Review

OPEN

Task-sharing with community health workers to treat hypertension: a scoping review

Yoko Inagaki[a], Kunihiro Matsushita[b,c,d], Lawrence J. Appel[b,c,d], Henry B. Perry[a], and Dinesh Neupane[a,b,c]

Many studies have implemented and evaluated task-sharing interventions with community health workers (CHWs) to manage hypertension. To identify gaps in research, we conducted a scoping review. We searched original articles published in PubMed and EMBASE between 2010 and 2022 and found 122 articles meeting our inclusion criteria. Only seven articles were from low-income countries (LICs), most of which were qualitative studies or mixed methods studies. In the identified 122 articles, CHWs often performed health education (61.3%) and measured blood pressure (60.4%). Whereas CHWs carried out pharmacological treatment in only three studies. Participant homes (75.0%) were the most common setting for receiving interventions. Our study identified specific needs for future research, specifically, studies in LICs that are experimental in design and that collect relevant qualitative information, and studies in which CHWs do advanced task. In addition, publications of CHW studies should provide a more comprehensive list of intervention features.

Keywords: community health workers, hypertension, task-sharing

Abbreviations: BP, blood pressure; CHW, community health worker; CVD, cardiovascular disease; DBP, diastolic blood pressure; HIC, high-income country; LIC, low-income country; LMIC, low- and middle-income country; MIC, middle-income country; NCD, non-communicable disease; NPHW, non-physician health worker; RCT, randomized controlled trial; SBP, systolic blood pressure; WHO, World Health Organization

INTRODUCTION

Hypertension is a leading modifiable risk factor for premature cardiovascular death, estimated to be responsible for 11.3 million deaths across the world in 2021 [1]. Although the importance of its early prevention and control has been well recognized, global hypertension control remains suboptimal. In 2019, less than a half of hypertensive adults worldwide were receiving pharmacological treatment and only 30% of them achieved hypertension control [2]. Treatment and control rates are much lower in low- and middle-income countries (LMICs) [3–5]. While hypertension control rate improved in high-income countries (HICs) from 38.6% in 2000 to 50.4% in 2010, it became even worse in LMICs, dropping from 29.4% in 2000 to 26.3% in 2010 [3]. Research studies show hypertension is more common and more poorly controlled among those with lower socio-economic status [6,7], and poorly controlled hypertension can lead to fatal or incapacitating cardiovascular events, along with substantial healthcare expenses [8]. To mitigate health inequities and reduce the burden of cardiovascular diseases (CVDs), new strategies to achieve hypertension control are much needed.

The need for alternative strategies is especially important in LMICs, because of insufficient numbers of physicians to diagnose and treat hypertensive adults. A previous study reported that only 31% of lower middle-income countries (MICs) and 11% of low-income countries (LICs) have enough physicians for hypertensive adults to be seen at least 3 times a year, compared to 98% of HICs and 78% of upper MICs [9]. Another study done with data from 191 countries showed that 41 countries could not even provide one visit per year for hypertensive adults; all of these countries were either LICs or lower MICs [10]. The asymptomatic nature of the condition and the distance to healthcare facilities, a common problem in many LMICs, further prevents hypertensive adults from being diagnosed and treated at an early stage of their illnesses.

One solution, that is applicable to both LMIC and resource-constrained areas of HIC, is to share physician tasks with trained nonphysician health workers (NPHW) who can properly treat hypertensive adults. Task-sharing is an aspect of contemporary health systems in which the entire task or key components of it are carried out by cadres of health workers without advanced medical training [11,12]. Not only in LMICs, but also in HICs, this concept has attracted attention as a means to allow physicians to focus on tasks that require their specialized skills. Studies on task-sharing with NPHWs have rapidly increased in the last 20 years, including those with community health workers

Journal of Hypertension 2024, 42:000–000

[a]Department of International Health, [b]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, [c]Welch Center for Prevention, Epidemiology, and Clinical Research and [d]Johns Hopkins School of Medicine, Baltimore, Maryland, USA

Correspondence to Yoko Inagaki, Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205, USA.
E-mail: yinagak2@jhu.edu

Received 11 August 2023 **Revised** 1 July 2024 **Accepted** 29 July 2024

DOI:10.1097/HJH.0000000000003834

(CHWs). The background, education and training of CHWs varies by country, but in general, CHWs are lay individuals from a community who receive relatively brief professional trainings to deliver essential health services to communities [13–17]. They may have little or no educational background, but by undergoing professional trainings, they are allowed to do certain protocol-based care. In 2019, Anand *et al.* conducted a systematic review and meta-analysis of task-sharing interventions with NPHWs for hypertension management in LMICs, which suggested that task-sharing with CHWs can reduce systolic BP by 3.67 mmHg [95% confidence interval (CI): 2.77–4.58] [18]. In 2020, a large-scale multicountry cluster-randomized controlled trial (RCT) was conducted by Tazeen *et al.* which showed that sharing tasks with governmental CHWs in Bangladesh, Pakistan, and Sri Lanka can reduce systolic blood pressure (BP) by an average of 5.2 mm Hg (95% CI 3.2–7.1) [19]. Thus, there is growing evidence that task-sharing with CHWs can improve hypertension control in LMICs. Not only in LMICs, but also in HICs, the effectiveness of task-sharing with CHWs has been widely reported [20,21].

There are several reasons why sharing tasks with CHWs should be a highly effective and pragmatic way to control hypertension at scale. First, they are the largest size of workforce among all types of health workers. According to the World Health Organization (WHO), there are >1000 times greater number of CHWs compared to doctors, nurses, and midwives all combined [22]. Second, as many CHWs perform their tasks in homes of community members, they have greater reach to hypertensive adults than the other NPHWs, who tend to work in health facilities. Third, as many CHWs are required to be originally from or live in the community they serve, it is likely that CHWs have a great rapport with hypertensive adults.

Although previous systematic reviews on task-sharing with CHWs have addressed its effectiveness on hypertension control [18,20,21,23–28], none of them have comprehensively provided key characteristics of task-sharing studies, such as location (i.e. country), type of CHW tasks (e.g. BP measurement, initiation and refill of medications), settings (e.g., homes, health facilities), and type of BP monitor used by CHWs. Additionally, existing studies reviewed only experimental studies, but not other types of studies such as observational, qualitative, and mixed-methods studies, although these studies can provide useful information to inform future interventions on how to best mobilize CHWs in hypertension management. Instead of reviewing studies from all countries across the globe, existing studies and reviews also tended to be limited in scope, e.g. including data from one country [23,24], from LMICs only [18,25,26,28], or from HICs only [20,21,27]. Thus, the objectives of this study are to review all task-sharing studies with CHWs for hypertension control which were carried out at any location in the world, to summarize key characteristics of task-sharing interventions and compare by country-income groups or by regions, and to identify gaps in research and areas that merit future investigation.

METHODS

We performed a scoping review of peer-reviewed articles. A scoping review is a type of literature review that aims to map the main source of evidence available and to identify research gaps by assessing relatively broader range of articles than systematic reviews [29]. Our protocol was drafted based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [30], and was finalized by the research team (Y.I., H.P., and D.N.). The protocol is available upon request to the corresponding author.

Information sources and search strategy

We conducted a literature search in PubMed and EMBASE. The search queries included two key words, "*hypertension" and "community health workers"* (see Table 1, Supplemental Digital Content, http://links.lww.com/HJH/C542 for the final search strategy). The query for "*community health workers"* included specific names used for CHWs in many countries, such as Village Doctors in China, Female Community Health Volunteers in Nepal, Accredited Social Health Activists in India, Community Health Officers in Ghana, Health Extension Workers in Ethiopia, among others. The search strategy was drafted by the first author (YI) with consultation to an informationist, and finalized by the research team (Y.I., H.P., and D.N.).

Eligibility criteria

Peer-reviewed articles were included if they were: an original article published between January 2010 and May 2022, written in English, and contained any description of task-sharing with CHWs or CHWs and other health workers (i.e., multidisciplinary health team) for management of hypertension among adults. We originally aimed to include articles since the inception of each database. However, as there were only a few articles before 2009 and most of them were not relevant, the protocol was revised, and the timeline was limited to 2010–2022. Both single-country and multicountry studies were included. Task-sharing studies with CHWs for management of hypertension in pregnant women or children were excluded as clinical management of these populations requires different approaches. Nonoriginal articles such as commentaries, editorials, letters, and protocols were excluded. To avoid duplicate counting of the same intervention, secondary data analysis of previously published studies were excluded. Review articles were also excluded. However, we conducted a manual search for articles that met the eligibility criteria among those cited in review articles. Quantitative, qualitative, and mixed methods studies were included. Quantitative studies were further classified into experimental or observational studies. Experimental studies are further classified into randomized controlled trials (RCTs), quasi-experimental studies, or prepost (i.e. single-arm) studies. Observational studies are classified further into either cohort or cross-sectional studies.

Screening and data extraction

Title and abstract screening, full literature review, and data extraction were conducted by one reviewer (Y.I.) using Google data extraction form (see Table 2, Supplemental Digital Content, http://links.lww.com/HJH/C542) based on the Cochrane Handbook for Systematic Reviews of Interventions [31] and was finalized through discussion with the

additional two research team members (H.P. and D.N.). Data on country, country-income level, and region were extracted according to criteria of the World Bank Group [32]. Information on study type, study design, CHW tasks, settings, type of BP monitors used, and other NPHWs to share tasks in addition to CHWs (i.e., multidisciplinary health team), were also extracted as key characteristics of a study. The following data were also extracted from experimental studies: effect size of primary outcomes, sample size of participants per arm, the number of CHWs sharing additional tasks per arm, and frequency of participant-CHW encounter. The sample size and the number of CHWs were used to estimate the median catchment size by dividing the sample size by the number of CHWs. Participants were defined as beneficiaries in communities who received health services for hypertension management from CHWs. Ethical approval was not required.

RESULTS

Our initial search yielded a total of 4196 articles. Title and abstract screening identified 326 potentially eligible articles, of which 84 were duplicates and thus excluded. Full review of the remaining 242 articles led to the identification of 122 articles that qualified for data extraction (Fig. 1).

The number of articles published per year increased over time (see Fig. 1, Supplemental Digital Content, http://links.lww.com/HJH/C542). Of the identified 122 articles, 115 and 7 were single-country and multicountry studies, respectively. Among 115 single-country studies, less than one-third (31.3%) and two-thirds (62.6%) were from HICs and MICs, respectively, while only seven studies were carried out in LICs (Table 1). Summary of seven studies identified from LICs are presented in Tables 2 and 3. Experimental (63.9%) and observational (43.0%) studies were the type of study most often published for studies conducted in HICs and MICs, respectively. In contrast, the majority of publications from LICs were qualitative or mixed-methods studies. By regional group, North America ($n = 36$) and South Asia ($n = 34$) were the two regions with the highest number of studies identified, each of which were largely from the United States ($n = 35$) and India ($n = 26$), respectively (Fig. 2). Among 48 Sub-Saharan African countries, where unmet need of hypertension treatment is the greatest, there

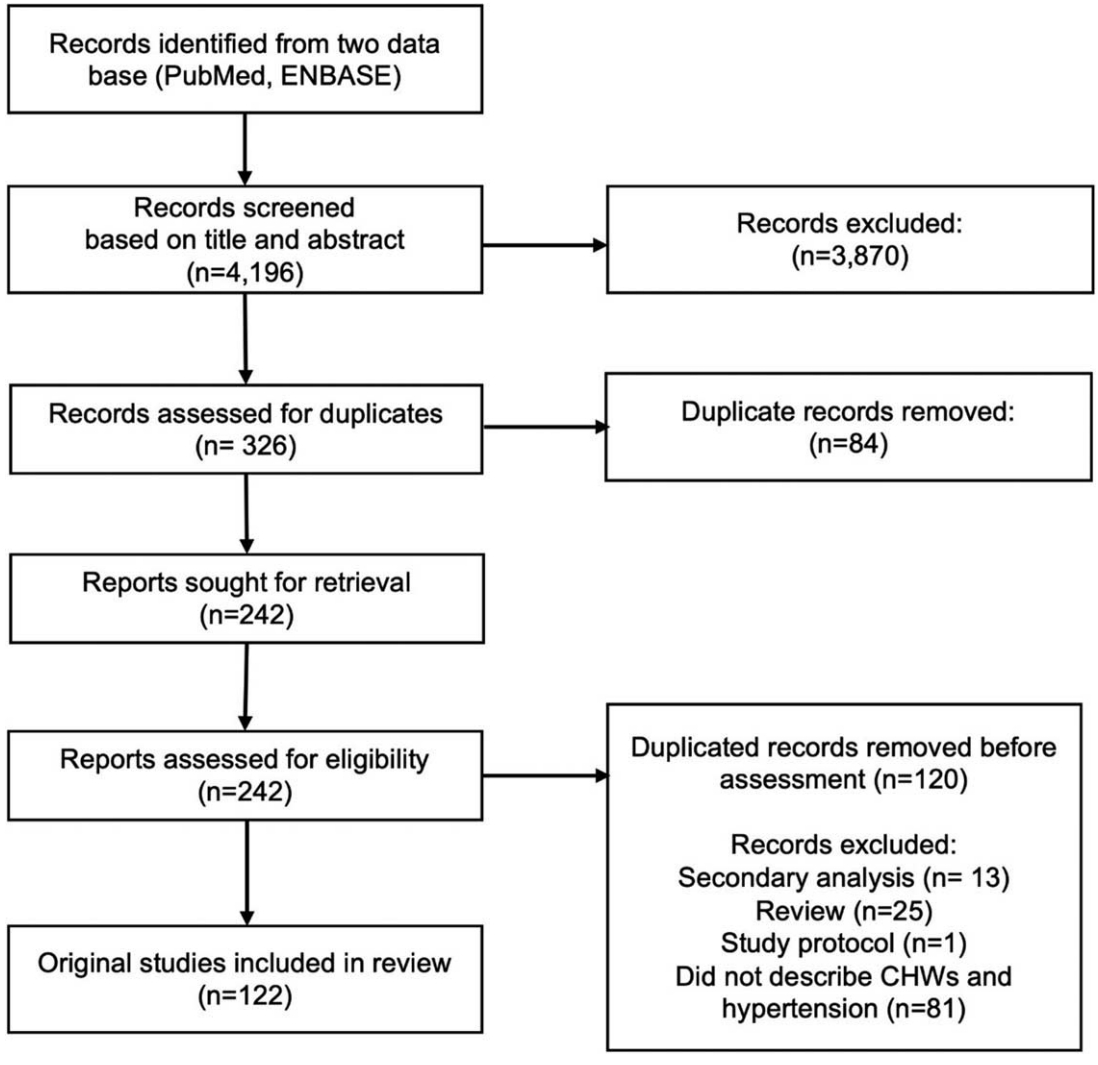

FIGURE 1 PRISMA flow chart.

TABLE 1. Study types by country-income level and region

		Quantitative						
		Experimental			*Observational*			
	Total	*RCT*	*Quasi-experimental*	*Prepost*	*Cohort*	*Cross-sectional*	*Qualitative*	*Mixed-methods*
Included studies, n (%)	122 (100)	32 (26.2)	3 (2.5)	18 (14.8)	2 (1.6)	39 (32.0)	15 (12.3)	13 (10.7)
By country income-level, n (%)	115[a] (100)							
High-income	36 (100)	12 (33.3)	1 (2.8)	10 (27.8)	0 (0.0)	7 (19.4)	5 (13.9)	1 (2.8)
Middle-income	72 (100)	18 (25.0)	1 (1.4)	8 (11.1)	2 (2.8)	29 (40.3)	7 (9.7)	7 (9.7)
Low-income	7 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (28.6)	3 (42.9)	2 (28.6)
By region, n (%)	115[a] (100)							
North America	36 (100)	12 (33.3)	1 (2.8)	10 (27.8)	0 (0.0)	7 (19.4)	5 (13.9)	1 (2.8)
South Asia	34 (100)	11 (32.4)	0 (0.0)	6 (17.6)	1 (2.9)	11 (32.4)	1 (2.9)	4 (11.8)
Sub-Saharan Africa	23 (100)	2 (8.7)	0 (0.0)	0 (0.0)	0 (0.0)	11 (47.8)	6 (26.1)	4 (17.4)
Latin America and Caribbean	11 (100)	4 (36.4)	0 (0.0)	2 (18.2)	1 (9.1)	3 (27.3)	0 (0.0)	1 (9.1)
East Asia and Pacific	8 (100)	1 (12.5)	1 (12.5)	0 (0.0)	0 (0.0)	4 (50.0)	2 (25.0)	0 (0.0)
Middle East and North Africa	3 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)

[a]Seven multicountry studies were excluded.

were only 8 countries with at least one task-sharing study identified. No studies were identified from Europe and Central Asia.

The type of CHW tasks were described in a total of 105 articles (Table 4). Health education (68.6%) and BP measurement (60.0%) were the tasks most often performed by CHWs. CVD risk assessment was done by CHWs in only one-quarter (27.6%) of the studies. There were only three studies in which CHWs initiated or refilled antihypertensive drugs; CHWs in India refilled antihypertensive medicines in a mixed-method study [33], and village doctors (i.e., government-certified CHWs in China) refilled and initiated antihypertensive medicines in two RCTs [34,35].

A total of 90 articles described the settings of services. Overall, most of the services for hypertension management were done by CHWs at the homes of participants ($n = 71$), followed by public spaces ($n = 18$) and health facilities ($n = 11$). In LMICs, the participant home was the most common site for CHW visits (87.1%), followed by health facilities and public spaces (both at 10.9%). In HIC, participant home (48.1%) and public space (40.7%) were the two most common locations. Of the 46 studies describing the type of BP monitors used by CHWs, nearly 90% documented the use of digital BP monitors. Please refer to Table 4, Supplemental Digital Content, http://links.lww.com/HJH/C542 to find further information for each of the identified 122 articles, such as author, year of publication, country, study type, sample size, study settings, role of CHWs, key results, among others.

Quantitative studies

Experimental studies

There was a total of 53 experimental studies identified, including 32 RCTs [19,34,36–65], 3 quasi-experimental studies [66–68], and 18 prepost studies [69–86]. Three of them were multicountry studies [19,55,66]. Among 50

TABLE 2. CHW tasks, settings, BP monitors, and type of other nonphysician health workers in included studies

	CHW tasks					
	All[a]	*Health education*	*BP measurement*	*CVD risk assessment*	*Medication initiation*	*Medication refill*
Included studies, n (%)	105 (100)[b]	72 (68.6)	63 (60.0)	29 (27.6)	2 (1.9)	2 (1.9)
By country income-level, n (%)	99 (100)[c]					
High-income	33 (100)	24 (72.7)	9 (27.3)	4 (12.1)	0 (0.0)	0 (0.0)
Middle-income	61 (100)	39 (63.9)	46 (75.4)	21 (34.4)	1 (1.6)	2 (3.3)
Low-income	5 (100)	4 (80.0)	3 (60.0)	1 (20.0)	0 (0.0)	0 (0.0)
By region, n (%)	99 (100)[c]					
North America	33 (100)	24 (72.7)	9 (27.3)	4 (12.1)	0 (0.0)	0 (0.0)
South Asia	31 (100)	20 (64.5)	22 (71.0)	8 (25.8)	0 (0.0)	1 (3.2)
Sub-Saharan Africa	19 (100)	12 (63.2)	15 (78.9)	8 (42.1)	0 (0.0)	0 (0.0)
Latin America and Caribbean	10 (100)	8 (80.0)	8 (80.0)	4 (40.0)	0 (0.0)	0 (0.0)
East Asia and Pacific	5 (100)	2 (40.0)	3 (60.0)	1 (20.0)	1 (20.0)	1 (20.0)
Middle East and North Africa	1 (100)	1 (100)	1 (100)	1 (100)	0 (0.0)	0 (0.0)

BP, blood pressure, CVD, cardiovascular disease.
[a]Total number of articles in which CHW tasks were specified. If CHWs performed multiple tasks in an article, each task was counted separately. For example, if CHWs performed both BP measurement and CVD risk assessment, we counted as BP measurement = 1 and CVD risk assessment=1.
[b]SEVENTEEN articles not clearly stating CHW tasks were excluded.
[c]Seven multicounty studies and 16 single-country studies not clearly stating CHWs tasks were excluded.

TABLE 3. CHW tasks, settings, BP monitors, and type of other nonphysician health workers in included studies

	Settings						BP monitors				Health workers			
	All[a]	*Participant home*	*Public space*	*Health facility*	*Telephone*	*Anywhere*	*All*[d]	*Digital only*	*Manual only*	*Both*	*All*[g]	*CHWs*	*Team-based*	
All included studies	95 (100)[b]	71 (74.7)	18 (18.9)	11 (11.6)	5 (5.3)	3 (3.2)	46 (100)[e]	41 (89.1)	4 (8.7)	1 (2.2)	107 (100)[h]	84 (78.5)	23 (21.5)	
By country income-level	89 (100)[c]						41 (100)[f]				100 (100)[i]			
High-income	27 (100)	13 (48.1)	11 (40.7)	3 (11.1)	5 (18.5)	2 (7.4)	4 (100)	4 (100)	0 (0.0)	0 (0.0)	34 (100)	21 (61.8)	13 (38.2)	
Middle-income	57 (100)	50 (87.7)	7 (12.3)	4 (7.0)	0 (0.0)	0 (0.0)	34 (100)	31 (91.2)	2 (5.9)	1 (2.9)	62 (100)	55 (88.7)	7 (11.3)	
Low-income	5 (100)	4 (80.0)	0 (0.0)	3 (60.0)	0 (0.0)	0 (0.0)	3 (100)	1 (33.3)	2 (66.7)	0 (0.0)	4 (100)	3 (75.0)	1 (25.0)	
By region	89 (100)[c]						41 (100)[f]				100 (100)i			
North America	27 (100)	13 (48.1)	11 (40.7)	3 (11.1)	5 (18.5)	2 (7.4)	4 (100)	4 (100)	0 (0.0)	0 (0.0)	34 (100)	21 (61.8)	13 (38.2)	
South Asia	30 (100)	27 (90.0)	5 (16.7)	1 (3.3)	0 (0.0)	0 (0.0)	17 (100)	16 (94.1)	1 (5.9)	0 (0.0)	30 (100)	28 (93.3)	2 (6.7)	
Sub-Saharan Africa	18 (100)	15 (83.3)	1 (5.6)	4 (22.2)	0 (0.0)	0 (0.0)	14 (100)	11 (78.6)	2 (14.3)	1 (7.1)	19 (100)	18 (94.7)	1 (5.3)	
Latin America and Caribbean	9 (100)	7 (77.8)	0 (0.0)	2 (22.2)	0 (0.0)	0 (0.0)	3 (100)	3 (100)	0 (0.0)	0 (0.0)	10 (100)	6 (60.0)	4 (40.0)	
East Asia and Pacific	4 (100)	4 (100)	1 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100)	2 (66.7)	1 (33.3)	0 (0.0)	6 (100)	6 (100)	0 (0.0)	
Middle East and North Africa	1 (100)	1 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100)	0 (0.0)	1 (100)	

[a]Total number of articles in which settings of task-sharing with CHWs were specified. If CHWs performed their tasks at multiple places, each place was counted separately.
[b]Twenty-seven studies not clearly stating settings of task-sharing with CHWs were excluded.
[c]Seven multicountry studies and 26 single-country studies not clearly stating the settings of task-sharing with CHWs were excluded.
[d]Total number of articles in which CHWs measured BP and type of BP monitors used was specified.
[e]Seventy-six articles not clearly stating settings of task-sharing with CHWs were excluded.
[f]Seven multicountry studies and 74 single-country studies not clearly stating settings of task-sharing with CHWs were excluded.
[g]Total number of articles in which the composition of health workers was specified.
[h]Twenty-two studies not clearly stating the composition of health workers were excluded.
[i]Seven multicountry studies and 22 single-country studies not clearly stating the composition of health workers were excluded.

single-country studies, approximately each half were carried out in HICs ($n = 23$) and MICs ($n = 27$).

Many studies implemented task-sharing interventions to marginalized adults; the study populations were ethnic minorities, low socioeconomic status populations, and/or uninsured persons in nearly three-quarters (73.9%) of the experimental studies identified from HICs. Similarly, those with low socio-economic status and/or living in rural areas or urban slums were the study populations in about two-thirds (63. 0%) of that identified from MICs. The median sample size of participants and the number of CHWs was 406 per arm and 12 per arm, respectively. Consequently, the estimated median catchment size was 67 per CHW.

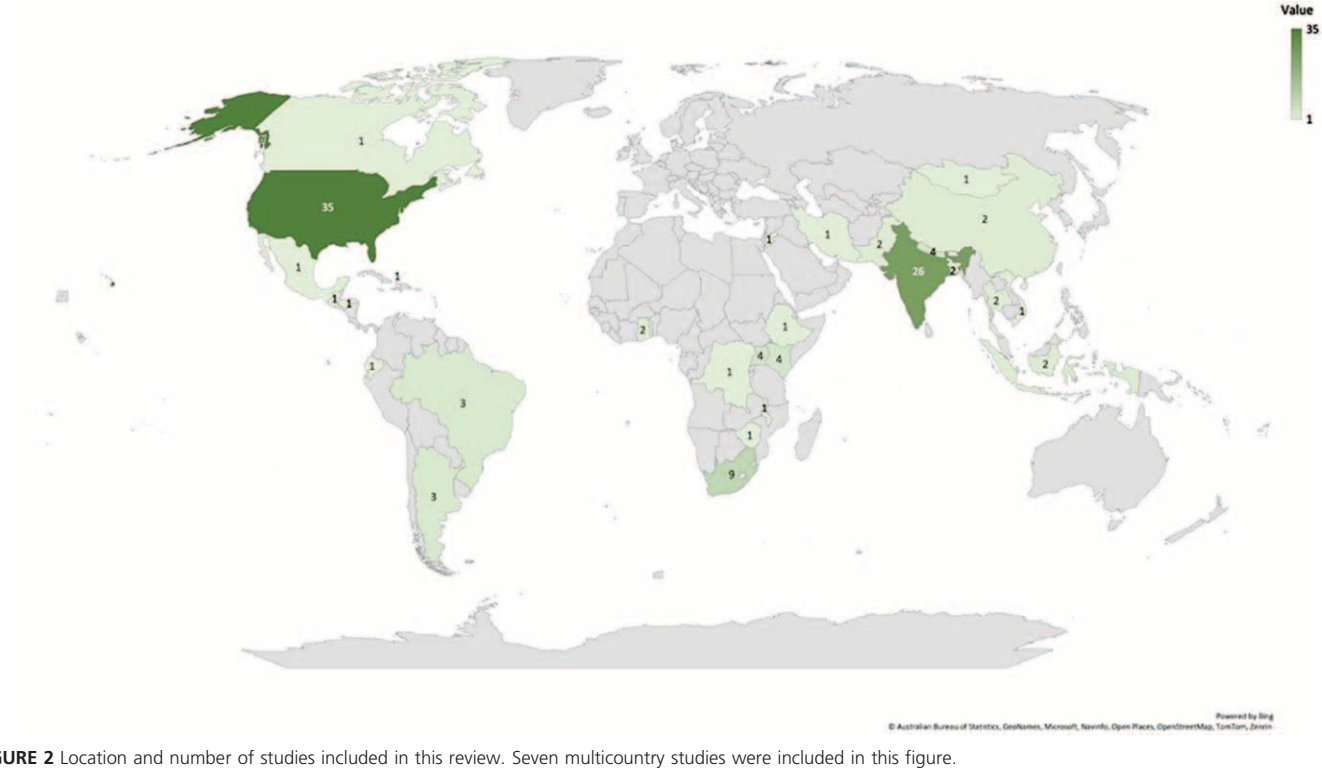

FIGURE 2 Location and number of studies included in this review. Seven multicountry studies were included in this figure.

TABLE 4. Summary of seven papers from low-income countries

Author (year)	Location	Study type	Study overview	Main findings
Chang (2019)	Uganda, Kisoro district	qualitative	• Examined perceived challenges to HTN/DM2 care among patients with HTN/DM2, facility-based HWs, and VHTs in Nakaseke rural district in Uganda. • VHTs are the formal CHW program led by the Uganda government. • IDIs with 24 patients with HTN and/or DM, 11 facility-based HWs, and 12 VHTs were conducted.	• Many of the VHTs answered HTN/DM2 care is not the part of their routine tasks nor ever trained to manage HTN/DM2 by themselves. • Many of the patients did not think VHTs could manage HTN/DM2 in community. • Use of herbal medicine: facility-based HWs reported patients keep using herbs instead of prescribed antihypertensive. • Limited time availability of physicians: Both physicians and patients perceived physicians do not having enough time to provide nonpharmacological treatment (i.e., health education and lifestyle counseling) or together deciding on medication treatment.
Batte (2021)	Uganda	qualitative	• Qualitatively investigated acceptability of health education by VHTs, which was conducted as a part of the following intervention. • PLWH with HTN in Nakaseke district received health education about HTN management for 20–30 mins which was conducted by VHTs after their routine HTN clinic visit. • 22 IDIs and 3 FGDs were conducted among PLWH with HTN and VHTs.	• PLWH/HTN perceived it is easier to discuss lifestyle modification with VHTs than with physicians because of VHTs: • Have greater time availability than physicians • Have preexisting rapport with PLWH/HTN • Use colloquial, nontechnical terms • VHTs perceived they are highly motivated to provide hypertension education. • Lack of VHT salaries: VHTs perceived it is hard to provide services on a volunteer basis because of their necessity to earn a livelihood by working in agriculture full-time. • Homes of PLWH with HTN was preferred as a setting for health education by both VHTs and patients because of the comfortability and convenience.
Stephens (2021)	Uganda	cross-sectional	• Described the development of the community-based NCD management program with VHWs in Kisoro district using cross-sectional data (2011–2021) • VHWs are a CHW program led by the nongovernmental sector. • Every two years, VHWs screened HTN with manual BP monitors through household visits. • Once a month, VHWs and patients with SBP>169 at the time of screening met at a health post, where VHWs conduct health education, BP measurement, and CVD risk assessment under supervision by physicians. • If uncontrolled BP(SBP>170 mmHg) or high CVD risk is detected, supervising physicians prescribed antihypertensive drugs to patients.	• Of 43 000 residents in 43 rural villages who were screened by VHWs during 2012–2016, 22% had BP>140/90 mm Hg. 84% of those with SBP>160 mm Hg were not aware of their high BP status. • Health posts in Kisoro districts shortened the distance to the nearest health service from 8 km to 0.67 km. • In 2019 because of the insufficient funding and resulting drug shortage, the program reduced antihypertensive drug dosage if a patient has SBP<175 mmHg.
Musoke (2021)	Uganda	mixed methods	• Explored level of knowledge, attitude, and involvement in NCD management services among VHTs in Wakiso district. • Invested perception of community members toward VHT involvement in NCD management • A questionnaire was administered to 485 VHTs [cross-sectional], and 6 FGDs were conducted with 8–12 community members per each group [qualitative]	• Awareness: The majority of VHTs identified HTN as NCD (77.1%) and recognized that NCDs are preventable (71.8%) and curable (89.9%). • Attitude: The majority of VHTs perceived they can provide NCD management (94.4%), particularly health education (96.3%) but not so much for screening (19.2%), and medication adherence support (3.3%) • CHW involvement: 63.7% of VHTs answered they have ever been involved in HTN management, and 69.5% have ever been trained. • Nonprofit organizations (87.2%) were the major organization providing HTN trainings. • VHTs perceived lack of training (37.6%) and insufficient level of knowledge (58.4%) as barriers. • Community members perceived VHT involvement in NCD management is not feasible, based on experience when VHTs were not able to answer their question related to NCDs during home visits.

TABLE 4 (*Continued*)

Author (year)	Location	Study type	Study overview	Main findings
Author (year)	Location	Study type	Study overview	Main findings
Ratnayake (2021)	Democratic Republic of Congo	mixed methods	• Assessing the effectiveness of NCD management service at primary health facilities and by CHW home visitation in conflict-affected Beni region. • The CHW program was led by a nonprofit organization. • After a patient was diagnosed with HTN/DM2 at the primary health center, CHWs visited his/her home to provided health education, medication adherence support, and referrals if poorly controlled. • Retrospective cohort analysis of 833 patients with HTN/DM2 who were diagnosed at primary health facilities was conducted during April – October 2018 • IDIs was conducted at baseline (April 2018) with 5 HTN/DM2 patients and 5 facility-based HWs, and at the endline (October 2018) with 7 HTN/DM2 patients and 6 facility-based HWs	• At the endline, 88.7% and 7.1% of patients was found to be hypertensive and diabetic, respectively. • Attitude to CHW's involvement: Both patients and facility-based HWs positively perceived CHW home visitation for HTN/DM2 management. • Continuity and medication adherence: Patients perceived home visits by CHWs can improve their adherence to clinic visits, and medication adherence.
Teshome (2022)	Ethiopia	cross-sectional	• Investigated interrater reliability of hypertension detection between HEWs and facility-based health professionals. • HEWs are the formal CHWs program led by the Ethiopian government. • Prior to the testing, 20 HEWs without previous HTN trainings and 5 facility-based HWs (nurses and public health officers) have received a three-day training on BP measurement and readings. • BP of 1177 adults in rural districts (Dabat and Gondar Zuria) of Ethiopia was conducted by the forementioned HEWs and facility-based HWs	• Interrater agreement for high BP (≥140/90mmHg) was very high at κ= 0.91 (95%CI: 0.88, 0.94) • High sensitivity and specificity of HTN detection by HEWs: Considering facility-based HWs as a gold standard, the sensitivity and specificity of high BP detection by HEWs were 90.8% (95% CI: 89.6, 92.0) and 98.8% (95% CI: 98.1, 99.5), respectively.
Safary (2021)	Malawi	qualitative	• Examined the role and tasks that CHWs[a] in Lilongwe, Malawi played after providing them with one-day HTN management training. • The training encompassed skills for health education, BP measurement with digital BP monitors, CVD risk assessment and referral. The settings were both at households and health facilities. • IDIs were conducted among 15CHWs and note from 10 observation fields were reviewed.	• CHWs are motivated to provide health education for HTN control as a routine task. • Lack of clinical protocol: CHWs perceived it is difficult to refer a patient to a health facility without a referral protocol.

CHW, community health workers; FGDs, focus group discussion; HEWs, health extension workers; HTN, hypertension; HWs, health workers; IDIs, in-depth interview; NCD, noncommunicable disease; PLWH, people living with HIV/AIDS; VHTs, village health teams; VHWs, village health workers.
[a]The operating sector was not clearly described (e.g., governmental, nongovernmental sectors).

There was a total of 17, 5, 4, and 3 controlled trials (i.e., RCTs or quasi-experimental studies) reporting change in systolic BP (SBP), diastolic BP (DBP), BP control rate (<140/90 mmHg) and medication adherence rate as primary outcomes, respectively. Among them, statistically significant differences were documented for SBP in 10 of 17 studies [19,37,40,42,46,48,52,59,62,68], DBP in 4 of 5 studies [48,52,59,68], BP control rate in 3 of 4 studies [34,39,48], and medication adherence in 3 of 4 studies [35,44,54].

We explored key characteristics of task-sharing with CHWs in the 35 controlled trials (i.e., 32 RCTs and 3 quasi-experimental). Health education (82.9%) was more often performed in this subset than in overall studies (68.6%). BP measurement was done in less than a half ($n = 14$), and the remaining tasks such as CVD risk assessment ($n = 4$), medication initiation ($n = 2$), and refill ($n = 1$) were rarely performed. Findings on the settings, type of BP monitors used by CHWs were similar to that from the overall studies.

Observational studies

Forty-one observational studies, including 39 cross-sectional [87–125] and 2 cohort studies [126,127] were included. There is one multicountry study identified [103]. Of the 40 single-country observational studies included, 7, 31, and 2 studies were carried out in HICs, MICs, and LICs, respectively.

These observational studies were quite heterogenous in terms of methods and outcomes, making it difficult to synthesize findings; one common feature was that measurement of BP by CHWs was used to estimate incidence, prevalence, or proportion of high BP [87,93,99,101,105,106,109,111,115,119,120,122,125–127] in communities ($n = 15$). Consequently, BP measurement was the most often performed by CHWs in included observational studies; among 35 observational studies describing the type of CHW tasks, BP measurement was performed by CHWs at 80.0%.

The second common type of studies were cross-sectional studies assessing knowledge level of CHWs to perform hypertension management ($n = 5$). These five studies were

done in South Africa [92,118], Nepal [100], Ghana [94], and India [102], where CHWs showed various levels of understanding in hypertension.

The third common type of studies were those measuring diagnostic validity of hypertension by CHWs ($n = 2$). One of them was a multicountry study done in Bangladesh, Guatemala, Mexico, and South Africa [103]. In this study, a total of 42 CHWs calculated CVD risk score of a total of 4,049 adults based on age, sex, smoking status, diabetes status, SBP, height, and weight data that they collected or measured. By comparing CVD score calculated by CHWs to that by nurses and physicians (considered as a gold standard), the authors identified a high interrater agreement with weighted kappa (κ) = 0.95 (95% CI 0.94–0.96). Another study done in rural Ethiopia also showed a very high agreement with $\kappa = 0.91$ between hypertension diagnosis by CHWs and that by nurses and public health officers (considered as a gold standard) [88].

Qualitative and mixed-methods studies

Fifteen qualitative [128–142] and 13 mixed-methods [33,143–154] studies were included. After excluding three multicountry studies, approximately half ($n = 14$) was done in MICs, and each half of the rest was done in HICs ($n = 6$) and LICs ($n = 5$).

Of the 15 qualitative studies, 12 [128–131,133–140] identified facilitators and barriers to scale up task-sharing interventions with CHWs through observation, in-depth interviews, or focus group discussions. The two themes frequently identified as facilitators were rapport between CHWs and communities and high motivation among CHWs to perform tasks for hypertension management. On the other hand, barriers often identified were insufficient CHW training and supervision, medicine shortages, lack of remuneration for CHW, and mistrust of CHWs by other health workers.

There were 14 mixed-methods studies included. Pilot studies assessing feasibility or acceptability of task-sharing intervention with CHWs were the most often observed ($n = 5$) [143,144,151,153,154]. The remaining papers were quite heterogenous, the detail of which can be found in Table 4, Supplemental Digital Content, http://links.lww.com/HJH/C542.

DISCUSSION

To our knowledge, this is the first scoping review that provided detailed characteristics of existing task-sharing with CHWs for hypertension management based on peer-reviewed articles. Our key findings are threefold. First, of the 122 studies, most trials were conducted in HICs and MICs, while only 7 studies have been conducted in LICs, none of which were trials. Second, CHWs rarely performed technical tasks beyond health education and BP measurement. Third, key features of task-sharing interventions with CHWs were often incompletely reported.

Of the seven papers identified from LICs, none were trials (i.e. experimental studies). As addressed earlier, LICs will likely benefit the most from implementation of task-sharing with CHWs for hypertension management, given the dearth of physicians [155], the high risk of premature death due to hypertension [156], and the limited access to health facilities [157]. However, existing trials have been done only in HICs and MICs. As LICs are quite different from them in terms of cultural context, resource availability, and levels of CHW program development, there is a need to develop a task-sharing intervention specific to LICs. To develop such interventions, we first need qualitative information, such as patient and stakeholder perspectives on hypertension management by CHWs, and existing challenges and opportunities in CHW programs.

The seven papers identified from LICs gave us some insights about existing challenges and opportunities. In Uganda, one of the challenges was the lack of monetary remuneration. Village Health Teams (VHTs, the government certified CHWs in Uganda) expressed their dilemma that the lack of monetary remuneration in the VHT program forces them to rely on farming full-time for all of their income, thereby limiting their availability to provide expanded services to control hypertension in communities [158]. Documentation of these opportunities and challenges in CHW programs can inform the design of feasible, acceptable, and effective task-sharing interventions with CHWs. In fact, we only found one or two of qualitative or mixed-methods articles per LIC. Thus, as a future direction in research, we first need more studies containing qualitative information from LICs to assist in designing and conducting trials, ultimately generating evidence on task-sharing for hypertension management in LICs.

CHWs rarely perform more advanced tasks beyond health education and BP measurement. Of the 122 articles included, we found only 29 and 3 articles in which CHWs performed CVD risk assessment and pharmacotherapy, respectively. Specifically, in terms of pharmacological treatment, we found only two papers in which CHW initiated antihypertensive medicine [34,35]. Both of them were from China where government-certified CHWs (i.e., Village Doctors) are authorized to prescribe antihypertensive medicines without physician consultation. One of these studies showed a statistically significant, net mean reduction in SBP of 14.5 mmHg at 18 months [34], suggesting that drug treatment by CHWs has a potential to drastically improve hypertension control. In 2021, the WHO recommended sharing more tasks for hypertension management with NPHWs, specifying that pharmacological treatment can be done by NPHWs if they are given training, prescribing authority, management protocols and physician oversight [159]. However, remarkably few countries have given prescription authority to any NPHWs, which has been a bottle neck for researchers to investigate the effectiveness of drug treatment by CHWs.

Historically, CHWs have initiated antibiotics, antimalarials, and oral rehydration salts for sick children [160]; vaccinated and administered oral vitamins to healthy children [161]; distributed antiretroviral medicine for people living with HIV/AIDS [162]; provided iron and folic acid to pregnant women [163]; and administered injectable contraceptives for women in reproductive age [164]. Thus, there have been mounting evidence suggesting that CHWs can perform more advanced tasks for hypertension control beyond health education and BP measurement. Furthermore, some antihypertensive medicine (e.g. amlodipine) can be initiated without

having patients come to health facilities for laboratory blood testing [165]. If CHWs can initiate and refill antihypertensive medicine, this health system reform may substantially reduce cardiovascular mortality.

To move research forward, favorable regulatory environment and funding opportunities are required for rigorously conducting studies that share tasks with CHWs for pharmacological treatment of hypertension. Hence, we urge legislators and authorities to re-evaluate current policies and grant prescription authority to CHWs and other NPHWs, at least within a research setting. Simultaneously, researchers should gather more country-specific data on facilitators and barriers to scaling up and implementing pharmacological treatment by CHWs.

Key characteristics of task-sharing interventions were often incompletely reported. Of a total of 122 papers included, about 15% and 25% were missing information about the type of CHW tasks and the settings, respectively. Of 63 papers describing that CHWs measured BP of participants, approximately 15% did not specify the type of BP monitors used. Complete description of these characteristics is crucial for optimization of a task-sharing intervention. For example, CHWs using digital BP monitors for BP measurement are likely to achieve greater BP control than with manual BP monitors, which require technical competence. Identifying these optimal conditions for task-sharing with CHWs, such as which type of tasks should be shared with CHWs, in what settings, using what type of BP devices, among others, could help us formulate an actionable policy or recommendations that explicitly specify the key features of task-sharing interventions with CHWs. To our knowledge, this is the first review paper to summarize whether papers have documented key features of such interventions.

A strength of our study is that we included all types of studies of task-sharing with CHWs for hypertension control, allowing us to gather relevant information beyond that provided in systematic reviews of trials. Hence, we were able to report on various outcomes. It also allowed us to document results in relevant strata, e.g. by country income group, regional group, and by study type.

Our study also has limitations. First, only one reviewer did the screening, full text review, and data extraction; use of a single reviewer is known to have a higher chance of omitting relevant articles compared to two or more reviewers [166,167] Second, we did not include articles written in languages other than English. Third, we did not exclude low-quality studies based on sample size and other risk of biases. However, these are not required when conducting a scoping review according to PRISMA-ScR [30], and our goal was to include any relevant studies to understand the characteristics of published studies, generate themes, and identify gaps in research.

Implication in research

Our study has both research and policy implications. It informs policy makers of a need to ease the regulatory environment to execute trials in which CHWs can perform drug treatment, independent of a country's income strata. It also informs researchers of a need to conduct trials in LICs that also report qualitative information about task-sharing interventions with CHWs. Lastly, we call for researchers to report greater detail about task-sharing interventions with CHWs.

CONCLUSION

This study provided a summary of task-sharing with CHWs for management of hypertension in adults based on 122 peer-reviewed articles published in between 2010 to 2022. Only 7 studies were executed in LICs, none of which were trials. All the existing trials were done in HICs and MICs. Among them, few studies tested effectiveness of sharing more advanced tasks beyond health education and BP measurement with CHWs. More trials are needed in LICs where the unmet need of hypertension treatment is the severest. To understand the effectiveness of sharing further technical tasks with CHWs, such as drug treatment, policy makers in HICs and MICs need to relax the regularity environment at least within research settings. Lastly, researchers need to report greater detail about task-sharing interventions with CHWs in peer-reviewed articles.

ACKNOWLEDGEMENTS

This project is supported by the National Heart, Lung, And Blood Institute of the National Institutes of Health under Award Number R01HL172271. K.M., L.J.A., and D.N. are supported by Resolve to Save Lives. Resolve to Save Lives is funded by Bloomberg Philanthropies, the Bill and Melinda Gates Foundation, and Gates Philanthropy Partners, which is funded with support from the Chan Zuckerberg Initiative.

Contributions: Y.I. summarized and interpreted data, wrote the first draft, incorporated coauthors' suggestions, and prepared the final version for submission. D.N. and H. P. conceptualized the study, assisted Y.I. with data collection and data interpretation, and contributed to draft revisions. K.M. and L.J.A. contributed to the interpretation of data and provided critical feedback on subsequent drafts. All authors approved the final version for submission.

Previous presentation: This study was presented at the International Society of Hypertension meeting in Kyoto, Japan in October 2022.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Vaduganathan M, Mensah GA, Turco JV, Fuster V, Roth GA. The global burden of cardiovascular diseases and risk: a compass for future health. *J Am Coll Cardiol* 2022; 80:2361–2371.
2. Zhou B, Carrillo-Larco RM, Danaei G, Riley LM, Paciorek CJ, Stevens GA, *et al*. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet* 2021; 398:957–998.
3. Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K, *et al*. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. *Circulation* 2016; 134:441–450.
4. Pereira M, Lunet N, Azevedo A, Barros H. Differences in prevalence, awareness, treatment and control of hypertension between developing and developed countries. *J Hypertens* 2009; 27:963–975.

5. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, *et al.* Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *JAMA* 2013; 310:959–968.
6. Marmot MG, Stansfeld S, Patel C, North F, Head J, White I, *et al.* Health inequalities among British civil servants: the Whitehall II study. *Lancet* 1991; 337:1387–1393.
7. Marmot MG, Shipley MJ, Rose G. Inequalities in death–specific explanations of a general pattern? *Lancet* 1984; 1:1003–1006.
8. Gaziano TA. Economic burden and the cost-effectiveness of treatment of cardiovascular diseases in Africa. *Heart* 2008; 94:140–144.
9. Neupane D, Gao Y, Feng Y, Matsushita K, Appel LJ. Estimation of the global gap in clinic visits for hypertension care between patient need and physician capacity. *Hypertension* 2021; 78:779–786.
10. Carrillo-Larco RM, Guzman-Vilca WC, Neupane D. Estimating the gap between demand and supply of medical appointments by physicians for hypertension care: a pooled analysis in 191 countries. *BMJ Open* 2022; 12:59933.
11. World Health Organization. Task sharing to improve access to Family Planning/Contraception. Geneva: World Health Organization; 2018. Available at: https://apps.who.int/iris/bitstream/handle/10665/259633/WHO-RHR-17.20-eng.pdf.
12. World Health Organization. Task shifting: rational redistribution of tasks among health workforce teams: global recommendations and guidelines. Geneva: World Health Organization; 2007. Available at: https://apps.who.int/iris/bitstream/handle/10665/43821/9789241596312_eng.pdf?sequence=1.
13. Perry HB, Zulliger R, Rogers MM. Community health workers in low-, middle-, and high-income countries: an overview of their history, recent evolution, and current effectiveness. *Annu Rev Public Health* 2014; 35:399–421.
14. Perry HB, editor. Health for the people: national community health worker programs from Afghanistan to Zimbabwe. Washington DC: USAID Jhpiego; 2020 [cited Jul 10 2023]. Available at: https://chwcentral.org/wp-content/uploads/2021/11/Health_for_the_People_Natl_-Case%20Studies_Oct2021.pdf.
15. Lehmann U, Sanders D, Community Health Workers: What do we know about them?. *The state of evidence on programmes, activities, costs and impact on health outcomes of using community health workers*. Geneva: World Health Organization; 2007.
16. Rifkin S B Community Health Workers. In: Heggenhougen K, Quah S, editors. International encyclopedia of public health, Vol 1. San Diego: Academic Press; 2008. pp. 773–782.
17. Scott K, Beckham SW, Gross M, Pariyo G, Rao KD, Cometto G, *et al.* What do we know about community-based health worker programs? A systematic review of existing reviews on community health workers. *Hum Resour Health* 2018; 16:39.
18. Anand TN, Joseph LM, Geetha AV, Prabhakaran D, Jeemon P. Task sharing with nonphysician health-care workers for management of blood pressure in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet Glob Health* 2019; 7:e761–e771.
19. Jafar TH, Gandhi M, de Silva HA, Jehan I, Naheed A, Finkelstein EA, *et al.* A community-based intervention for managing hypertension in rural South Asia. *N Eng J Med* 2020; 382:717–726.
20. Pasha M, Brewer LPC, Sennhauser S, Alsawas M, Murad MH. Health-care delivery interventions for hypertension management in underserved populations in the united states: a systematic review. *Hypertension* 2021; 78:955–965.
21. Brownstein JN, Chowdhury FM, Norris SL, Horsley T, Jack L, Zhang X, *et al.* Effectiveness of community health workers in the care of people with hypertension. *Am J Prev Med* 2007; 32:435–447.
22. World Health Organization. Global health observatory [Internet]. [cited 2023 Dec 6]. Available at: https://www.who.int/data/gho.
23. Huang W, Long H, Li J, Tao S, Zheng P, Tang S, *et al.* Delivery of public health services by community health workers (CHWs) in primary healthcare settings in China: a systematic review (1996–2016). *Glob Health Res Policy* 2018; 3:18.
24. Long H, Huang W, Zheng P, Li J, Tao S, Tang S, *et al.* Barriers and facilitators of engaging community health workers in non-communicable disease (NCD) prevention and control in China: a systematic review (2006–2016). *Int J Environ Res Public Health* 2018; 15:2378.
25. Joshi R, Alim M, Kengne AP, Jan S, Maulik PK, Peiris D, *et al.* Task shifting for non-communicable disease management in low and middle income countries – a systematic review. *PLoS One* 2014; 9: e103754.
26. Ogedegbe G, Gyamfi J, Plange-Rhule J, Surkis A, Rosenthal DM, Airhihenbuwa C, *et al.* Task shifting interventions for cardiovascular risk reduction in low-income and middle-income countries: a systematic review of randomised controlled trials. *BMJ Open* 2014; 4: e005983.
27. Kim K, Choi JS, Choi E, Nieman CL, Joo JH, Lin FR, *et al.* Effects of community-based health worker interventions to improve chronic disease management and care among vulnerable populations: a systematic review. *Am J Public Health* 2016; 106:e3–e28.
28. Mbuthia GW, Magutah K, Pellowski J. Approaches and outcomes of community health worker's interventions for hypertension management and control in low-income and middle-income countries: systematic review. *BMJ Open* 2022; 12:e053455.
29. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005; 8:19–32.
30. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, *et al.* PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018; 169:467–473.
31. Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, editors. Cochrane handbook for systematic reviews of interventions version 6.3 (updated February 2022). Cochrane, 2022. Available at: www.training.cochrane.org/handbook.
32. World Bank Group. Data - World Bank Country and Leading Group [Internet]. The World Bank [cited 2023 Jul 11]. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.
33. Sankaran S, Ravi PS, Wu YE, Shanabogue S, Ashok S, Agnew K, *et al.* An NGO-implemented community-clinic health worker approach to providing long-term care for hypertension in a remote region of Southern India. *Glob Health Sci Pract* 2017; 5:668–677.
34. Sun Y, Mu J, Wang DW, Ouyang N, Xing L, Guo X, *et al.* A village doctor-led multifaceted intervention for blood pressure control in rural China: an open, cluster randomised trial. *Lancet* 2022; 399:1964–1975.
35. Tian M, Ajay VS, Dunzhu D, Hameed SS, Li X, Liu Z, *et al.* A cluster-randomized, controlled trial of a simplified multifaceted management program for individuals at high cardiovascular risk (SimCard Trial) in Rural Tibet, China, and Haryana, India. *Circulation* 2015; 132:815–824.
36. Boulware LE, Ephraim PL, Hill-Briggs F, Roter DL, Bone LR, Wolff JL, *et al.* Hypertension self-management in socially disadvantaged African Americans: the achieving blood pressure control together (ACT) randomized comparative effectiveness trial. *J Gen Intern* 2020; 35:142–152.
37. Towfighi A, Cheng EM, Ayala-Rivera M, Barry F, McCreath H, Ganz DA, *et al.* Effect of a coordinated community and chronic care model team intervention vs usual care on systolic blood pressure in patients with stroke or transient ischemic attack: the SUCCEED randomized clinical trial. *JAMA Netw Open* 2021; 4:e2036227.
38. Sylaja PN, Singh G, Sivasambath S, Arun K, Jeemon P, Antony R, *et al.* Secondary prevention of stroke by a primary healthcare approach: an open-label cluster randomised trial. *J Clin Neurosci* 2021; 84:53–59.
39. Gamage DG, Riddell MA, Joshi R, Thankappan KR, Chow CK, Oldenburg B, *et al.* Effectiveness of a scalable group-based education and monitoring program, delivered by health workers, to improve control of hypertension in rural India: a cluster randomised controlled trial. *PLoS Med* 2020; 17:e1002997.
40. Khetan A, Zullo M, Rani A, Gupta R, Purushothaman R, Bajaj NS, *et al.* Effect of a community health worker-based approach to integrated cardiovascular risk factor control in india: a cluster randomized controlled trial. *Glob Heart* 2019; 14:355–365.
41. Peiris D, Praveen D, Mogulluru K, Ameer MA, Raghu A, Li Q, *et al.* SMARThealth India: A stepped-wedge, cluster randomised controlled trial of a community health worker managed mobile health intervention for people assessed at high cardiovascular disease risk in rural India. *PLoS One* 2019; 14:e0213708.
42. Worster DT, Franke MF, Bazúa R, Flores H, García Z, Krupp J, *et al.* Observational stepped-wedge analysis of a community health worker-led intervention for diabetes and hypertension in rural Mexico. *BMJ Open* 2020; 10:e034749.
43. Vedanthan R, Kamano JH, DeLong AK, Naanyu V, Binanay CA, Bloomfield GS, *et al.* Community health workers improve linkage

to hypertension care in western Kenya. *J Am Coll Cardiol* 2019; 74:1897–1906.
44. Joshi R, Agrawal T, Fathima F, Usha T, Thomas T, Misquith D, *et al.* Cardiovascular risk factor reduction by community health workers in rural India: a cluster randomized trial. *Am Heart J* 2019; 216:9–19.
45. Poggio R, Melendi SE, Beratarrechea A, Gibbons L, Mills KT, Chen CS, *et al.* Cluster randomized trial for hypertension control: effect on lifestyles and body weight. *Am J Prev Med* 2019; 57:438–446.
46. Neupane D, McLachlan CS, Mishra SR, Olsen MH, Perry HB, Karki A, *et al*. Effectiveness of a lifestyle intervention led by female community health volunteers versus usual care in blood pressure reduction (COBIN): an open-label, cluster-randomised trial. *Lancet Glob Health* 2018; 6:e66–e73.
47. Islam NS, Wyatt LC, Taher MD, Riley L, Tandon SD, Tanner M, *et al*. A culturally tailored community health worker intervention leads to improvement in patient-centered outcomes for immigrant patients with type 2 diabetes. *Clin Diabetes* 2018; 36:100–111.
48. Ursua RA, Aguilar DE, Wyatt LC, Trinh-Shevrin C, Gamboa L, Valdellon P, *et al*. A community health worker intervention to improve blood pressure among Filipino Americans with hypertension: a randomized controlled trial. *Prev Med Rep* 2018; 11:42–48.
49. Kangovi S, Mitra N, Norton L, Harte R, Zhao X, Carter T, *et al*. Effect of community health worker support on clinical outcomes of low-income patients across primary care facilities: a randomized clinical trial. *JAMA Intern Med* 2018; 178:1635–1643.
50. de Souza CF, Dalzochio MB, Zucatti ATN, De Nale R, de Almeida MT, Gross JL, *et al.* Efficacy of an education course delivered to community health workers in diabetes control: a randomized clinical trial. *Endocrine* 2017; 57:280–286.
51. Zgibor JC, Ye L, Boudreau RM, Conroy MB, Vander Bilt J, Rodgers EA, *et al.* Community-based healthy aging interventions for older adults with arthritis and multimorbidity. *J Community Health* 2017; 42:390–399.
52. He J, Irazola V, Mills KT, Poggio R, Beratarrechea A, Dolan J, *et al.* Effect of a community health worker-led multicomponent intervention on blood pressure control in low-income patients in argentina: a randomized clinical Trial. *JAMA* 2017; 318:1016–1025.
53. Kangovi S, Mitra N, Grande D, Huo H, Smith RA, Long JA. Community health worker support for disadvantaged patients with multiple chronic diseases: a randomized clinical trial. *Am J Public Health* 2017; 107:1660–1667.
54. Xavier D, Gupta R, Kamath D, Sigamani A, Devereaux PJ, George N, *et al.* Community health worker-based intervention for adherence to drugs and lifestyle change after acute coronary syndrome: a multicentre, open, randomised controlled trial. *Lancet Diabetes Endocrinol* 2016; 4:244–253.
55. Tian M, Ajay VS, Dunzhu D, Hameed SS, Li X, Liu Z, *et al.* A cluster-randomized, controlled trial of a simplified multifaceted management program for individuals at high cardiovascular risk (SimCard Trial) in rural Tibet, China, and Haryana, India. *Circulation* 2015; 132:815–824.
56. Pérez-Escamilla R, Damio G, Chhabra J, Fernandez ML, Segura-Pérez S, Vega-López S, *et al.* Impact of a community health workers-led structured program on blood glucose control among Latinos with type 2 diabetes: the DIALBEST trial. *Diabetes Care* 2015; 38:197–205.
57. Jafar TH, Jehan I, Liang F, Barbier S, Islam M, Bux R, *et al*. Control of blood pressure and risk attenuation: post trial follow-up of randomized groups. *PLoS One* 2015; 10:e0140550.
58. De Pue JD, Dunsiger S, Seiden AD, Blume J, Rosen RK, Goldstein MG, *et al*. Nurse-community health worker team improves diabetes care in American Samoa: results of a randomized controlled trial. *Diabetes Care* 2013; 36:1947–1953.
59. Allen JK, Himmelfarb CRD, Szanton SL, Bone L, Hill MN, Levine DM. COACH trial: a randomized controlled trial of nurse practitioner/community health worker cardiovascular disease risk reduction in urban community health centers: rationale and design. *Contemp Clin Trials* 2011; 32:403–411.
60. Cooper LA, Roter DL, Carson KA, Bone LR, Larson SM, Miller ER, *et al.* A randomized trial to improve patient-centered care and hypertension control in underserved primary care patients. *J Gen Intern Med* 2011; 26:1297–1304.
61. Spencer MS, Rosland AM, Kieffer EC, Sinco BR, Valerio M, Palmisano G, *et al*. Effectiveness of a community health worker intervention among African American and Latino adults with type 2 diabetes: a randomized controlled trial. *Am J Public Health* 2011; 101:2253–2260.
62. Jafar TH, Islam M, Hatcher J, Hashmi S, Bux R, Khan A, *et al.* Community based lifestyle intervention for blood pressure reduction in children and young adults in developing country: cluster randomised controlled trial. *BMJ* 2010; 340:c2641.
63. Goudge J, Chirwa T, Eldridge S, Gómez-Olivé FXF, Kabudula C, Limbani F, *et al.* Can lay health workers support the management of hypertension? Findings of a cluster randomised trial in South Africa. *BMJ Glob Health* 2018; 3:e000577.
64. Kondal D, Jeemon P, Manimunda S, Narayanan G, Purty AJ, Negi PC, *et al*. Structured lifestyle modification interventions involving frontline health workers for population-level blood pressure reduction: results of a cluster randomized controlled trial in India (DISHA Study). *J Am Heart Assoc* 2022; 11:e023526.
65. Jahan Y, Rahman MM, Faruque ASG, Chisti MJ, Kazawa K, Matsuyama R, *et al.* Awareness development and usage of mobile health technology among individuals with hypertension in a rural community of Bangladesh: randomized controlled trial. *J Med Internet Res* 2020; 22: e19137.
66. Fort MP, Murillo S, López E, Dengo AL, Alvarado-Molina N, De Beausset I, *et al*. Impact evaluation of a healthy lifestyle intervention to reduce cardiovascular disease risk in health centers in San José, Costa Rica and Chiapas, Mexico. *BMC Health Serv Res* 2015; 15:577.
67. Lopez PM, Islam N, Feinberg A, Myers C, Seidl L, Drackett E, *et al.* A place-based community health worker program: feasibility and early outcomes, New York City, 2015. *Am J Prev Med* 2017; 52 (Suppl 3): S284–289.
68. Visanuyothin S, Plianbangchang S, Somrongthong R. An integrated program with home blood-pressure monitoring and village health volunteers for treating poorly controlled hypertension at the primary care level in an urban community of Thailand. *Integr Blood Press Control* 2018; 11:25–35.
69. Alvarez C, Ibe C, Dietz K, Carrero ND, Avornu G, Turkson-Ocran RA, *et al.* Development and implementation of a combined nurse care manager and community health worker training curriculum to address hypertension disparities. *J Ambul Care Manage* 2022; 45:230–241.
70. Samuel-Hodge CD, Ziya Gizlice. Allgood SD, Bunton AJ, Erskine A, Leeman J, *et al*. A hybrid implementation-effectiveness study of a community health worker-delivered intervention to reduce cardiovascular disease risk in a rural, underserved non-Hispanic Black population: the CHANGE study. *Am J Health Promot* 2022; 36:948–958.
71. Risica PM, McCarthy ML, Barry KL, Oliverio SP, Gans KM, de Groot AS. Clinical outcomes of a community clinic-based lifestyle change program for prevention and management of metabolic syndrome: results of the "Vida Sana/Healthy Life" program. *PLoS One* 2021; 16: e0248473.
72. Deo S, Singh P. Community health worker-led, technology-enabled private sector intervention for diabetes and hypertension management among urban poor: a retrospective cohort study from large Indian metropolitan city. *BMJ Open* 2021; 11:e045246.
73. Pakhare A, Joshi A, Anwar R, Dubey K, Kumar S, Atal S, *et al*. Linkage to primary-care public health facilities for cardiovascular disease prevention: a community-based cohort study from urban slums in India. *BMJ Open* 2021; 11:e045997.
74. Meyer M, Enguidanos S, Zhu Y, Likar D, Batra R. Community Medication Education, Data, & Safety (C-MEDS): findings from a pilot project. *J Am Geriatr Soc* 2021; 69:813–821.
75. Schwalm JD, McCready T, Lear SA, Lamelas P, Garis L, Musa H, *et al.* Exploring new models for cardiovascular risk reduction: The Heart Outcomes Prevention and Evaluation 4 (HOPE 4) Canada Pilot Study. *CJC Open* 2021; 3:267–275.
76. Dandge S, Jeemon P, Reddy PS. Technology enabled nonphysician health workers extending telemedicine to rural homes to control hypertension and diabetes (TETRA): a prepost demonstration project in Telangana, India. *PLoS One* 2019; 14.:.
77. Jain M, Pandian J, Samuel C, Singh S, Kamra D, Kate M. Multicomponent short-term training of ASHAs for stroke risk factor management in rural India. *J Neurosci Rural Pract* 2019; 10:592–598.
78. Abdel-All M, Thrift AG, Riddell M, Thankappan KRT, Mini GK, Chow CK, *et al.* Evaluation of a training program of hypertension for

accredited social health activists (ASHA) in rural India. *BMC Health Serv Res* 2018; 18:320.
79. Krantz MJ, Beaty B, Coronel-Mockler S, Leeman-Castillo B, Fletcher K, Estacio RO. Reduction in cardiovascular risk among Latino participants in a community-based intervention linked with clinical care. *Am J Prev Med* 2017; 53:e71–e75.
80. Mendoza Montano C, Fort M, Deramirez M, Cruz J, Ramirez-Zea M. Evaluation of a pilot hypertension management programme for Guatemalan adults. *Health Promot Int* 2016; 31:363–374.
81. Williams LB, Franklin B, Evans MB, Jackson C, Hill A, Minor M. Turn the beat around: a stroke prevention program for African-American churches. *Public Health Nurs* 2016; 33:11–20.
82. Dye CJ, Williams JE, Evatt JH. Improving hypertension self-management with community health coaches. *Health Promot Pract* 2015; 16:271–281.
83. Reiger S, Harris JR, Chan KCG, Oqueli HLHL, Kohn M. A community-driven hypertension treatment group in rural Honduras. *Glob Health Action* 2015; 8:28041.
84. Krantz MJ, Coronel SM, Whitley EM, Dale R, Yost J, Estacio RO. Effectiveness of a community health worker cardiovascular risk reduction program in public health and healthcare settings. *Am J Public Health* 2013; 103:e19–e27.
85. Balagopal P, Kamalamma N, Patel TG, Misra R, Misra R, Balagopal P, *et al.* A community-based participatory diabetes prevention and management intervention in rural India using community health workers. *Diabetes Educ* 2012; 38:822–834.
86. Ayala GX. Team the SDPRC. Effects of a promotor-based intervention to promote physical activity: Familias Sanas y Activas. *Am J Public Health* 2011; 101:2261.
87. Stephens JH, Addepalli A, Chaudhuri S, Niyonzima A, Musominali S, Uwamungu JC, *et al.* Chronic Disease in the Community (CDCom) program: hypertension and noncommunicable disease care by village health workers in rural Uganda. *PLoS One* 2021; 16:e0247464.
88. Teshome DF, Balcha SA, Ayele TA, Atnafu A, Sisay M, Asfaw MG, *et al.* Trained health extension workers correctly identify high blood pressure in rural districts of northwest Ethiopia: a diagnostic accuracy study. *BMC Health Serv Res* 2022; 22:375.
89. Thomas LS, Buch E, Pillay Y. An analysis of the services provided by community health workers within an urban district in South Africa: a key contribution towards universal access to care. *Hum Resour Health* 2021; 19:22.
90. Zaman MM, Moniruzzaman M, Chowdhury KN, Zareen S, Hossain AE. Estimated total cardiovascular risk in a rural area of Bangladesh: a household level cross-sectional survey done by local community health workers. *BMJ Open* 2021; 11:e046195.
91. de Fátima dos Santos A, da Rocha HA, de Lourdes Dayrellde LimaII ÂM, de Abreu DMX, Silva ÉA, de Araújo LHL, *et al.* Contribution of community health workers to primary healthcare performance in Brazil. *Rev Saude Publica* 2020; 54:1–10.
92. Tsolekile LP, Schneider H, Puoane T. The roles, training and knowledge of community health workers about diabetes and hypertension in Khayelitsha, Cape Town. *Curationis* 2018; 41:e1–e8.
93. Basu P, Mahajan M, Patira N, Prasad S, Mogri S, Muwonge R, *et al.* A pilot study to evaluate home-based screening for the common non-communicable diseases by a dedicated cadre of community health workers in a rural setting in India. *BMC Public Health* 2019; 19:14.
94. Nyame S, Iwelunmor J, Ogedegbe G, Adjei KGA, Adjei K, Apusiga K, *et al.* Capacity and readiness for implementing evidence-based task-strengthening strategies for hypertension control in ghana: a cross-sectional study. *Glob Heart* 2019; 14:129–134.
95. Morris-Paxton AA, Rheeder P, Ewing RMG, Ewing D. Detection, referral and control of diabetes and hypertension in the rural Eastern Cape Province of South Africa by community health outreach workers in the rural primary healthcare project: Health in Every Hut. *Afr J Prim Healthcare Fam Med* 2018; 10:e1–e8.
96. Mannik JR, Figol A, Churchill V, Aw J, Francis S, Karino E, *et al.* Community-based screening for cardiovascular risk using a novel mHealth tool in rural Kenya. *J Innov Health Inform* 2018; 25:176–182.
97. Brown LD, Vasquez D, Salinas JJ, Tang X, Balcázar H. Evaluation of healthy fit: a community health worker model to address hispanic health disparities. *Prev Chronic Dis* 2018; 15:E49.
98. Saleh S, Alameddine M, Farah A, El Arnaout N, Dimassi H, Muntaner C, *et al.* eHealth as a facilitator of equitable access to primary healthcare: the case of caring for noncommunicable diseases in rural and refugee settings in Lebanon. *Int J Public Health* 2018; 63:577–588.
99. Degennaro V, Malcolm S, Crompton L, Vaddiparti K, Mramba LK, Striley C, *et al.* Community-based diagnosis of noncommunicable diseases and their risk factors in rural and urban Haiti: a cross-sectional prevalence study. *BMJ Open* 2018; 8:e020317.
100. Neupane D, McLachlan CS, Mishra SR, Kallestrup P. Understanding and motivations of female community health volunteers about blood pressure control: a prerequisite for developing community-based hypertension interventions in Nepal. *Glob Heart* 2017; 12:227–232.
101. Rheeder P, Morris-Paxton AA, Ewing RMG, Woods D. The noncommunicable disease outcomes of primary healthcare screening in two rural subdistricts of the Eastern Cape Province, South Africa. *Afr J Prim Healthcare Fam Med* 2017; 9:e1–e7.
102. Raithatha SJ, Kumar D, Amin AA. Training village health workers in detection and monitoring of noncommunicable diseases: a low cost option for rural areas facing the emerging health epidemic. *Fam Community Health* 2017; 40:253–257.
103. Gaziano TA, Abrahams-Gessel S, Denman CA, Montano CM, Khanam M, Puoane T, *et al.* An assessment of community health workers' ability to screen for cardiovascular disease risk with a simple, noninvasive risk assessment instrument in Bangladesh, Guatemala, Mexico, and South Africa: an observational study. *Lancet Glob Health* 2015; 3:e556–e563.
104. Li T, Lei T, Xie Z, Zhang T. Determinants of basic public health services provision by village doctors in China: using noncommunicable diseases management as an example. *BMC Health Serv Res* 2016; 16:42.
105. Lin CW, Abdul SS, Clinciu DL, Scholl J, Jin X, Lu H, *et al.* Empowering village doctors and enhancing rural healthcare using cloud computing in a rural area of mainland China. *Comput Methods Programs Biomed* 2014; 113:585–592.
106. Menon J, Joseph J, Thachil A, Attacheril TV, Banerjee A. Surveillance of noncommunicable diseases by community health workers in Kerala: the epidemiology of noncommunicable diseases in rural areas (ENDIRA) study. *Glob Heart* 2014; 9:409–417.
107. Sánchez V, Cacari Stone L, Moffett ML, Nguyen PG, Muhammad M, Bruna-Lewis S, *et al.* Process evaluation of a promotora de salud intervention for improving hypertension outcomes for Latinos living in a rural U.S.-Mexico border region. *Health Promot Pract* 2014; 15:356–364.
108. Lee YJ, Boden-Albala B, Larson E, Wilcox A, Bakken S. Online health information seeking behaviors of Hispanics in New York City: a community-based cross-sectional study. *J Med Internet Res* 2014; 16:e176.
109. Ha DA, Goldberg RJ, Allison JJ, Chu TH, Nguyen HL. Prevalence, awareness, treatment, and control of high blood pressure: a population-based survey in Thai Nguyen, Vietnam. *PLoS One* 2013; 8:e66792.
110. Farzadfar F, Murray CJL, Gakidou E, Bossert T, Namdaritabar H, Alikhani S, *et al.* Effectiveness of diabetes and hypertension management by rural primary health-care workers (Behvarz workers) in Iran: a nationally representative observational study. *Lancet* 2012; 379:47–54.
111. Whitley EM, Main DS, McGloin J, Hanratty R. Reaching individuals at risk for cardiovascular disease through community outreach in Colorado. *Prev Med (Baltim)* 2011; 52:84–86.
112. Promthet S, Saranrittichai K, Kamsa-ard S, Senarak W, Vatanasapt P, Wiangnon S, *et al.* Situation analysis of risk factors related to non-communicable diseases in Khon Kaen Province, Thailand. *Asian Pac J Cancer Prev* 2011; 12:1337–1340.
113. Marmamula S, Modepalli SB, Kumbham TR, Challa R, Keeffe JE. Prevalence of disabilities and noncommunicable diseases in an elderly population in the Telangana state, India: a population-based cross-sectional study. *BMJ Open* 2021; 11:e041755.
114. Nambiar D, Bhaumik S, Pal A, Ved R. Assessing cardiovascular disease risk factor screening inequalities in India using Lot Quality Assurance Sampling. *BMC Health Serv Res* 2020; 20:1077.
115. Mphekgwana PM, Malema N, Monyeki KD, Mothiba TM, Makgahlela M, Kgatla N, *et al.* Hypertension prevalence and determinants among black South African adults in semi-urban and rural areas. *Int J Environ Res Public Health* 2020; 17:7463.
116. Ni Z, Atluri N, Shaw RJ, Tan J, Khan K, Merk H, *et al.* Evaluating the feasibility and acceptability of a mobile health–based female

community health volunteer program for hypertension control in rural Nepal: Cross-Sectional Study. *JMIR Mhealth Uhealth* 2020; 8: e15419.
117. Kalyan M, Dhore P, Purandare V, Deshpande S, Unnikrishnan AG. Obesity and its link to undiagnosed diabetes mellitus and hypertension in rural parts of western India. *Indian J Endocrinol Metab* 2020; 24:155–159.
118. Onagbiye SO, Tsolekile LP, Puoane T. Knowledge of noncommunicable disease risk factors among community health workers in South Africa. *Open Public Health J* 2020; 13:430–437.
119. Cheadle A, Rosaschi M, Burden D, Ferguson M, Greaves B, Houston L, *et al.* A community-wide collaboration to reduce cardiovascular disease risk: the hearts of Sonoma county initiative. *Prev Chronic Dis* 2019; 16:E89.
120. Maiya AG, Gundmi S, Matpady P, Jadhav R, Lingadakai R, Hande M, *et al.* Prevalence of foot complications in people with type 2 diabetes mellitus: a community-based survey in rural Udupi. *Int J Low Extrem Wounds* 2018; 17:169–175.
121. Pedley CF, Case LD, Blackwell CS, Katula JA, Vitolins MZ. The 24-month metabolic benefits of the healthy living partnerships to prevent diabetes: A community-based translational study. *Diabetes Metab Syndr* 2018; 12:215–220.
122. Khetan A, Zullo M, Hejjaji V, Barbhaya D, Agarwal S, Gupta R, *et al.* Prevalence and pattern of cardiovascular risk factors in a population in India. *Heart Asia* 2017; 9:e010931.
123. Wennerstrom A, Bui T, Harden-Barrios J, Price-Haywood EG. Integrating community health workers into a patient-centered medical home to support disease self-management among Vietnamese Americans: lessons learned. *Health Promot Pract* 2015; 16:72–83.
124. Bitencourt F, Gottschall CAM. Evaluation of accuracy of rastreometer: a new equipment for hypertension tracking. *Arq Bras Cardiol* 2012; 98:151–160.
125. Madela SSS, James S, Sewpaul R, Madela SSS, Reddy P. Early detection, care and control of hypertension and diabetes in South Africa: a community-based approach. *Afr J Prim Healthcare Fam Med* 2020; 12:e1–e9.
126. Pakhare AP, Lahiri A, Shrivastava N, Joshi A, Khadanga S, Joshi R. Original research: Incident hypertension in urban slums of central India: a prospective cohort study. *Open Heart* 2021; 8:e001539.
127. Moreira J, Figueroa MM, Anselmi M, Prandi R, Montaño CC, Bell D, *et al.* Long-term outcomes of a cohort of hypertensive subjects in rural ecuador. *Glob Heart* 2019; 14:373–378.
128. Hall-Lipsy E, Anderson EJ, Taylor AM, Warholak T, Axon DR, Faqeeri Z, *et al.* Community health worker perspectives of an academic community medication therapy management collaboration. *J Am Pharm Assoc* 2020; 60:475–480; e1.
129. Batte C, Mukisa J, Rykiel N, Mukunya D, Checkley W, Knauf F, *et al.* Acceptability of patient-centered hypertension education delivered by community health workers among people living with HIV/AIDS in rural Uganda. *BMC Public Health* 2021; 21:1343.
130. Chang H, Hawley NL, Kalyesubula R, Siddharthan T, Checkley W, Knauf F, *et al.* Challenges to hypertension and diabetes management in rural Uganda: a qualitative study with patients, village health team members, and healthcare professionals. *Int J Equity Health* 2019; 18:38.
131. Rachlis B, Naanyu V, Wachira J, Genberg B, Koech B, Kamene R, *et al.* Community perceptions of community health workers (CHWs) and their roles in management for HIV, tuberculosis and hypertension in western Kenya. *PLoS One* 2016; 11:e0149412.
132. Parmar PK, Rawashdah F, Al-Ali N, Abu Al Rub R, Fawad M, Al Amire K, *et al.* Integrating community health volunteers into noncommunicable disease management among Syrian refugees in Jordan: a causal loop analysis. *BMJ Open* 2021; 11:e045455.
133. Tan J, Xu H, Fan Q, Neely O, Doma R, Gundi R, *et al.* Hypertension care coordination and feasibility of involving female community health volunteers in hypertension management in Kavre District, Nepal: a qualitative study. *Glob Heart* 2020; 15:73.
134. Iwelunmor J, Onakomaiya D, Gyamfi J, Nyame S, Apusiga K, Adjei K, *et al.* Adopting task-shifting strategies for hypertension control in ghana: insights from a realist synthesis of stakeholder perceptions. *Glob Heart* 2019; 14:119–127.
135. Rahmawati R, Bajorek B. A community health worker-based program for elderly people with hypertension in indonesia: a qualitative study, 2013. *Prev Chronic Dis* 2015; 12:E175.
136. Vogel MT, Petrescu-Prahova M, Steinman L, Clegg-Thorp C, Farmer C, Sarliker SE, *et al.* Partnerships for blood pressure control in Washington state, December 2016–July 2017. *Health Promot Pract* 2021; 22:52–62.
137. Guerra B, Vaffis S, Axon DR, Leal S, Warholak T, Taylor AM, *et al.* Perceptions and experiences of promotoras and pharmacists in an academic-community partnership providing telephonic MTM services to a Spanish-speaking, rural population: a focus group study. *J Manag Care Spec Pharm* 2020; 26:1390–1397.
138. Balli ML, Dickey TA, Purvis RS, Warmack TS, Riklon S, McElfish PA. 'You Want to Give the Best Care Possible, and You Know When They Leave Your Pharmacy, You Didn't Give the Best Care Possible Most of the Time': pharmacist- and community health worker-identified barriers and facilitators to medication adherence in Marshallese patients. *J Racial Ethn Health Disparities* 2019; 6:652–659.
139. Safary E, Mwandeti M, Matanje B, Beiersmann C, Mtaita C, Shiroya V, *et al.* Role of community health volunteers in identifying people with elevated blood pressure for diagnosis and monitoring of hypertension in Malawi: a qualitative study. *BMC Cardiovasc Disord* 2021; 21:361.
140. Rahmawati R, Bajorek B. Perspectives on antihypertensive medication: a qualitative study in a rural Yogyakarta province in Indonesia. *Drugs Ther Perspect* 2016; 32:76–83.
141. Katigbak C, Van Devanter N, Islam N, Trinh-Shevrin C. Partners in health: a conceptual framework for the role of community health workers in facilitating patients' adoption of healthy behaviors. *Am J Public Health* 2015; 105:872–880.
142. Chimberengwa PT, Naidoo M. A description of community-based participatory research of hypertension awareness, prevention and treatment in a district of Matabeleland South Province, Zimbabwe. *Afr J Prim Healthcare Fam Med* 2019; 11:1839.
143. Aw M, Ochieng BO, Attambo D, Opot D, Aw J, Francis S, *et al.* Critical appraisal of a mHealth-assisted community-based cardiovascular disease risk screening program in rural Kenya: an operational research study. *Pathog Glob Health* 2020; 114:379–387.
144. Barsky J, Hunter R, McAllister C, Yeates K, Campbell N, Liu P, *et al.* Analysis of the implementation, user perspectives, and feedback from a mobile health intervention for individuals living with hypertension (DREAM-GLOBAL): mixed methods study. *JMIR Mhealth Uhealth* 2019; 7:e12639.
145. Khetan A, Patel T, Hejjaji V, Barbhaya D, Mohan SKM, Josephson R, *et al.* Role development of community health workers for cardiovascular disease prevention in India. *Eval Program Plann* 2018; 67:177–183.
146. Allen CG, Nell Brownstein J, Satsangi A, Escoffery C. Community health workers as allies in hypertension self-management and medication adherence in the United States, 2014. *Prev Chronic Dis* 2016; 13:E179.
147. Levitt NS, Puoane T, Denman CA, Abrahams-Gessel S, Surka S, Mendoza C, *et al.* Referral outcomes of individuals identified at high risk of cardiovascular disease by community health workers in Bangladesh, Guatemala, Mexico, and South Africa. *Glob Health Action* 2015; 8:26318.
148. Ndou T, van Zyl G, Hlahane S, Goudge J. A rapid assessment of a community health worker pilot programme to improve the management of hypertension and diabetes in Emfuleni sub-district of Gauteng Province, South Africa. *Glob Health Action* 2013; 6:19228.
149. Musoke D, Atusingwize E, Ikhile D, Nalinya S, Ssemugabo C, Lubega GB, *et al.* Community health workers' involvement in the prevention and control of noncommunicable diseases in Wakiso District, Uganda. *Global Health* 2021; 17:7.
150. Ratnayake R, Wittcoff A, Majaribu J, Nzweve JP, Katembo L, Kasonia K, *et al.* Early experiences in the integration of noncommunicable diseases into emergency primary healthcare, Beni Region, Democratic Republic of the Congo. *Ann Glob Health* 2021; 87:27.
151. Rosana P, Danaei G, Gutierrez L, Cavallo A, Lopez MV, Irazola V. An innovative approach to improve the detection and treatment of risk factors in poor urban settings: a feasibility study in Argentina. *BMC Public Health* 2021; 21:567.
152. Webber M, Joubert J, Fendt-Newlin M, Devassy SM, Scaria L, Benny AM, *et al.* Towards the development of an intervention to address social determinants of non-communicable disease in Kerala, India: a mixed methods study. *Int J Environ Res Public Health* 2020; 17:8636.
153. Jafar TH, De Silva A, Naheed A, Jehan I, Liang F, Assam PN, *et al.* Control of blood pressure and risk attenuation: a public health intervention in rural Bangladesh, Pakistan, and Sri Lanka: feasibility trial results. *J Hypertens* 2016; 34:1872–1881.

154. Riddell MA, Mini GK, Joshi R, Thrift AG, Guggilla RK, Evans RG, *et al.* ASHA-led community-based groups to support control of hypertension in rural India are feasible and potentially scalable. *Front Med (Lausanne)* 2021; 8:771822.
155. Agyeman-Manu K, Ghebreyesus TA, Maait M, Rafila A, Tom L, Lima NT, *et al.* Prioritising the health and care workforce shortage: protect, invest, together. *Lancet Glob Health* 2023; 11:e1162–e1164.
156. Bennett JE, Stevens GA, Mathers CD, Bonita R, Rehm J, Kruk ME, *et al.* NCD Countdown 2030: worldwide trends in noncommunicable disease mortality and progress towards Sustainable Development Goal target 3.4. *Lancet* 2018; 392:1072–1088.
157. Weiss DJ, Nelson A, Vargas-Ruiz CA, Gligorić K, Bavadekar S, Gabrilovich E, *et al.* Global maps of travel time to healthcare facilities. *Nat Med* 2020; 26:1835–1838.
158. Batte C, Mukisa J, Rykiel N, Mukunya D, Checkley W, Knauf F, *et al.* Acceptability of patient-centered hypertension education delivered by community health workers among people living with HIV/AIDS in rural Uganda. *BMC Public Health* 2021; 21:.
159. World Health Organization. Guideline for the pharmacological treatment of hypertension in adults. Guideline for the pharmacological treatment of hypertension in adults. Geneva: World Health Organization; 2021. Available at: https://www.ncbi.nlm.nih.gov/books/NBK573631/.
160. Amouzou A, Morris S, Moulton LH, Mukanga D. Assessing the impact of integrated community case management (iCCM) programs on child mortality: review of early results and lessons learned in sub-Saharan Africa. *J Glob Health* 2014; 4:020411.
161. Glenton C, Scheel IB, Lewin S, Swingler GH. Can lay health workers increase the uptake of childhood immunisation? Systematic review and typology. *Trop Med Int Health* 2011; 16:1044–1053.
162. Kredo T, Adeniyi FB, Bateganya M, Pienaar ED. Task shifting from doctors to nondoctors for initiation and maintenance of antiretroviral therapy. *Cochrane Database Syst Rev* (7):2014;CD007331.
163. Kok MC, Dieleman M, Taegtmeyer M, Broerse JEW, Kane SS, Ormel H, *et al.* Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. *Health Policy Plan* 2015; 30:1207–1227.
164. Malarcher S, Meirik O, Lebetkin E, Shah I, Spieler J, Stanback J. Provision of DMPA by community health workers: what the evidence shows. *Contraception* 2011; 83:495–503.
165. Frieden TR, Varghese CV, Kishore SP, Campbell NRC, Moran AE, Padwal R, Jaffe MG. Scaling up effective treatment of hypertension—a pathfinder for universal health coverage. *J Clin Hypertens (Greenwich)* 2019; 21:1442–1449.
166. Stoll CRT, Izadi S, Fowler S, Green P, Suls J, Colditz GA. The value of a second reviewer for study selection in systematic reviews. *Res Synth Methods* 2019; 10:539–545.
167. Mahtani KR, Heneghan C, Aronson J. Single screening or double screening for study selection in systematic reviews? *BMJ Evid Based Med* 2020; 25:149–150.