Reimagining Primary Health Care: A Historical and Contemporary Review of Community-Based Care Models and Innovations

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Abstract

BACKGROUND

Historically, community-based care has served as a foundation of health service delivery in resource-constrained settings. However, shifting demographics, rising chronic diseases burdens, and digital transformations increasingly challenge the sustainability and equity of these models. We reviewed historical as well as contemporary evidence on community-based care and provide a consolidated summary on the effectiveness and limitations of existing models; identify emerging challenges and future directions to ensure that future remains aligned with the goal of universal health coverage.

METHOD

Wes conducted a scoping review of available literature using the Arksey and O'Malley framework. A comprehensive search was conducted across PubMed, Scopus, Web of Science, Google Scholar, and grey literature from 1975 to 2025 using a combination of search terms related to community-based care models, community health workers, volunteer-based programs, or digital innovations linked to community care. The data were synthesized thematically into categories reflecting historical evolution, key achievements, challenges, and future directions.

RESULTS

A total of 134 documents were reviewed. Community-based care consistently improved access to essential services, particularly maternal and child health, infectious disease control, and health promotion in underserved populations. Programs led by volunteer and community health worker led programs contributed to health systems strengthening but faced persistent challenges including high attrition, limited funding, and fragmented integration. Case studies from Nepal, Ethiopia, Brazil, and Rwanda highlighted significant reductions in child mortality, improvement in maternal care, and strengthened resilience during pandemics. Emerging challenges included syndemics, demographic transitions, urbanization, and weakening social structures. Digital technologies and artificial intelligence emerged as potential tools to expand access and efficiency, though they also pose risks if deployed inequitably or without adequate regulation.

CONCLUSION

Community-based care remains essential for bridging gaps in health system and advancing universal health coverage. Its continued effectiveness will depend on evolving into diagonally integrated, technologically enabled, and people centered model that balances innovation with equity, trust, and

cultural relevance. Long-term investment in governance, workforce training, digital infrastructure, and active community engagement will be critical to building resilience against future health crises.

BACKGROUND

Community-based care (CBC) has long served as a vital mechanism for delivering health services, especially in settings where formal healthcare systems are limited or overburdened. CBC refers to an approach in which individuals, often laypersons or non-physician providers are trained to offer essential health services within their own communities. CBCs emphasize accessibility, affordability, and cultural relevance, helping to bridge gaps in care for underserved populations(1–4). While more recently viewed as innovative responses to modern health crises, CBC systems have deep historical roots. Examples include China's Barefoot Doctors (1960s), Nepal's Female Community Health Volunteers (FCHVs) (1988), and Uganda's Village Health Teams (VHTs) (2001) (5–7). Preceding these efforts, Russia's feldshers in the 19th century and house-visiting physicians in the early 20th century United States exemplified early forms of localized, people-centred care (8). These historical models evolved pragmatically, often emerging from necessity in the absence of trained physicians or institutional care. In many cases, they also reflect long-standing traditions of community-based healing and mutual support (9, 10).

Over the past several decades, CBC has contributed to substantial gains in global health, perhaps especially in maternal and child health, infectious disease control, and health education (11). These programs have helped extend services to remote areas, increase trust in health systems, and foster community ownership of health outcomes. At the same time, the success of CBC has often depended on its alignment with local context, culturally, economically, and politically (12, 13).

However, new challenges require CBC models to evolve. Rapid urbanization, climate change, demographic shifts (including aging and youth bulges), and the rise of chronic non-communicable diseases are altering global health landscapes (14, 15). The COVID-19 pandemic has further exposed vulnerabilities and inequalities within both high-and low-income settings, underscoring the importance of community-rooted health systems (16, 17). As the various models of CBC evolved, they increasingly relied on trusted community members to deliver essential services, giving rise to cadre who are now widely recognized as community health workers (CHWs) (18).

Community health workers form the backbone of CBC, critically linking communities with health system and driving service delivery to the local population. While the Lancet analysis of South Asian CHWs programs underscores their centrality, it has limited scope and overlooks wider systemic transition. Situating CHWs within the global evolution of CBC is therefore crucial to address evident challenges and prepare for future demographic, technological and syndemic shifts (19). In this paper, we revisit the role of community-based care within a changing world. We examine its evolution, assess its current challenges, and explore how digital technologies, especially artificial intelligence, might enhance or complicate its delivery. Our goal is to review existing CBC models; bringing both historical and contemporary evidence and provide a consolidated summary on the effectiveness and limitations of

existing models; identify emerging challenges and future directions to ensure that future remains aligned with the goal of universal health coverage for the future (20).

METHODS

Review design

We conducted this scoping review using the methodological framework proposed by Arksey and O'Malley (21). The review followed the five recommended stages: 1) identifying the research question through an iterative review and discussion among key authors; 2) identifying the initial set of relevant studies based on the discussion; 3) searching studies or reports in major databases including grey literatures; 4) collating and synthesizing of data relevant to research questions; 5) discussion of findings among the researchers and experts as a part of assessing the relevance and validation of the findings (22, 23). Using these steps, we identified selected themes, which are discussed in detail in the subsequent sections (Fig. 1).

<Figure 1>

Search strategy and inclusion criteria

To identify relevant studies, a comprehensive literature search was conducted across four major academic databases: PubMed, Scopus, Web of Science, and Google Scholar. A total of 520 documents were retrieved from these databases. In addition, grey literatures were retrieved from institutional websites such as those of the World Health Organization, UNICEF, the World Bank, and national ministries of health (n = 60).

The search strategy used various combinations of terms including:

"Community-based care" OR "community health services" OR "community-oriented primary care" OR "community health worker" OR "CHW" OR "volunteer health worker" OR "digital health" OR "telemedicine" OR "mobile health" OR "mHealth" OR "artificial intelligence" OR "AI in health care" OR "machine learning" OR "health system integration" OR "diagonal integration" OR "horizontal integration" OR "syndemic" OR "syndemics" OR "pandemic preparedness" OR "COVID-19" OR "primary health care" OR "universal health coverage" OR "low-and-middle income countries" OR "LMICs".

We reviewed both peer-reviewed and non-peer-reviewed sources, including websites, conference abstracts, and reports. A total of 134 documents were identified through mutual consensus between SA. and B.A. Literature was screened against predefined inclusion criteria, which required that studies present primary research or case studies addressing at least one of the following areas: (i) descriptions and evaluation of community-based care model (including community health workers, volunteers and peer support models); (ii) emerging issues topics such as digital health, Artificial Intelligence (AI) and their integration in CBC; (iii) primary and community health services, or broader health system considerations. Non-English publications and conference abstracts were excluded from the review.

Further, articles were excluded when the description of health care was based at the hospital or institutions away from the community, when they did not have adequate details (or relevance) on CBC or CHW implementations including contents on syndemics, integration and digital (AI) integration.

Data abstraction

Data were extracted on author, year, study title, methods, key findings, limitations, and future directions. A single reviewer (SA) synthesised the evidence using tables and narrative summaries, with input and consensus from all authors. We grouped the literature into five thematic grouping: defining CBC, evolution and impact of CBC, barriers and facilitators to CBC adoption and digital technologies and artificial intelligence in enhancing CBC delivery. Our synthesis followed a thematic structure, progressing from broad categories to specific insights. Consistent with scoping review methodology, study quality was not assessed (21).

Synthesis and organization of findings

Included articles underwent thematic synthesis reiteratively synthesizing and refining the pre-defined themes. Subthemes were generated inductively to reflect recurring patterns across studies, while also accommodating context-specific insights. Findings were first summarised in tabular form, which helped to visualise overlaps and gaps across studies. Finally, consolidated findings are presented across the major themes, and their corresponding topics were selected based on their relevance and importance and are later presented in the main text (Table 1.

<Table 1>

RESULTS

Characteristics of included studies

Of the 134 documents included in this review (1975–2025), the majority were narrative reviews, program descriptions, or policy commentaries (62%), followed by systematic/scoping reviews and meta-analyses (22%), and primary empirical studies (16%) comprising qualitative research, cross-sectional surveys, mixed-methods designs, and two randomized trials. Most studies were country-specific (71%), with strong representation from Nepal, Ethiopia, India, Kenya, and Tanzania, alongside global or multi-country reviews (29%). Publications increased steadily after 2000, peaking during the 2010s–2020s, reflecting growing global focus on universal health coverage, NCDs, digital health, and pandemic preparedness.

Defining Community-Based Care

A total of 134 documents were reviewed in this paper, encompassing a diverse scenarios and context of CBC, including policy development, implementation strategies, and real-world applications. The majority of these documents focused on how CBC has evolved as a response to gaps in traditional healthcare systems, particularly in underserved or marginalized populations. Community based care is defined as a holistic approach to healthcare service delivery that takes place outside of traditional institutions, primarily within the communities and homes and by non-physician or lay health providers (24–26). In addition to reinforcing the accessibility and cultural sensitiveness, historically CBC has been planned for rural populations, extending its utility to emerging and re-emerging conditions (27). Moreover, CBC can also be understood through social and political movements of an outlier such as the Black Panther Party, that pioneered community-led health programs that addressed both medical needs and broader social determinants of health in the United States, which in the 1960s and 70 (28).

CBC should be accompanied by built-in community engagement so that it can strengthen the access and utilization of health services. The key components of the CBC include community health workers, youth volunteers, and peer supporters all backed up by more technically trained staff. Generalization of their profile and role is difficult because of the diversity of their responsibilities within and across health programs. For instance, training community health workers to diagnose and treat falciparum malaria is relatively straightforward, whereas diagnosing tuberculosis requires more complex skills, and managing chronic noncommunicable diseases is even more demanding (29, 30). The effectiveness of community health care workers depends on the primary care health infrastructure, local government and policy support, intersectoral collaboration, referral mechanism, and monitoring and evaluation mechanism (31–34). These components of CBC are vital in strengthening the health system and achieving universal health coverage (UHC). Godlee et al. highlight that addressing barriers to reliable health care such as affordability, language, and infrastructure is fundamental to reducing health inequities and strengthening health systems. Community based care serves as an important mechanism for delivering such information and supporting progress toward universal health coverage (35). Moreover, achieving universal health coverage requires not only equitable access to essential health services but also financial protection to prevent impoverishment due to healthcare costs (36, 37). There are various proposed models of CBC, such as Community Health Worker (CHW) led models and volunteer led models. The latter can include home based care through mid-wife's attendance to pregnant women, and peer support models in HIV and TB treatment (21, 38).

Community health workers are trusted frontline health workers with intimate knowledge of their communities (39). According to the US Health Resources and Services Administration (HRSA, 2007), community health workers are volunteers or paid individuals who bridge language, literacy, and cultural meanings for people and communities while promoting health education, care, coordination activities, linkages to resources, and patient-family-self efficacy (40). Their key roles are often focused on health education and promotion, advocacy and support, outreach and engagements, monitoring and follow-up, and health data maintenance. Volunteer led models of CBC are widely adopted, particularly in low resource or rural settings, which relies on trained, non-paid individuals from the community to deliver various essential health services. These cadres of informal health workers in CBC support the formal

health systems serving in areas of disease prevention, health promotion, and curative health services along with psychological support (41, 42). These volunteers provide essential care within the home setting, deliver often as relatives or local community members, especially in areas where formal health services are scarce (43). Likewise, in a peer supported model, volunteers with lived experience (e.g., with mental health issues, HIV, and addiction) support others with similar challenges, as they promote empathy, reduce stigma and gained social capital (44). Integrated within the primary health care systems, volunteers work side by side with formal health workers in clinics or community outreach in screening, monitoring and referring of patients (6, 45).

While CBC can be an essential support to the health system, they have unique challenges. For instance, volunteers often drop out due to lack of compensation, need for ongoing training, and issue of assurance on quality of care provided. A study in Simiyu Region, Tanzania which has the highest density of Primary Health Care (PHC) facilities in Africa, found that in over 4 years period, 12.7% of the CHWs left the program where the key issue included inadequate financial incentives, personal work commitment, family pressure and relocation due to work (46). Similarly, in western Kenya, a 33% drop out rate was observed among the CHWs in home-based care of HIV/AIDS program, citing similar reasoning (47). These patterns raise broader concerns regarding both the sustainability and cost efficiency of community health programmes, considering the costs associated with the continual recruitment and training of new community health workers, as opposed to investing in the retention of those already trained and proficient. However, financial constraints often limit the ability to provide adequate compensation and support, despite evidence that underfunding may ultimately result in higher overall costs due to turnover and inefficiency (48).

Evolution and impact of community-based care

Historically rooted in social movements such as Chinese ‘barefoot doctors’, Russian ‘feldsher’, and indigenous practices, CBC has evolved from informal caregiving to structured public health programs (10, 49–51). Each of these historical initiatives are driven by the tenets of capitalizing community-based health human resources for primary health care. Community oriented health care constitutes one of the foundational pillars of modern primary healthcare, embraced by the historical declaration of Alma-Ata conference held in September 1978. This declaration emphasized on the centrality of universal health care that can be achieved through improving community based primary health care (52). Over the past century, CBC has become a growing force in extending healthcare and improving population health by enabling the delivery of essential services, such as immunization, maternal and child health, infectious disease control, and health education (Fig. 2).

<Figure 2>

Before the 20th century, informal form of caregiving was provided by the individuals such as Traditional Birth Attendants (TBA), traditional healers (herbalists, bone setters, faith healers, witchcraft and sorcerers) and respected community elders, which formed early versions of CBC across indigenous and rural societies (60–62). These caregivers operated within deeply rooted ethnic, spiritual, and ecological

knowledge system by using locally available resources emphasizing holistic approaches to health and wellbeing of population they served. Their practice was often community centred and was built on trust, social cohesion, and lived experiences rather than any form of formal training.

For instance, in Barefoot Doctors' program in China, rural villagers were provided brief training (3–6 months) for basic medical care and health education. This pioneering rural healthcare initiative launched during the cultural revolution (1966–1976) to address the severe shortage of medical professionals, played a crucial role in expanding access and improving health outcomes in underserved areas (5). These individuals, often farmers who worked in fields, received 3 to 6 months of training in western medicine, traditional Chinese medicine, anatomy, hygiene, and reproductive health. They played a critical role in providing medical care during off-hours hence the term 'barefoot' (53). Their efforts contributed to significant public health improvements, including reduction in infant mortality rate from 200 to 34 per 1000 live births and an increase in life expectancy from 35 to 60 years between 1962 and 1982 (53). These early efforts laid foundation for current approaches in primary health care delivery including building local health care capacities, fostering community trust and cultural competencies (63).

Inspired by this success and following the recommendation of the Alma Ata declaration, other countries began exploring and adapted the CBC model within their health care systems. For example, CBC models such as Female Community Health Volunteer (FCHV) program in Nepal, Village Health Teams in Uganda, and Community Health Agents (Agentes Comunitários de Saúde) in Brazil, began to proliferate improving the community health status (6, 7, 64) (Table 2). Governments began to realize the beneficial role of traditional healers and integrated them increasingly into the framework of national health systems. As a result, several nations incorporated Trained Birth Attendants (TBA), traditional medicine practitioners (Ayurveda, Unani, and Homeopathy) or similar disciplines into formal healthcare system (62). Scholars have been increasingly arguing for the inclusion of traditional medicine in the formal healthcare, particularly in primary healthcare delivered through CBC despite the advancement of health system over the years (65). Over the years, adapted versions of CBC have been implicated to promote community ownership and participatory decision making by incorporating traditional medicine into the primary healthcare, as the care providers are based within the community where they can ensure access (66). Despite increasing support for integrating traditional medicine into CBC, resistance remains strong in many high-income countries where medical practice is strictly regulated and funds for evidence-based medicine are available. In such settings legal restrictions often limit diagnosis and treatment to licensed biomedical professionals, citing concerns over safety and evidence (67). In Australia, debates continue over the role of Aboriginal healers amid professional and institutional reluctance (68). These tensions reflect the challenge of balancing cultural inclusion with regulatory standards.

Table1. Theme synthesis and organization of findings.

THEMES	TOPICS
Defining community-based care	Scope and definitions, CHWs, volunteers, peer-support models, role in UHC
Evolution and impacts of community-based care	Historical trajectories, integration into PHC, improvements in MCH, infectious disease control, case studies (Ethiopia, Nepal, Brazil)
Emerging challenges and changing landscape	Syndemics (HIV-TB, COVID-19–NCDs), demographic transitions, urbanization, weakening social structures
Digital disruption: AI and technology in community care	mHealth, telemedicine, AI decision-support tools, equity and governance issues
Future directions and policy implications	Diagonal integration, sustainable financing, CHW training, digital readiness, community engagement

The evolution of CBC has yielded significant public health successes across diverse settings such as its role in achieving UHC goals and addressing social determinants of health (79–81). For instance, Ethiopia's Health Extension Program (HEP) uses female health extension workers which provides basic services in maternal child health, sanitation and disease prevention that contributed to major reductions in child mortality, as well as malaria and HIV prevalence (82). It is particularly important in providing cost effective healthcare solutions and responding to outbreaks and emergencies. For example, in Vietnam, Village Health Workers (VHWs) were effective in providing cost effective health care solutions for the prevention and control of NCD such as hypertension and diabetes, helping to improve awareness and community level interventions (83). The role of CHWs in CBC is critical for the effective delivery of health services. The Word Bank database map (Fig. 3) illustrates the presence and scale of CHWs across countries. Several countries in sub-Saharan Africa and Southeast Asia generally have more extensive CHW networks. Figure 3 highlights global variation in the implementation and integration of CHWs within national health systems (Fig. 3).

<Figure 3>

One of the most notable achievements has been the expansion of healthcare access to underserved and remote populations through the deployment of trained community health worker. For instance, the Health Expansion Program (HEP) launched in 2003 in Ethiopia, worked mainly in disease prevention, family health, environmental hygiene and sanitation, and health promotion in rural communities (84). This contributed to significant reduction in one of their health indicators - under five mortalities from 203 per 1,000 live births in 1990 to 58 in 2016 (85). Similarly, in India, the Accredited Social Health Activist (ASHA) program launched in 2006, was associated with significant improvements in maternal healthcare. Exposure to ASHA services in rural communities was linked to a 17% increase in first Ante Natal Care (ANC-1) visits (95% CI 11.8–22.1), 5% increase in four or more ANC visits (95% CI – 1.6–11.1), 26% increase in skilled birth attendance (SBA) (95% CI 20–31.1), and a 28% increase in facility based births(95% CI 22.4–32.8) (86). In Bangladesh, non-governmental initiative: Bangladesh Rural Advancement Committee (BRACs), whose community health volunteers played a pivotal role in

promoting oral rehydration therapy (ORS), reducing child deaths from diarrhoeal disease between the 1980a and early 2000s (87). These achievements have demonstrated the CBC's health benefits particularly in the field of childhood undernutrition, maternal and child health, expanding access to family-planning, and immunization (1, 56, 84) (Fig. 4).

<Figure 4>

Through participatory approach and local leadership, CBC has fostered health ownership and accountability in the communities. For example, in Ethiopia, through the initiative of HEP, the government trained and deployed female Health Extension Workers (HEWs) to provide essential health services at the community level. Community members were actively involved in identifying health priorities, constructing health posts, and supporting HEWs. This participatory approach helped foster a strong sense of ownership over local health services and improved health outcomes such as immunization coverage and maternal health (84).

Evolution of CBC has been heterogenous across the countries, but the impact when integrated into the formal health system seems to demonstrate its effectiveness (Table 3).

Table 2: List of various prominent CBC programs.

CBC PROGRAM	COUNTRY	ESTABLISHED (YEAR)	MISSION	ROLE
Aboriginal Medical Service (AMS) Redfern (69)	Australia	1971	Deliver culturally appropriate health services to Aboriginal communities.	First Aboriginal community-controlled health service provides culturally appropriate, community-controlled healthcare and support services to improve the health and wellbeing of Aboriginal and Torres Strait Islander people; model replicated nationwide.
Bangladesh Rural Advancement Committee (BRAC's) *Shasthya Shebika* Program (70)	Bangladesh	1970	Empower women to deliver essential health services in rural areas.	Female community health workers provide health education, maternal and child health services, and referrals.
Barefoot Doctors Program (5)	China	1968	Provide basic healthcare services to rural populations lacking access to trained physicians.	Trained rural individuals to deliver primary care, health education, and preventive services in their communities.
Jamkhed Comprehensive Rural Health Project (CRHP) (71)	India	1970	Improve rural health through community participation and empowerment.	Community-led development programs including health education, women's groups, and sanitation initiatives.
National Community Health Assistant Program (72)	Liberia	2016	Extend health services to remote communities beyond 5 km from health facilities.	Paid community health assistants provide integrated primary health services.
Female Community Health Volunteers (FCHVs) (56)	Nepal	1988	Deliver primary health care to women and families in rural districts.	Volunteers provide health education, distribute vitamin A, and manage childhood pneumonia.
Lady Health Workers Program (73)	Pakistan	1994	Provide primary health care and family planning services at the doorstep.	Trained female workers deliver preventive, promotive, and basic curative care in rural communities.
Feldsher System (74)	Russia	1870	Deliver basic medical services in rural areas through	Feldshers provided preventive, diagnostic, and basic curative

			trained non-physician practitioners.	services, especially where physicians were unavailable.
Wellbody Alliance (75)	Sierra Leone	2006	Ensure healthcare as a human right in Kono District.	Operates primary care facilities, women's centre, and provides HIV/AIDS and TB treatment.
Ujamaa Villages (76)	Tanzania	1967	Promote collective farming and equitable access to social services through villagization.	Implemented communal living and farming, with integrated health and education services in rural villages.
Comprehensive Community Based Rehabilitation in Tanzania (CCBRT) (77)	Tanzania	1994	Provide disability and rehabilitation services to low-income Tanzanians.	Offers ophthalmology, orthopaedics, maternal health, and rehabilitation services.
Ethiopia’s Health Extension Workers (78)	Ethiopia	2003	expand access to essential preventive, promotive, and basic curative health services at the community level	Provide health services under four areas: hygiene and environmental sanitation, disease prevention and control, family health services, and health education and communication.
Uganda’s Village Health Teams (VHTs) (78)	Uganda	2001	promote community participation in the delivery of essential health services and empower households to take responsibility for their own health.	volunteers of health promoters and community mobilizers, health education, promote preventive practices, and conduct home visits.

Table 3: CBC evolution and its impact in Rwanda, Papua New Guinea, Moldova

Country	CBC evolution and its impact
Rwanda	Rwanda had the lowest life expectancy of any country globally from 1989 to 1997, primarily due to burden of communicable diseases and unsafe birth practices, further exacerbated by the 1994 genocide, and health workforce setback further plagued the health system of the country. However, Rwanda's health system now is often cited as successful example of CBC fostering community ownership, accountability and cost effectiveness in resource-limited settings as CHWs are elected by their communities and trained to provide primary health services and health education. It is observed that Rwanda's CBC strategy contributed to 70% decline in under-five mortality between 2002 and 2011, demonstrating the impact of this model (88).
Papua New Guinea	Papua New Guinea (PNG) struggled with poor health indicators, with life expectancy around 55 years in early 2000s due to infectious diseases like malaria and tuberculosis, maternal health issues, and geographic isolation limiting healthcare access. The health workforce density was below 0.3 health workers per 1,000 population. PNG's community health workers, chosen by local communities and trained to provide primary care and health promotion, have played a key role in bridging healthcare gaps. These community-based approaches contributed to a decline in under-five mortality from about 100 per 1,000 live births in 1990 to approximately 57 per 1,000 in 2015, emphasizing their importance in resource-constrained, hard-to-reach settings (89).
Moldova	Moldova faced health system challenges post-Soviet Union dissolution, with life expectancy dropping to around 66 years in the 1990s, partly due to rising communicable diseases such as tuberculosis and HIV, poor maternal health services, and economic hardships. Workforce shortages and infrastructure weaknesses (approximately 2 physicians per 1,000 population) strained healthcare delivery. The country introduced community health initiatives involving local health promoters, which improved early disease detection and maternal-child health services. This community-centered approach contributed to a steady increase in life expectancy to over 70 years by 2015 and a decline in maternal mortality from 56 to 22 deaths per 100,000 live births over the same period, despite limited resources (90).

Table 4. Tasks traditionally executed by CHWs which could be optimised using digital inputs

Task	Digitalisation/AI Input	Example	Time Saved (per day)	Reason for Savings
Health education and awareness	AI chatbots and mobile apps for health messaging	WHO's HealthBuddy+ chatbot(161) , mHealth apps like MomConnect (162)	20–30 minutes	Pre-recorded messages and chatbots reduce time spent on repetitive information
Disease screening and risk assessment	AI symptom checkers	Ada Health symptom checker (163), Babylon Health triage tool (164)	10–20 minutes	AI apps help streamline symptom checklists and reduce manual evaluation time
Monitoring treatment adherence	AI-based SMS reminders	99DOTS for TB adherence (165), Medisafe medication reminder app (166)	15–20 minutes	Automated SMS reminders reduce follow-up burden
Data collection and reporting	Digital data tools with AI validation	DHIS2 Tracker with AI-based validation (167), CommCare mobile data collection (168)	30–45 minutes	Digital forms with autofill and validation speed up data entry and reduce rework
Triage and referral	AI triage bots and apps	Digital triage apps like RapidPro (169) , AI-powered Patient Triage by Infermedica (170)	10–15 minutes	AI decision tools provide instant referral guidance
Maternal and child health tracking	Mobile apps with alerts	mSakhi app for ASHAs (171), Safe Delivery App (172)	15–30 minutes	Automated scheduling and alerts reduce manual tracking
Mental health support	AI chatbots for mental wellbeing	Wysa AI chatbot (173), TalkLife peer support platform (174)	5–15 minutes	AI assistants manage initial support interactions
Chronic disease follow-up	BP tracking, reminders	Simple App for hypertension (175), Glucose Buddy for diabetes (176)	15–30 minutes	Tools like Simple App track BP, send reminders, and automate logs
Community engagement and mobilisation	AI messaging platforms	U-Report UNICEF (177), MobiliseMe AI-based outreach tool (178)	10–15 minutes	AI-personalised messaging replaces manual outreach

Health surveillance and outbreak response	Early warning via AI	ProMED-mail early warning (179), DHIS2 surveillance dashboards (180)	1–3 hours per event	Faster detection and reporting during outbreaks, saving several hours per event
Supply chain management	Forecasting and routing	mSupply mobile (181), OpenLMIS (182)	10–20 minutes	Automated stock level alerts avoid manual tallying and urgent ordering
Total Productivity Grain from Digitalisation (AI input): Daily time saved (average): 1.5–3 hours. Annual gain: ~78-156 hours per CHW (assuming 1-day work weeks). This equals to additional capacity to screen 156-312 patients with hypertension (assuming CHWs take on average 30 mins contact time per patient).				

<Table 3>

Over time, the CBC structures have demonstrated resilience during the health emergencies and pandemics by enabling rapid responses and maintenance of health services. For, example during Ebola outbreak in West Africa (2014–2016), Sierra Loene mobilized its network of CHWs to support surveillance, contact tracing, and health education, whose presence were crucial for early detection, quarantine enforcement and maintaining routine immunization services (91). Similarly, during the COVID-19 Pandemic, Vietnam relied heavily on the village health workers, who played a key role in early detection, local contact tracing, monitoring community health and enforcing quarantine which helped contain outbreaks early and avoid widespread transmission in the first wave of 2020 (17).

Despite many success stories of CBC, it has faced significant limitations. A major concern are the inconsistencies in the training and supervision of the services, which often results in the heterogenous quality of care owing to their variable clinical competence (92). In many resource-constrained settings, task shifting is used to address workforce shortages and to optimize the use of resources. However, CHWs are often expected to take on a wide range of demanding tasks without adequate compensation or support, leading to increased burden of work and reduced health service quality. This ultimately can lead to burnout and dropout (93–95). Community based-care activities often suffer from fragmentation due to inadequate coordination leading to duplication of efforts and inefficiencies among government, non-government organizations, and donors (96, 97). The 2019 resolution of World Health Assembly expressed concern over the ‘uneven integration’ of CHWs into health system, a situation partly attributed to the lack of integration of CHW program into broader health system planning, coordination, and partnerships (98). For example, Uganda launched CHW programme in 2001, with the aim to address the high disease burden and critical shortage of health professionals. While often cited in health system research as a success story, Uganda also serves as a cautionary tale about fragmentation and donor driven inefficiencies, where overlapping health initiatives, such as those in maternal child health and communicable diseases, have at times resulted in parallel reporting systems, conflicting priorities, and resource wastage (7, 99).

The integration of CBC into formal health system remains a challenge in many settings, where referral mechanism, data sharing and policy alignment are often underdeveloped. For example, traditional healers and informal health service providers, although central to health in rural communities, are rarely incorporated into the national health policy making. A study from rural Nigeria highlighted the crucial role of informal providers such as medicine vendors who strengthened the primary health care in a community. However, their integration into formal health systems was limited, leading to fragmented care and missed opportunities for comprehensive health strategies. This can be attributable to lack of knowledge and appreciation of traditional medicine or a misplaced expectation to match the competence of medically trained doctors (100, 101).

Community based-care programs often lack robust monitoring and evaluation (M&E) mechanisms, impeding efforts to assess effectiveness and inform scale-up strategies (24). A study done in Wakiso district, Uganda accessed the performance CHWs where only 20% demonstrated high performance, those receiving refresher training were 12 times more likely to perform well, and 90 of respondents reported stock-outs in the past six months, highlighting critical gaps in M&E system to support CHWs effectiveness (102). Cultural barriers, such as mistrust of formal health providers such as doctors, nurses or gender norms restricting CHWs access to households, can also diminish program reach and acceptability (24).

Finally, sustainable resource allocation remains a persistent issue. Many CBC initiatives rely on short-term donor funding rather than stable, long-term investment by national governments (103). These limitations underscore the need for more strategic planning, systemic integration, and long-term policy commitment to ensure the effectiveness and sustainability of community-based care. The future success of CBC depends on the stronger integration of CBC within formal healthcare systems, ongoing investment in health infrastructure and its incorporation at the implementable policy levels.

Emerging challenges and a changing landscape

The global health landscape is undergoing rapid and complex transformation. There are emerging challenges, particularly in relation to health service access and delivery. One particular concern are syndemics. For example, in the 1990s and early 2000s, The HIV/AIDS epidemic in Sub-Saharan Africa saw significant overlapping with surge in tuberculosis (TB) cases. People with HIV have weekend immune system, making them far more susceptible to contracting TB (104, 105). Likewise, in a recent COVID-19 pandemic, it became clear that people with pre-existing non-communicable disease (e.g., diabetes, hypertension, obesity) were at higher risk of severe COVID-19 outcomes (106). The dual burden of these diseases overwhelmed the fragile healthcare system, especially in resource limited settings. The risk of death and severe illness was significantly higher in people with such conditions (16, 107). Integrated service delivery and decentralized care models focusing with CBC can bundle services, for example HIV testing with TB or malaria/dengue testing along with COVID testing and health education to reduce missed opportunities of diagnosis and improve outcomes.

Another emerging challenge in the new health landscape are demographic transitions where a shift in fertility and mortality patterns can lead to shifts in population growth (if mortality drops before fertility does) followed by shifts in the age structure of populations. These changes, particularly the aging of populations and the transition from infectious to chronic non-communicable diseases (NCDs), present growing challenges for health systems. One associated emerging issue is the gap between the clinical practice of medical providers and the current burden of disease. Many professionals are prepared to manage acute infectious illnesses but are increasingly required to address NCDs such as diabetes, cardiovascular disease, and cancer (108). These shifts present distinct challenges along with opportunities for healthcare delivery, particularly for CBC (109). The elderly and individuals with disabilities (for e.g. restricted mobility) in the community are often unable to access the health services.

Various CBC strategies, such as home-based monitoring and care, CHW led screening and follow up, health education, and social support group can offer essential services to these populations within the community. Syndemicity of the disease burden is an escalating challenge in low-and middle-income countries (LMICs), where there is continuous struggle to combat infectious diseases on top of an increasing burden of NCDs (110). Another aspect of demographic transition is youth bulges- an age pyramid dominated by large cohorts between 15 and 30 years of age, often resulting from rapidly declining fertility rate (111, 112). Countries with a large youth population face unique health challenges, for example, reproductive health issues such as early childbearing, high rates of sexually transmitted disease (112, 113). They also face mental health concerns, substance abuse, unemployment related stress.

Urbanization and health disparities pose additional challenges. As urban areas expand, often without adequate infrastructure, new health risks emerge. For instance, poor housing, air pollution, overcrowding, and inadequate sanitation increase the risk of infectious disease such as TB, diarrheal infections, and vector borne diseases (114). Simultaneously, these environmental and social stress factors contribute to NCDs including asthma, hypertension, and cardiovascular diseases (115). Urban slums often lack access to quality health services in formal healthcare infrastructures. This leads to delayed diagnosis, inadequate treatment, and poor health outcomes among the urban poor, further deepening existing health inequalities (115, 116). Addressing these challenges requires a shift towards inclusive urban health strategies that integrate CBC, strengthen primary healthcare, and engage local stakeholders in planning and delivery of health services that explicitly include the vulnerable population, such as migrants, informal workers and those living in slums (117, 118).

Changes in social structures are evident in many urban and rural settlements, with the latter undergoing substantial transformation towards urbanization (119). In many societies, traditional social structures such as extended families, community networks, and prevailing gender norms have long played a central role in caregiving, health, and social support (120). While gender roles have often been framed as clearly defined, in practice they have varied significantly across time and place. In some contexts, contemporary shifts have challenged traditional norms, while in others, there has been a reassertion of more rigid interpretations of gender roles, often explained as going back to traditional values. Yet, historical

evidence shows these norms have always been socially constructed and fluid, shaped by economic, political and cultural change (121). Globalization, migration, and evolving cultural norms have led to changes in the social structures. Increased migration, often for work has led to family fragmentation and elderly parents, children and women are frequently left behind without consistent caregiving or support (122, 123). Such migrant populations also face legal, cultural, linguistic barries in accessing healthcare and are at increased risk to mental health, communicable disease and occupational injuries (124).

As societies change, particularly in high-income and urbanized settings, the concept of CBC is increasingly challenged. One of the significant aspects is socio-cultural shifts observed is to move from communal living and extended families to nuclear families or even individual living. This shift has been observed in Nepal, where ~ 70% of families now live in nuclear arrangements (125). However, this transformation does not follow a straight developmental line. Instead, social structures resemble a branching tree: some kin-based forms decline, others transform or persist, and entirely new configurations emerge, driven by diverse cultural, economic, and political influences (126). This transition weakens the sense of community cohesion and informal support system such as CBC programs that heavily rely on them. In many LMICs, CBC is facilitated by a strong community fabric, where volunteerism and neighbourhood-based solidarity enable the function of CHWs. In urban settings the a desire for privacy, freedom and financial independence leads to fragmented living arrangements and declining communal interaction (127). This also weakens informal care networks such as CBC and increase the demand for institutional based health services. In addition, there is a changing gender role, as such more women enter workforce leading to shift away from the traditional role of caregiving (128, 129).

Changing social structure are reshaping how people live, relate and access healthcare, often increasing vulnerability, particularly for migrants, women, elderly, and youths. These structural shifts demand a health system that is flexible, people-centred, and inclusive with particular focus on CBC that compensates for ever weakening of traditional social support system (81). There is also need for health services to become more culturally sensitive and responsive to present day diverse household arrangements and proactive in addressing social isolation, mental health and gender-based disparities.

Digital disruption: AI and technology in community care

Digital health, AI, and mobile technologies are rapidly transforming the landscape of primary healthcare delivery, particularly LMICs. These technologies are not only enhancing access to health services and its efficacy but also challenging traditional concepts of what constitutes a ‘community’ in health services delivery (81, 130). As there is increasing inclination toward incorporating digital technologies in healthcare services, there is less reliance on institutional settings such as local clinics or hospitals. One striking social development is the way people seek health information online often leading to misinformation, disinformation, and inappropriate self-diagnosis (131). The concept of ‘community’ in healthcare is shifting from a geographically bounded population to a more dispersed, digitally connected network of individuals and providers (132). It is interesting to see how recent pandemic of COVID-19

embraced the use of various digital technology platforms such as telemedicine and virtual consultations in healthcare due to need for social distancing and nationwide lockdown (133, 134).

Exploring the aspect of digital health suggests possibilities for delivering healthcare services remotely such as telemedicine, application-based service including mobile health (m-Health), and virtual consultations (135). This allows at least in theory high quality care to reach underserved or remote population. Remote and virtual care models allow patients access medical advice, monitoring of treatment without visiting healthcare facilities physically. This can be particularly valuable in rural, underserved or emergency situations. It reduces travel time and costs for financially weak communities. It can improve continuity of care and timely attention to health needs (136).

Artificial intelligence has emerged as a transformative force in healthcare, offering significant potential to address workforce challenges and patient outcomes (137). It can be used in health screening and diagnosis, particularly employing machine learning and deep learning models, can analyse vast amount of medical data, such as scanned images, lab results, and electronic health records promptly and with accuracy. Artificial Intelligence can help detect early signs of diseases namely cancers (breast, lung, skin), diabetic retinopathy, often identifying anomalies which are frequently missed (138). Artificial Intelligence powered decision support in health system particularly for clinicians in making evidence-based decision by providing risk assessments, differential diagnosis, and treatment recommendations are promising prospects (139).

Community health workers can also operate these tools to improve outreach and reduce diagnostic and therapeutic information gaps. As adoption of AI in health care increases, there are growing interest in generative AI enabled by large language models (LLMs), which offers significant potential to improve healthcare delivery. Without proper safeguards, AI systems can make existing healthcare inequalities worse because they recycle inaccurate data (140). Biases may arise from under representation of populations (141, 142). If AI is trained on unfair or incomplete data, it will ignore the needs of minorities and vulnerable populations (142). Bias can occur when algorithms recycle historical patterns essentially encoding systemic bias as scientific truth. This ‘recycling of prior evidence’ can lead to decision making that perpetuates malpractice, especially in diagnostics, treatment recommendations and resource allocation (143). On the other hand, issues such as cultural and linguistic insensitivity are associated with AI, where failure to understand or appropriately respond to non-dominant language or cultural norms (144). Lack of human insights, which can lead to blind reliance on algorithmic outputs even when they may be incorrect or unethical. Nevertheless, there can be transparency and accountability gaps where developers or users may not fully understand how or why the AI is making the recommendations (145). To prevent these harms, it is essential in ensuring diverse and representative training data, build tools that are culturally and linguistically accessible and strong human oversight to review validate and context specific AI driven decisions in health system (146). This also raises questions about equity and digital literacy among health staffs and overreliance on technology and depersonalization of care (137).

There are challenges with dependable network access, logistics availability in remote areas, algorithmic biases, ethical concerns, data privacy (147, 148). While new technologies bring many benefits, they also change how we think about 'community', from being based on a physical space to being part of digital network (149, 150). Health care may become depersonalized if these technologies are not grounded in local social and cultural contexts of the community, risking a poor acceptability among community members (151). Digital technologies are best positioned to complement rather than replace human capacity in healthcare services.

DISCUSSION

This umbrella review tracks historical development in community-based programs, barriers and facilitators in the age of rapid technological advancement and AI. There is a need for policy makers to prioritize the formal recognition of CBC into national health strategies, backed by sustainable financing and intersectoral collaboration (37). Strengthening the training of CHWs is essential when there is need of multi-skilled, digitally literate health care workers capable of delivering integrated health services in the community they serve (37, 152). Investment in community level infrastructure, including reliable digital tools, mobile connectivity, and supply chain systems will be pivotal in efficient and data driven care (153).

Community engagement enhances CBC's accountability. It can ensure that the CBC's care is acceptable/culturally tailored to the community through feedback cycle, dialogues and even through identification of priority areas for CBC (154). Community engagement also enhances the access and acceptability through wide reach, engagement occurring at subliminal space (family, peers, and community members even when not deliberated) (155). Community engagement can become the conduit for health promotion (healthy behaviour, vaccination, improvement of water and sanitation), disease prevention and thus can be an extended arm of CBC (156).

While mHealth and digital platforms have already shown promise, emerging AI systems offer the potential to further enhance efficiency, decision-making, and personalization of care (59). Artificial Intelligence powered tools such as chatbots, predictive analytics, and clinical decision support systems can support CHWs in screening, triage, and referral decisions, especially in underserved remote areas where access to expert supervision is limited (157). These tools can help standardize protocols, reduce delays in diagnosis, and enable real-time data-driven responses (158). Artificial Intelligence can also facilitate natural language processing to translate or tailor health messages into culturally appropriate content, improving health literacy and community engagement (159). However, to ensure ethical and equitable deployment, AI integration must be guided by robust governance frameworks, data privacy protections, and inclusive design processes that reflect the realities of low-resource and diverse community contexts (160).

CBC must evolve by adopting scalable, people centred solutions that utilize these tools for improved access and continuity of care. By integrating digital platforms with community engagement strategies,

CBC can enhance real-time decision-making, promote preventive care, and bridge gaps in service delivery. These strategic shifts will position CBC as cornerstone of resilience, inclusive and future ready health system.

As the technology is rapidly advancing and health system incorporates more digital platforms, CBC must also evolve by adopting scalable, people centred solutions that utilize these tools for improved access and continuity of care. By integrating digital platforms with community engagement strategies, CBC can enhance real-time decision-making, promote preventive care, and bridge gaps in service delivery. These strategic shifts will position CBC as cornerstone of resilience, inclusive and future ready health system.

Strengths and limitations

The scoping review enabled the inclusion of a wide range of literature, capturing diverse perspectives on CBC including its historical evolution, links to primary health care, and real-world implementation. Expert consultation enhanced the relevance of the review, drawing on their experiential and epistemic insights. Notably, experts emphasized key themes such as sustainability, financing, dependency, and integration into health systems as central to CBC.

The review may reflect author bias due to prior experience in community-based health services, research, and implementation. Additionally, the heterogeneity of findings (e.g., impacts) may have been reduced by the authors' a priori assumptions related to community-based care. The absence of systematic quality appraisal limited quantitative impact assessment, and lack of meta-analysis are further limitations.

Recognizing the complexity of the topic, this review aimed to contextualize findings for real-world application. It offers a synthesized account of CBC's development, core characteristics, and implications for future directions.

CONCLUSION

Community based care has long been a cornerstone of health system delivery, much before the advent of modern healthcare services. However, evolving global health challenges now demand a fundamental rethinking of its structure and functionality. With the recent pandemic of COVID-19 and improvement in overall health indicators such as decreased maternal and infant mortality rates in communities underscored the adaptability and value of CBC, particularly the role of CHWs. However, persistent issues such as inadequate funding, weak integration into formal health system, limited trainings, and gender inequalities undermine their effectiveness and sustainability. As health system face rising challenges from syndemics, climate change, changing social structure, demographic transitions, and digital transformation, CBC must be reimagined to be more inclusive, well resourced, and technologically enabled. Strengthening CBC through robust trainings, digital integration, and policy support relevant with local context and culture is not only for achieving sustainable health goals but also for building resilient, equitable health systems capable of responding to future crisis.

Declarations

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CRediT Authors' contributions

SA: Conceptualisation, Literature review, Writing – original draft. **SRM:** Conceptualisation, Supervision, Writing – review & editing. **BA**: Conceptualisation, Supervision, Writing – review & editing. **LvS**: Supervision, Writing – review & editing. **DMP**: Conceptualisation, Supervision, Writing – review & editing.

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Data availability

The literature synthesized in this study is freely available through PubMed/Medline and Google Scholar.

Competing interests

The authors declare no competing interests.

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Not applicable.

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Figures

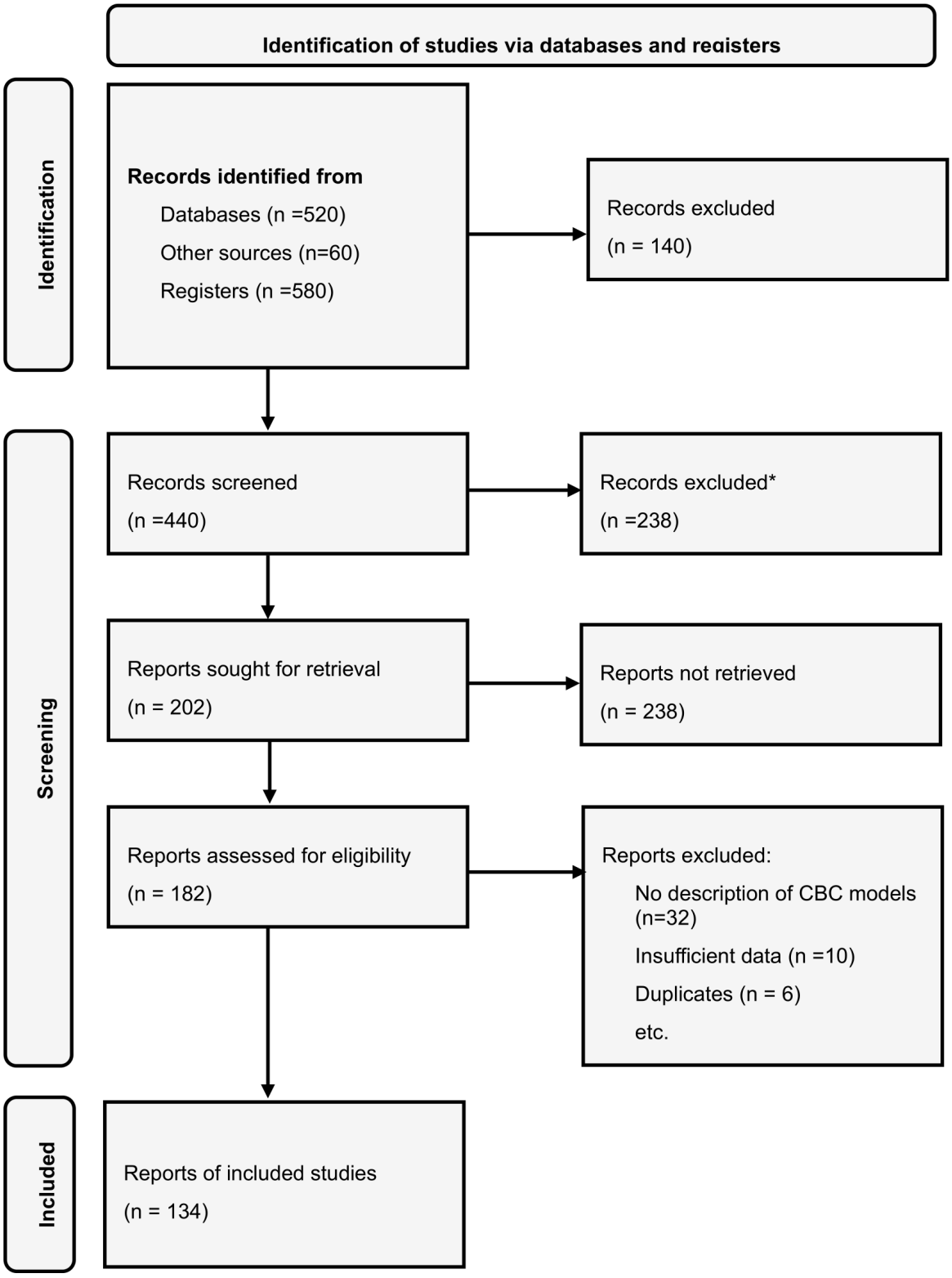

Figure 1

PRISMA flow chart of the systemic review process.

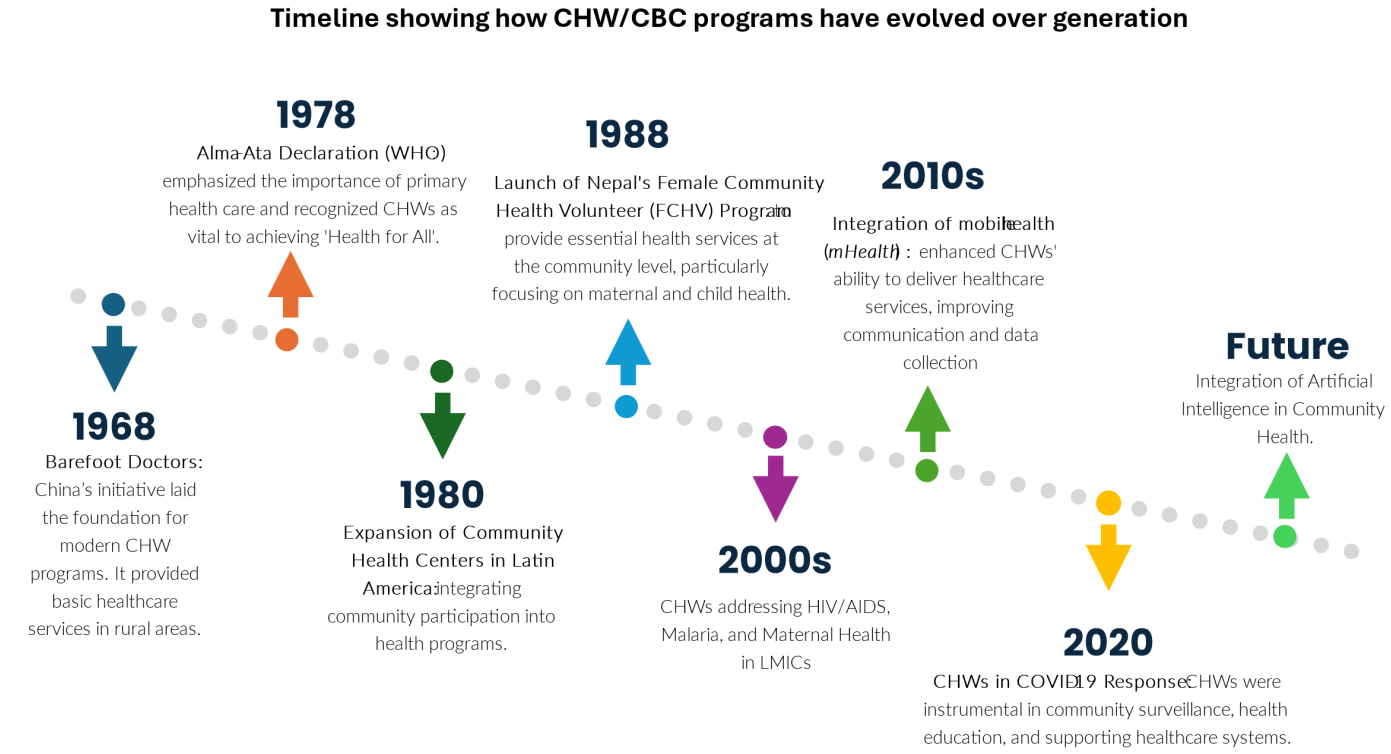

Figure 2

Timeline showing how CHW/CBC programs have evolved over generation (53-59)

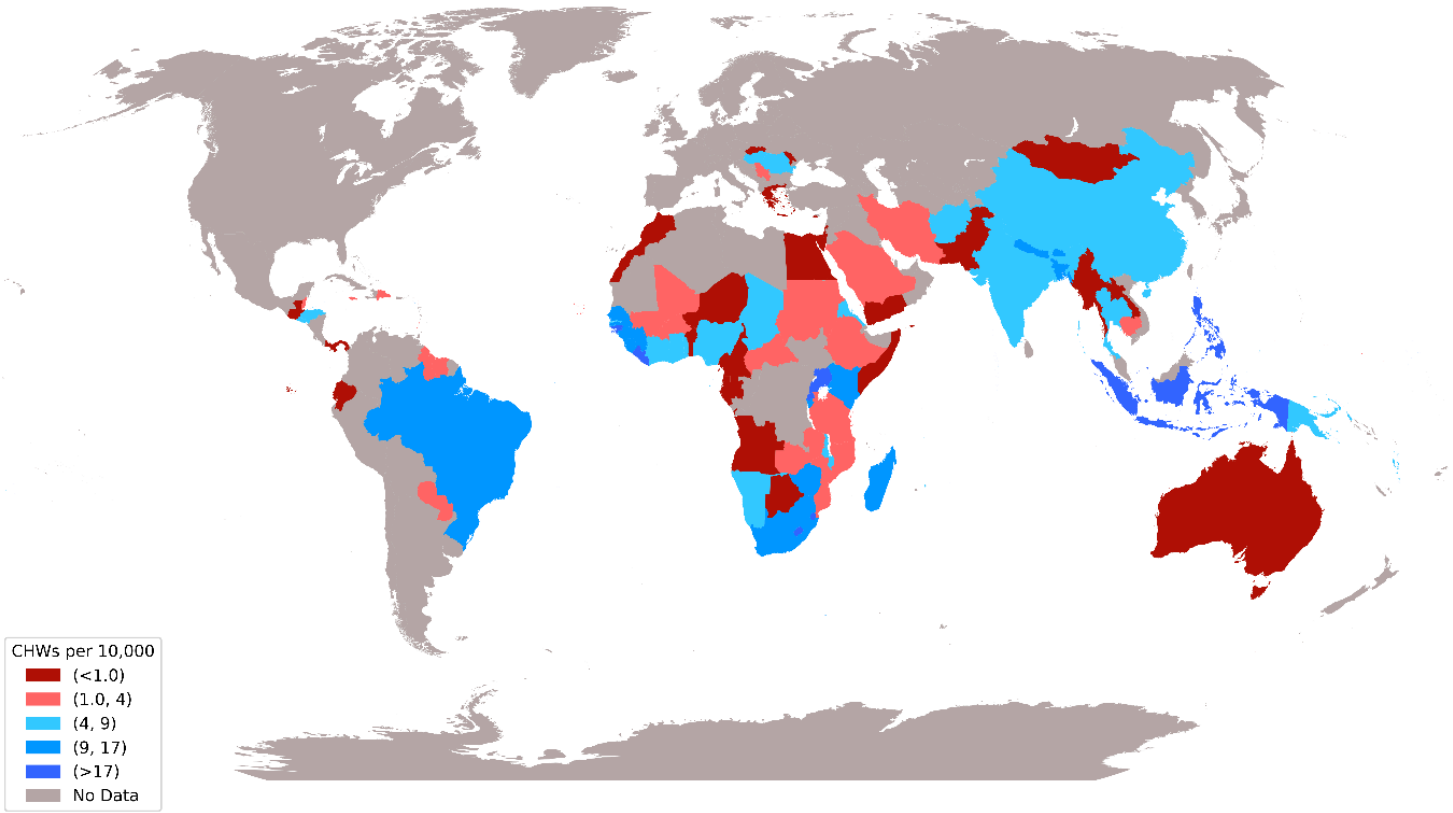

Figure 3

Countries with community health workers program. Data shows density of CHWs per 10,000 population (source World Bank Database https://data.worldbank.org/indicator/SH.MED.CMHW.P3).

Nepal

Female Community Health Volunteer (FCHV) Program

Overview:

FCHV established in 1988, is a cornerstone of the country's community-based primary health care system.

Key Features:

- Volunteer-based model with over 50,000 female CHWs, typically selected by their communities.
- Focuses on maternal and child health, nutrition, immunization, and family planning.
- Basic training and regular refresher courses, with strong supervision from health posts.

Impact:

- achievements in reducing maternal and under-five mortality.
- health promotion for remote populations.
- critical role during the COVID-19

Ethiopia

Health Extension Program (HEP)

Overview:

Launched in 2003, as a flagship government initiative that professionalizes CHWs known as Health Extension Workers (HEWs).

Key Features:

- Over 38,000 salaried, government-employed, mainly women, deployed in rural health posts.
- Deliver 16 packages of essential health services (disease prevention, family health, hygiene and sanitation, and health education).
- undergo one year of formal training and serve as the first contact point in the health system.
- Strong linkages with community health volunteers (Health Development Army) for outreach and mobilization.

Impact:

Brazil

Family Health Strategy (FHS), (Estratégia Saúde da Família)

Overview:

launched in the 1990s, is Brazil's principal approach to delivering comprehensive primary health care.

Key Features:

- Each FHS includes a physician, nurse, nurse assistant, and 4–6 CHWs (Agentes Comunitários de Saúde).
- salaried, trained, and responsible for 150–200 households, conducting home visits and linking families to care.
- Emphasis on continuity of care, health promotion, chronic disease management, and surveillance.
- Embedded in municipally managed public health system (SUS) with federal guidelines.

Impact:

- Linked to reductions in infant mortality,

Figure 4

CASE Studies: A selected case study of CBC programs in Nepal, Ethiopia, and Brazil

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryMaterial.docx