CHW services. For example, the cost of the SMS intervention in the TIME trial decreased dramatically from a pilot service to a national program, showing economies of scale [58]. Most CHW technology-enabled programs are pilot services funded outside domestic systems, and bridged operations to domestic financing are still an ongoing concern about growing CHW technology-enabled services [59].

Evidence of comparative effectiveness for varying service delivery models indicates that there is no service delivery model that works best for all conditions and populations. Rather, optimal model selection is guided by characteristics of the condition, population needs, and health system capacity. Facility-integrated models have the highest level of evidence for high-utilizing patients with multiple chronic conditions. For example, the IMPaCT multisite randomized trial demonstrated 69% fewer hospital days, substantial reductions in readmissions, and a positive return on investment, which establishes facility integration as a cost-effective approach for vulnerable populations [37]. These models operate by using care coordination and electronic health record integration to address the complex medical and social needs of patients with multiple chronic conditions. The capacity for replication across diverse health care settings with high fidelity to implementation confirms scalability when a standard set of protocols guides implementation [10]. Home-based models add particular value to addressing conditions that call for an assessment of the home environment, as well as building trust and rapport with underserved patients that are hard-to-reach. Nevertheless, home-based models require more resources for implementation than facility-based models, which constrains scalability of such models [38, 60]. Hybrid telehealth-integrated models emerged as effective alternatives, preserving health outcomes while increasing access to care, and the evidence further suggests that hybrid approaches combat equity issues that telemedicine-only approaches create [22]. It is, therefore, a significant finding to note that varying models demonstrate comparative advantage for certain populations and indicate distinction relevance based on context, too, rather than persisting in the assumption of the applicability of any one model universally.

In search of systematic reviews and randomized controlled trials, and similar implementation studies that examined quality of supervision, the quality of clinical supervision emerged as a consistent differentiator between high-quality, high-performing programs and low-quality, low-performing programs. Research indicates substantially higher odds of improved CHW performance with high-intensity supportive supervision, operating directly through accountability and indirectly through enhanced knowledge [61]. Followers of supportive supervision, that is, supportive supervision that emphasizes coaching, joint problem solving, and two-way communication, find stronger support in evidence than hierarchical or punitive models [62, 63]. Nevertheless, most large-scale programs are weakened by poor supervision that is related to inadequate support for supervisors as supervisors are not trained to use supportive supervision techniques and because supervisors have too many supervisees, are pulled away by competing clinical responsibilities, and can have transportation challenges and effectively no supervision-of-supervisors [45]. Concern towards the "forgotten middle" between CHWs and health leadership, at the health system level, could also reflect a significant gap. While there is scope for technology-enabled supervision through mobile platforms and performance dashboards to assist, such tools cannot substitute for human supportive supervision, to be clear, it's the human aspect of supportive supervision that matters most - research indicates tech-enabled platforms provide limited benefits [58, 64].

The harsh reality that a small fraction of CHW programs are sustained into implementation beyond the first cycle of funding, with most pilots assessing external funding, positioning sustainability as the most

important challenge for scaling CHW programs [54]. The evidence clearly demonstrates that a CHW as "a cheap solution" misunderstands that significant investment upfront and ongoing is necessary for training, supervision, competitive salary, supplies, and health system integration. The question is not whether to pay CHWs, but how to provide a sustainable framework for adequate pay and compensation. Recent consensus statements reaffirm that expecting individuals to volunteer their time in exchange for accessing healthcare is coercive, and these statements reflect an emerging consensus that just compensation is an ethical obligation [65, 66]. The evidence of inadequate speaking to one challenge and dissatisfaction and high probability of turnover is a common mention in articles related to national programs [62, 63, 67]. High turnover impacts continuity of programs, institutional knowledge, and relationships that are essential in communities to be effective programs. The World Health Organization's (WHO), guideline recommendation that CHWs should have a financial package that reflects job responsibilities provides the policy rationale, but inconsistency in implementation exists [48]. The significant difference in compensation between national programs reflects differences in political economies rather than evidence of acceptable levels of compensation. Institutionalization within governmental health systems is an important pathway to sustainability, but inadequate support systems are still a barrier to sustainability [68].

The positive evidence for return on investment provides an economic rationale for continued investment; several studies on health and social care interventions have demonstrated cost savings as well as, improved outcomes for several years [37, 69]. However, most assessments of cost-effectiveness offer a short lived and therefore limited assessment, and often do not factor in the retention cost, supervisory structure, and integration to the an overall system for a specific amount of years, appropriately. Thoughts for economic evaluations, long-term, are needed for fiscal decisions. There is extension of reimbursement and innovative health care models have indicated policy uptake in high-income settings; however, administrative burden and inadequate rates limit return on investment [70]. In low- and middle-income countries, the aspiration of transitioning from donor to domestic government financing remains elusive for the majority of programs, which will only be compounded by projected global health workforce shortages creating dire capacity constraints [71].

The systematic evidence exploring task-shifting for community health workers (CHWs) from physicians and nurses suggest such an approach can safely expand access while maintaining quality if applied with training, supervision, scope of practice, and referrals [72, 73]. Evidence demonstrating substantial increases in vaccination coverage through task-shifting to CHWs represent a more rapid path to scale-up [74]. An evidence review of cost-effectiveness has shown that there is substantial evidence for the benefits of task-shifting for tuberculosis and HIV/AIDS, with some evidence for reproductive, maternal, newborn, and child health [75]. The Cochrane review evidence showed that CHWs achieved equal or better outcomes than usual care for breastfeeding promotion, immunization uptake, and cure rates for tuberculosis when protocols were followed, suggesting task delineation and training does enable effectiveness [76]. The World Health Organization (WHO) task-shifting framework highlighting legal enabling structures, clarity of role, requisite skills, structured training, and support for service delivery indicates a way to consider task shifting in implementation; however, the reality of formal limitations of

scope of practice, and demystifying the go-to practice of CHWs reveals that boundaries of practice really need to be evidence based and consider access against the risk of safety [77].

The systematic review that synthesized studies from low- and middle-income countries gave a thorough analysis of equity, finding that there was a striking misalignment of CHWs reaching the groups that are most disadvantaged, but ensuring equitable health outcomes was consistently much more challenging [67]. Conducted a meta-analysis showing that mothers of higher socioeconomic status and education were considerably more likely to have antenatal care and institutional deliveries, even when CHW programs were in place [78]. This finding challenges the simplistic assumption that implementing CHWs is a guaranteed step toward health equity and that inequity is not a result of the program quality or scope of services delivered by CHWs. Structural barriers such as poverty that limit the ability to pay for anything, including facility fees or transportation costs, geographic distance from referral facilities, poor quality of facility services provided, and inequitable gender norms that reduce the ability for women to access healthcare are real limiting factors to CHW programs, regardless of their quality [79]. Examples of promising, equity promoting strategies include transportation stipends or accompanying clients to facilities, increasing the scope of service and including CHWs delivering curative services in remote areas, employing male and female CHWs for gender-specific services, and CHWs accompanying clients to ensure respectful treatment at facilities. The populations demonstrating the strongest evidence of benefit from CHW programming include rural residents, low-income residents, women, and residents with less than a secondary education. There is limited evidence on persons with disabilities, LGBTQI + populations, and migrants demonstrating critical gaps in CHW research [80]. These findings show that privileged groups still experience better outcomes than others, even in the presence of CHW programming, meaning these programs can widen disparities if equity is not the go-to approach or explicitly stated as the goal. An equity-focused implementation approach entails addressing the needs of the most marginalized populations, measuring and presenting equity stratified disaggregated outcomes, beyond health service delivery the barriers they encounter, and recognizing community health workers (CHWs) as advocates working to disrupt structural inequities rather than simply providing services to clients [81].

The identification of variability of CHW supervision models, service delivery models, and training modalities across the 30 studies in this scoping review substantively documents the evidence of implementation heterogeneity that broader systematic reviews and qualitative research describe, but cannot sufficiently express the richness of the documented findings. The six supervision models noted in our synthesis is a level of granularity not typically provided in the literature, and provides an opportunity to generate testable hypotheses about supervision models. The documented training lengths of CHWs ranged from 3 days to 100 hours but did not provide consistent evidence of improved outcomes, reiterating the importance of competency-based approaches emphasizing mastery, rather than simply time [51, 52]. The evidence aligns with broad education science literature that evidence suggests competency-based education has improved outcomes as opposed to solely seat-time requirements across a range of educational disciplines. Findings on technology integration indicate effectiveness when used to enhance or support CHWs with either technological support or other

personnel, with CHW support providing a greater impact than technology alone, which contributes to the growing digital health literature in CHW programs and practice. As in other health interventions, the prevalent trend of technology to augment rather than replace human connectedness appears to model pathways to fully integrate technology to support CHW roles [57, 59]. The difference in service delivery models advances understanding that facility-integrated approaches may provide the strongest evidence for scalability and cost-effectiveness for high-utilizing chronic disease populations, while home-based models are still valuable for some populations and conditions [37, 38]. Pathways to differentiate CHW service delivery models provides an intentionally more strategic meta-model choice for researchers instead of designating universally applicable CHW approaches.

In summary, the significant evidence that synthesized across the 30 studies, and with applied evidence from broader systematic reviews, suggests CHW programs and services provide promise but are yet not sufficient, to improve health outcomes and achieve health equity. The evidence unequivocally suggests CHW programs improve maternal-child health outcomes, infectious disease approaches or chronic disease care, as long as adequate and supportive supervision is included with training, the health system is integrated into the program, and that there is ongoing financing [45, 76]. The evidence is nuanced; however, the implications of the quality of implementation are a clear variance that leads to dramatic differences in health outcomes. While the WHO guidelines provide an evidence-informed pathway to design CHW programs, the global evidence supports there is consistent variability in quality of implementation in practice [48]. Next steps must regard CHWs as skilled health professionals who require decent working conditions and equitable compensation, that include strategic infrastructure investments in CHW supervision, and training systems; explore how technology can augment a human connection in client interaction; and address structural barriers to health equity that CHW programs can simultaneously participation to address but possibly cannot overcome. Further, with a projected health workforce shortage by 2030 globally, if concentrated in low-income countries, this creates urgency and opportunity for CHWs in relation to optimization and scale-up as part of health universal coverage strategies [71]. Success requires continued political mandate and system financial investment to the quality of implementation, unless we continue to regard CHWs for just-in-time solutions to health systems deficiencies with CHWs as a "quick fix."

Study Implications

This scoping review demonstrates that optimizing community health worker program effectiveness requires moving beyond simply deploying CHWs to ensuring implementation quality through enhanced supervision, competency-based training, strategic technology integration, and sustainable financing. Policymakers should prioritize investment in supervision infrastructure particularly real-time telehealth and enhanced field supervision models that demonstrate superior outcomes and transition from volunteer-based to professionally compensated CHW workforce models with fair remuneration commensurate with job demands. Health system leaders must strategically select service delivery models based on condition characteristics and population needs rather than assuming universal

applicability of any single approach, with facility-integrated models showing strongest evidence for high-utilizing chronic disease populations and hybrid telehealth models bridging equity gaps in access. The projected 10 million global health workforce shortage by 2030 necessitates immediate action to institutionalize CHW programs within government health systems with adequate domestic financing, moving beyond externally-funded pilots to sustainable integration as essential components of universal health coverage strategies, while explicitly addressing structural barriers to health equity through targeted implementation and disaggregated outcome measurement.

Study Limitations

This scoping review has several limitations that warrant consideration. The included studies predominantly represented externally-funded research projects or pilot programs with enhanced support structures including intensive supervision, comprehensive training, and technology resources that may not reflect implementation realities under routine government-financed programs operating with constrained budgets, limited supervision capacity, and infrastructure challenges. This gap between research conditions and real-world implementation contexts suggests that the documented effectiveness outcomes, particularly for technology-intensive models and enhanced supervision approaches, may overestimate achievable results during scaled implementation under resource-limited conditions. Additionally, most studies focused on demonstrating program effectiveness rather than systematically examining implementation failures, cost sustainability, or long-term workforce retention, limiting insights into barriers that prevent successful CHW program scale-up and institutionalization beyond pilot phases.

CONCLUSION

This scoping review demonstrates that community health workers represent an effective but implementation-dependent strategy for improving population health outcomes. The evidence unequivocally supports CHW effectiveness for maternal-child health, infectious disease management, and chronic disease care when programs incorporate supportive supervision, competency-based training, health system integration, and sustainable financing. However, implementation quality variations produce dramatically different outcomes ranging from 7–9% to 86% program completion rates depending on supervision intensity, and substantial differences in clinical outcomes across service delivery models. The identification of six distinct supervision models, vast training duration variations (3 days to 100 hours), and differential effectiveness of technology integration and service delivery approaches underscores that program design choices fundamentally determine success or failure.

Moving forward requires recognizing CHWs as skilled health professionals deserving fair compensation and decent work conditions rather than viewing them as cost-saving substitutes for strengthening the health system. WHO guidelines provide an evidence-based framework, although adherence remains inconsistent globally. Success requires sustained political will, adequate financing focused on

supervision infrastructure and workforce retention, strategic technology integration that augments rather than replaces human connections, and explicit attention to health equity through targeted implementation and disaggregated outcome measurement. The projected 10 million global health workforce shortages by 2030 concentrated in low-income countries creates both urgency and opportunity for CHW program optimization and scale-up as essential components of universal health coverage strategies. The field must transition from demonstrating "whether CHWs work" to rigorously implementing and evaluating "how to make CHW programs work at scale" under routine conditions with sustainable domestic financing.

Abbreviations

AAD	: Adjusted Absolute Difference
AC	: Accountable Care
ACT	: Artemisinin-Based Combination Therapy
aHR	: Adjusted Hazard Ratio
ANC	: Antenatal Care
aOR	: Adjusted Odds Ratio
ARV	: Antiretroviral
BP	: Blood Pressure
CHWs	: Community Health Workers
CQI	: Continuous Quality Improvement
ED	: Emergency Department
GPS	: Global Positioning System
HAZ	: Height-for-Age Z-score
HIV	: Human Immunodeficiency Virus
iCCM	: Integrated Community Case Management
IMCI	: Integrated Management of Childhood Illness
LDL-C	: Low-Density Lipoprotein Cholesterol
LMIC	: Low- and Middle-Income Country

MUAC	: Mid-Upper Arm Circumference
OR	: Odds Ratio
PMTCT	: Prevention of Mother-to-Child Transmission
QoC	: Quality of Care
QoL	: Quality of Life
RCT	: Randomized Controlled Trial
RD	: Risk Difference
RDT	: Rapid Diagnostic Test
RR	: Risk Ratio
SBP	: Systolic Blood Pressure
SC	: Standard Care
SMS	: Short Message Service
USA	: United States of America
VHW	: Village Health Worker
VIA	: Visual Inspection with Acetic Acid

Declarations

Ethics approval and consent to participate

Not Applicable

Consent for publication

Not Applicable

Competing Interest

The authors declare that they have no competing interests.

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Author Contribution

Study design: IK, FE, IMYSData collection: IK, FE, RI, HM, EMH, IMYS, VADData analysis: IK, FE, IMYS, VA, ROPStudy supervision: FE, CMC, MA, MUManuscript writing: IK, MA, RI, HM, ROP, EMH, IMYS, VA, CMC, MU, FE,Critical revisions for important intellectual content: FE, CMCThe manuscript has been read and approved by all authors, the criteria for authorship have been met, and each author believes that the manuscript represents honest work.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

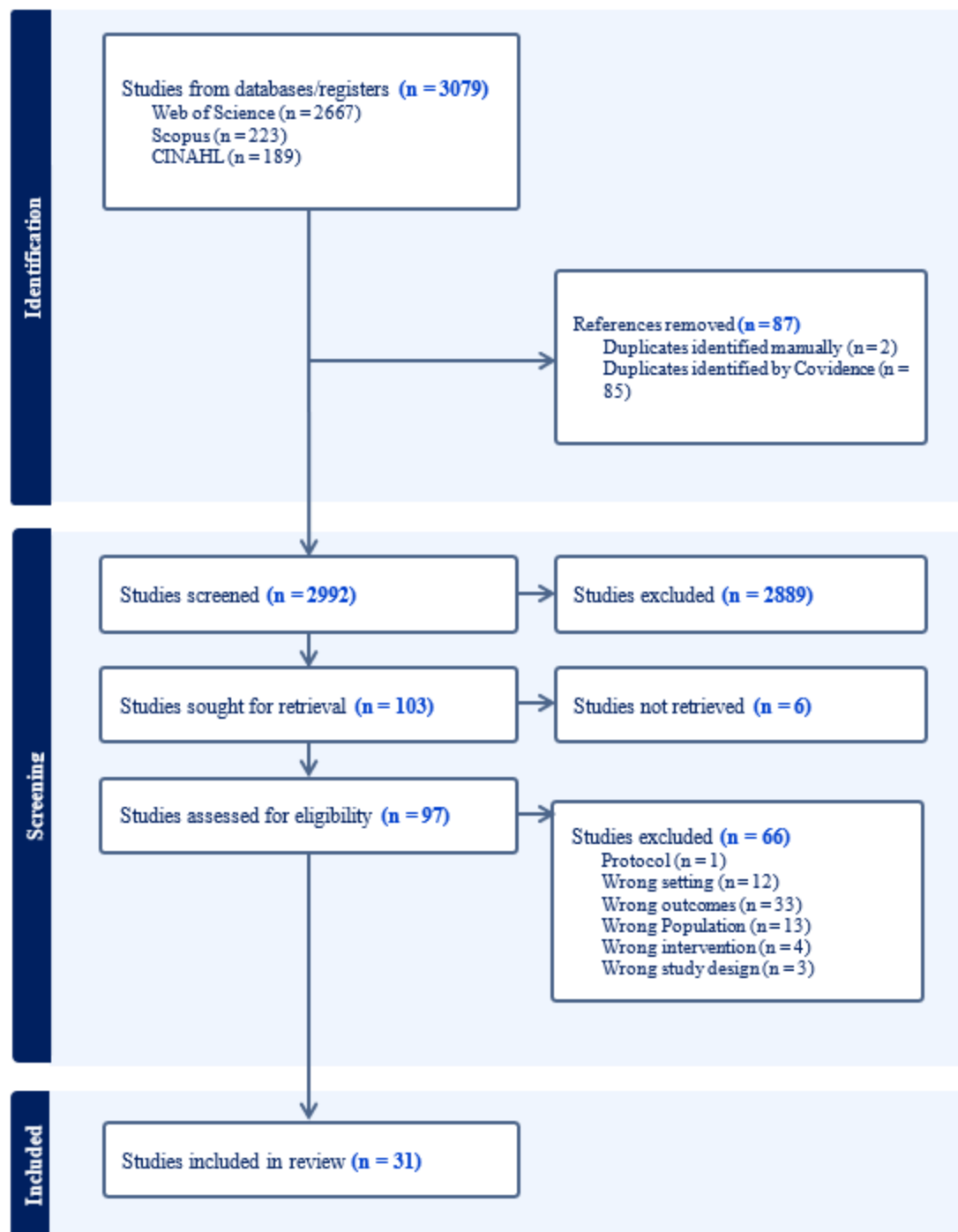


Figure 1

PRISMA Flowchart

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