The effectiveness of rural community health workers in improving health outcomes during the COVID-19 pandemic: a systematic review.

The effectiveness of rural community health workers during the COVID-19 pandemic

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Abstract

Background: Rural community health workers (CHWs) play a critical role in improving health outcomes during non-pandemic times, but evidence on their effectiveness during the COVID-19 pandemic is limited. There is a need to focus on rural CHWs and rural health systems as they have limited material and human resources rendering them more vulnerable than urban health systems to severe disruptions during pandemics.

Objectives: This systematic review aims to describe and appraise the current evidence on the effectiveness of rural CHWs in improving access to health services and health outcomes during the COVID-19 pandemic in low-and middle-income countries (LMICs).

Methods: We searched electronic databases for articles published from 2020 to 2023 describing rural CHW interventions during the COVID-19 pandemic in LMICs. We extracted data on study characteristics, interventions, outcome measures, and main results. We conducted a narrative synthesis of key results.

Results: Fifteen studies from 10 countries met our inclusion criteria. Most studies were from Asia (10 of 15 studies). Study designs varied and included descriptive and analytical studies. The evidence suggested that rural CHW interventions led to increased household access to health services, and may be effective in improving COVID-19 and non-COVID-19 health outcomes. Overall, however, the quality of evidence was poor due to methodological limitations; 14 of 15 studies had a high risk of bias.

Conclusion: Rural CHWs may have improved access to health services and health outcomes during the COVID-19 pandemic in LMICs but more rigorous studies are needed during future pandemics to evaluate their effectiveness in improving health outcomes in different settings and to assess appropriate support required to ensure their impact at scale.

Introduction

Globally, rural populations remain vulnerable to pandemics particularly in LMICs. As of November 2023, the current COVID-19 pandemic has led to 771 million infections and up to 18 million deaths have been attributed directly or indirectly to COVID-19 [1-2]. There are continued disparities in access to COVID-19 vaccines, COVID-19 therapeutics, and critical care capacity making the pandemic challenging to address, particularly in LMICs with significant rural populations [3-5]. Given the ongoing threat of current and future pandemics, evaluating key resources within rural health systems that can be deployed effectively to strengthen pandemic preparedness and response is vital.

Community Health Workers (CHWs) have been shown to be critical in global efforts to achieve Sustainable Development Goals (SDGs) and Universal Health Coverage (UHC) by 2030 [6]. CHWs were considered the cornerstone of primary health care in the 1978 Alma-Ata Declaration [1]. There is evidence to support CHW effectiveness in improving health outcomes during non-pandemic times, particularly in LMICs. A World Health Organization (WHO) systematic review of existing reviews showed that CHW interventions in LMICs were linked to improved physical activity, reduced repeated adolescent births, and reduced maternal, perinatal, and neonatal mortality rates [7]. Furthermore, a recent systematic review of CHW interventions demonstrated CHW effectiveness in improving population-based HIV related health outcomes in LMICs [8].

There is some evidence that CHWs have also played an important role during the COVID-19 pandemic, especially in LMICs. A recent qualitative study found that CHWs made significant contributions in COVID-19 surveillance, community education, and support of those affected by COVID-19 in India, Bangladesh, Pakistan, Sierra Leone, Kenya, and Ethiopia [9]. These findings align with those of Bhaumik et al who found that CHWs played a critical role during pandemics by participating in community engagement and contact tracing activities [10]. In

addition, these findings are consistent with the WHO Strategic Preparedness and Response Plan which emphasizes the need to listen to communities to reduce demand side barriers to health service utilization and access during the COVID-19 pandemic [11].

Although these studies establish the important role CHWs played during the COVID-19 pandemic, they do not have a specific focus on rural CHWs and rural health systems in LMICs. There is a need to pay special attention to rural CHWs and rural health systems because they face more challenges compared to their counterparts in urban settings. Rural health systems frequently experience inadequate infrastructure, equipment, and consumables, and they have a more limited health workforce than in urban settings [12-18]. Globally, 75% of physicians and 65% of nurses work in urban areas [19]. In the US for instance, there are 30.8 physicians per 10'000 people in urban areas in contrast to 10.9 physicians per 10,000 people in rural areas [19]. And in terms of financing, rural health systems are facing financial crises resulting in hospital closures including in HICs [20]. As a result, compared to urban health systems, rural health systems have a reduced capacity to absorb shocks during pandemics and are more vulnerable to health system disruptions during pandemics including the COVID-19 pandemic. Furthermore, recent evidence suggests that during the COVID-19 pandemic, rural health systems were less prepared compared to urban health systems and COVID-19 responses were not adequately tailored to rural areas [21]. The findings argue for more evidence to be generated to guide rural pandemic preparedness and response efforts to mitigate the lack of preparedness during future pandemics. Moreover, there is growing and compelling evidence that the COVID-19 pandemic led to reduced access to health services making urgent the need to identify health interventions in rural health systems that can mitigate the negative impact of reduced access to health services during a pandemic. A systematic review of 81 studies from 20 countries found that the utilization of diagnostic services, routine vaccinations, and surgical services decreased by a third during the COVID-19 pandemic [22]. Furthermore, more recent evidence shows significant reductions in the use of maternal and child health (MCH) services during the COVID-19 pandemic [23-26].

The objective of this systematic review is to describe and appraise the evidence of the effectiveness of rural CHWs in improving access to rural health services and subsequent rural health outcomes in LMICs during the COVID-19 pandemic with an intention to apply findings to future pandemics and outbreaks.

Methods

Search strategy

We conducted our searches in April and November 2023. We searched electronic databases including Pubmed/MEDLINE, EMBASE, Web of Science, WHO Global Health Library, and gray literature [Google Scholar, Clinical/Trials.gov, and the WHO International Clinical Trials Registry]. Searches identified articles that describe rural CHW interventions during the COVID-19 pandemic published from 2020 to November 2023. Our search terms used a combination of key terms: rural, and/or community health worker/primary healthcare worker/volunteer health worker/village health worker, and/or risk communication, and/or community empowerment, and/or pandemic, and/or COVID-19. Please see Table 1 for definitions of the different terms used in the paper.

Table 1: Definitions of terms

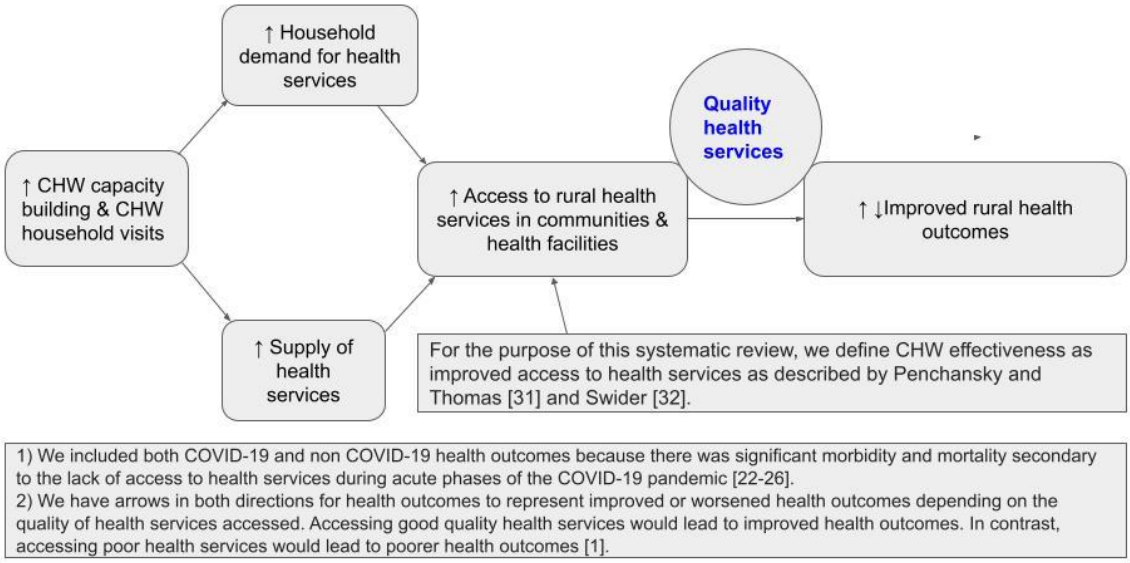
Term	Definition
Community Health Workers	Refer to health workers working in communities. Depending on the country and the health system, they may be referred to as village health workers, volunteer health workers, lay health workers, and accredited social health activists [ASHAs] [27]
Rural areas	Refer to regions with population densities of fewer than 150 per square kilometer according to the OECD definition [28]
Health outcomes	A change in the health of an individual, group of people or population which is attributable to an intervention or series of interventions [29]
Low-and middle-income countries	Low income economies: Gross national income (GNI) per capita: $1,135 or less Lower middle income economies: GNI per capita: $1,136 to $4,465 Upper-Middle-Income: GNI per capita: $4,466 to $13,845 [30]

Conceptual Framework for CHW effectiveness:

For the purpose of this systematic review, we define CHW effectiveness as improved access to health services as described by Penchansky and Thomas [31] and Swider [32], and improved downstream COVID-19 and non COVID-19 health outcomes linked to CHWs

visiting households to increase the demand for and the supply of health services during the COVID-19 pandemic in rural LMICs (Figure 1). We included both COVID-19 and non COVID-19 health outcomes because there was significant morbidity and mortality secondary to the lack of access to health services during acute phases of the COVID-19 pandemic [22-26].

Figure 1: Conceptual Framework [1, [22-26], [31-32]]:



Eligibility criteria

We used the following inclusion and exclusion criteria:

- *Inclusion criteria.* We included experimental, non-experimental, quantitative and qualitative research that examined the effectiveness of CHWs during the COVID-19 pandemic in rural areas in LMICs.

- *Exclusion criteria.* We excluded opinion articles and commentaries that presented expert opinions but no original data, studies set in urban areas, and literature

reviews/systematic reviews that addressed CHW interventions but did not specifically address rural CHWs during the COVID-19 pandemic. We used their reference lists, however, to find potential articles relevant to our systematic review. We excluded studies conducted in HICs.

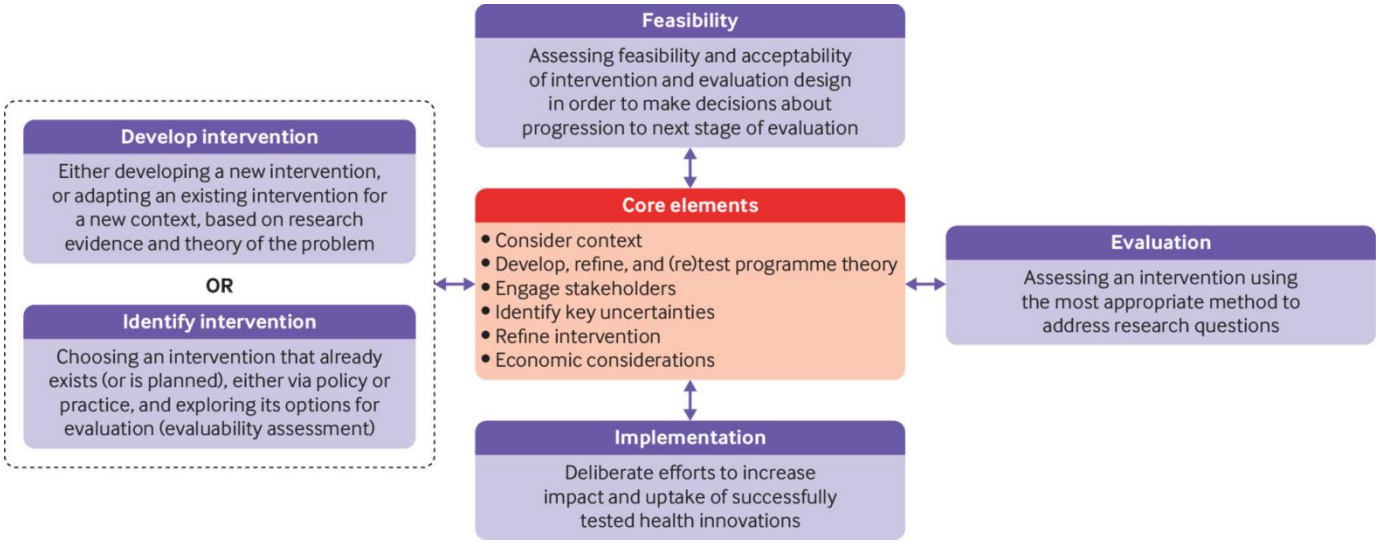
Two reviewers [NK and MM] screened all articles independently by title and abstract and subsequently the full texts to determine whether articles under consideration met inclusion criteria. Any selection discrepancies were discussed by NK and MM to reach consensus.

We followed PRISMA reporting guidelines and presented results of the study selection process using the PRISMA 2009 Flow Diagram. We registered our review in the International Prospective Register of Systematic Reviews [PROSPERO registration number: CRD42022336485].

Data extraction

Once we established the list of included articles, NK independently exported study records to an Excel sheet, removed duplicate studies, and extracted data on study locations, publication years, study designs, interventions, outcome measures, main results, and intervention phases according to dimensions of the Medical Research Council [MRC] complex interventions framework (Table 2). The MRC complex interventions framework was created to harmonize the evaluation of complex health interventions [33]. We used the most recent version of the MRC complex intervention framework to determine phases of CHW interventions in included articles. Following data extraction by NK, each data point was checked by MM.

Figure 2: MRC complex interventions framework



Quality assessment

To assess the quality of the evidence in the included studies, we used the Cochrane Systematic Review Quality Assessment tool to assess the risk of bias [34]. We scored each of the 7 criteria against a three-point rating scale corresponding to a high, low, or unclear risk of bias. NK evaluated the risk of bias.

Synthesis of evidence

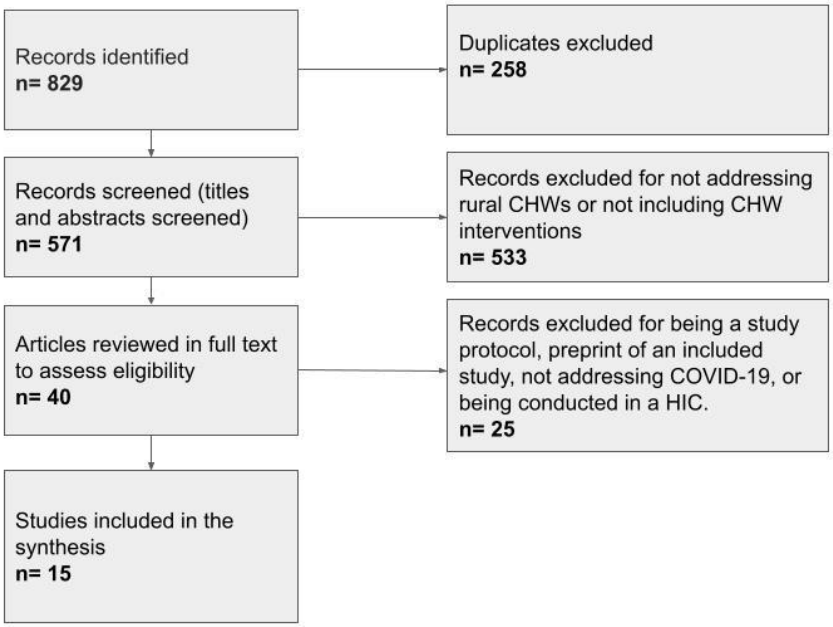
We conducted a thematic analysis and organized results according to the characteristics of included studies, CHW interventions and outcome measures during the COVID-19 pandemic, reported effectiveness of CHW interventions, and where available we reported stakeholder perspectives. In addition, we summarized the quality of the evidence and MRC phases of CHW interventions of included studies. We present our results in narrative and table forms.

Results

We identified 829 articles through electronic database searches; 571 articles remained following the removal of duplicates. NK and MM screened titles and abstracts of the 571 articles and excluded 533 articles as the focus was not on rural CHWs and/ or did not include CHW interventions. We assessed the full texts of the remaining 40 articles for eligibility, and 25 articles were excluded for not addressing COVID-19 and or being conducted in a HIC. In

addition, two articles were study protocols; and a second article was a preprint of an included study. Fifteen articles met our inclusion criteria and were included in our analyses. Figure 3 of the PRISMA flow chart outlines the screening and study selection process.

Figure 3: The PRISMA flow chart



Please see Table 2 for a summary of data extracted from the 15 included articles. We extracted data on study location, publication year, study design, objective, intervention, outcome measure/s, main results, phases according to the MRC complex interventions framework, and the quality of the evidence. In addition, we report on the risk of bias, and whether the study design had a comparative component.

Characteristics of included studies

The 15 rural studies included in our systematic review were published from 2020 to 2023 and were from ten countries: South Africa (1), Uganda (1), Ethiopia (1), Guatemala (1), Peru (1),

Thailand (1), India (6), Pakistan (1), Nepal (1), and Bangladesh (1) [35-49]. Most studies were from Asia [10 of the 15 studies]; three studies were from sub-Saharan Africa; two were from the Americas [35, 48-49].

There was a cost-effectiveness study [35] and interventional studies [36, 38, 39, 40, 41, 42, 44, 45, 47]. In addition, there were mixed-methods studies [37, 46, 48] and qualitative assessments of rural CHW interventions in India and Ethiopia [47, 49].

CHW interventions and outcome measures during the COVID-19 pandemic

CHW interventions were heterogeneous across the 15 studies. Interventions included a low literacy checklist to maintain access to prenatal care during the COVID-19 pandemic in Guatemala and CHW training in COVID-19 in Thailand, India, Nepal [36, 38, 42, 44, 47]. There were CHW interventions that leveraged previously established CHW programs to respond to the COVID-19 pandemic in hard-to-reach communities in Peru and India [37,43]. Other CHW interventions sought to expand COVID-19 testing in India and strengthen linkages to abortion and mental health services during the COVID-19 pandemic in Pakistan and India [39, 40, 42]. In addition, rural CHWs strengthened COVID-19 prevention by influencing health behavior in rural Bangladesh [46]. CHWs were also deployed to identify and refer possible cases of COVID-19 in rural Thailand, and in rural Uganda a call center was established to support rural CHWs in community-based COVID-19 interventions [38, 48].

In line with differences in rural CHW interventions, outcome measures were heterogeneous across the 15 studies. The outcome measures included: those related to CHW training, COVID-19 health outcome measures, non-COVID-19 health outcome measures, economic evaluation outcome measures [specifically the incremental cost effectiveness ratio [ICER]], and stakeholder perspectives.

CHW training outcome measures included the number of participants trained and CHW satisfaction. There was a wide range in the number of participants trained: eight traditional

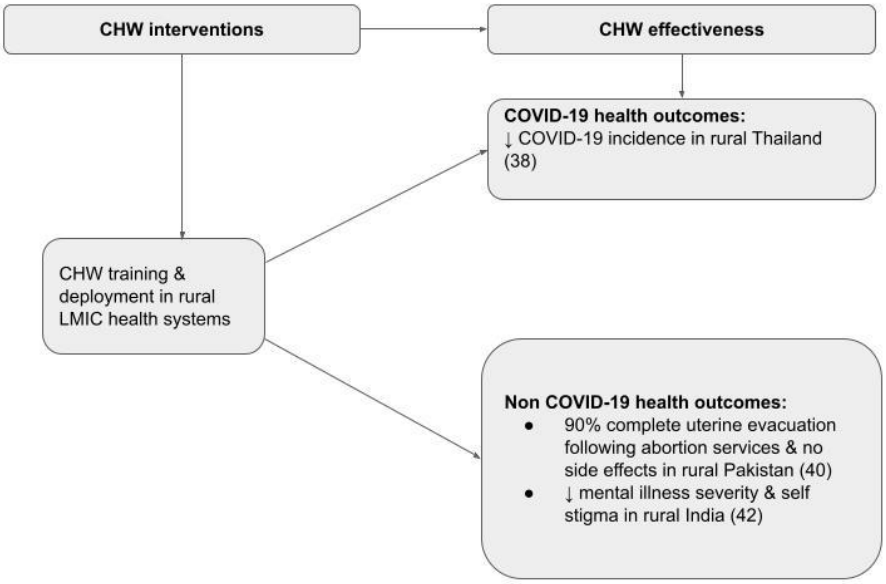
256 birth attendants [TBAs] were trained in Guatemala [36]. The highest number of CHW
257 participants was in India: 15,000 CHWs completed their training in Bihar and 80% of those
258 surveyed were satisfied with the training [43]. In addition, CHW COVID-19 knowledge was
259 measured in Nepal, and the mean CHW knowledge score of 300 CHWs trained increased
260 significantly from 4.1 to 6.3 [$p<0.001$]; the maximum possible score was 10 [45]. In
261 Bangladesh, more than 70% of community support team [CST] members including CHWs
262 had increased knowledge of mask wearing, keeping social distance, and washing hands
263 [46].
264
265 Four studies reported on COVID-19 specific outcomes including the incidence of COVID-19,
266 COVID-19 community seroprevalence, and COVID-19 vaccine uptake. Reinders et al
267 reported clusters of COVID-19 cases among indigenous populations in the Peruvian
268 Amazon but specific numbers of cases were not available at the time of publication [37].
269 Kaweenuttayanon et al reported a significant drop in the daily number of COVID-19 cases to
270 less than ten cases per day nationally following the CHW intervention in rural Thailand [38].
271 Isaac et al in a community-based testing intervention documented the rise in COVID-19
272 seroprevalence by a factor of 10, as the pandemic progressed with rising community
273 transmission [39]; a major limitation of this study was the absence of a comparison group
274 without intervention that limited an assessment of the effectiveness of the CHW COVID-19
275 testing program.
276
277 Three studies reported non COVID-19 health outcome measures. Shaikh et al reported on
278 abortion outcomes during the COVID-19 pandemic in Pakistan [40]. Sivakumar et al reported
279 on disability from mental illness, mental illness severity and self-induced stigma in rural India
280 during the COVID-19 pandemic [42].
281
282 Lastly, two studies had economic measures: Reddy et al in a modeling study found that the
283 ICER for an intervention including CHWs was $340 per year life saved; another study by

Joshi et al reported that the cost of developing a digital CHW program was US$ 208,814 [35, 41].

The effectiveness of rural CHWs during the COVID-19 pandemic

Three studies provided evidence on the effectiveness of rural CHWs during the COVID-19 pandemic by demonstrating increased access to COVID-19 and non COVID-19 health services and improving individual and population health outcomes (Figure 4). Rural CHWs were effective in conducting household visits and referrals in Thailand: CHWs visited more than 14 million households from March to April 2020; they identified and monitored 809,911 returnees to rural Thailand and referred 3346 symptomatic patients to hospitals [38]. This CHW intervention was linked to a reduction in the incidence of COVID-19 cases in Thailand, from a peak of 188 cases per day to less than 10 cases per day during the early phases of the COVID-19 pandemic in March and April 2020 [38]. In Pakistan, 176 women were referred by CHWs for telehealth consultations to get abortion services [40]. As a result of this intervention, 90% of women reported complete uterine evacuation, and none reported side effects from accessing abortion services [40]. In India, mental health outcomes improved after continued linkage to mental health services through rural CHWs during the COVID-19 pandemic. As a result of this rural CHW intervention, there were statistically significant improvements in disability from mental illness, mental illness severity, and self-stigma due to mental illness compared to baseline measures: the mean WHO Disability Assessment Schedule 2.0 score was reduced from 16/100 at baseline to 12/100 at the second follow up visit [p=0.001] [42]. Because of the heterogeneity in outcome measures across studies, a pooled analysis of effect measures was not possible.

Figure 4: The effectiveness of rural CHWs in LMICs during the COVID-19 pandemic as shown by increased access to health services and improved COVID-19 and non COVID-19 health outcomes.



Stakeholder perspectives

Five studies reported stakeholder perspectives. Stakeholders included CHWs, programme implementers, and program evaluators. Stakeholder perspectives were diverse and highlighted concerns about COVID-19 vaccine misinformation, lack of PPE and testing kits, increased rural CHW workload and vulnerability to COVID-19 infection, and the suspension of antenatal and postnatal visits during the COVID-19 pandemic [37, 47]. In Bangladesh, poor CHW training was seen as a hindrance to CHW effectiveness during the COVID-19 pandemic by CHWs [46]. In Uganda, in rural communities that had experienced Ebola outbreaks, CHWs felt there were no signs that people in their communities were suffering from severe health problems due to COVID-19 [48]. They felt COVID-19 symptoms were less severe and in sharp contrast to the severe symptoms seen in Ebola patients [48]. CHWs in rural Uganda also found that their community members were afraid to report symptoms, and they were afraid of being tested because they feared being quarantined and stigmatized [48]. With the telehealth intervention in rural Uganda, CHWs felt less isolated; contact with the call center allowed them to provide better care, and it improved the supply of medicine and other essential health products [48]. In Ethiopia, a qualitative study on a CHW intervention designed to deliver maternal, newborn, and child health in rural Ethiopia demonstrated significant fragmentation

of different components of the intervention including financing, supplies, CHW empowerment and coordination, and stakeholder engagement [49].

Quality of the evidence

Overall, the quality of the evidence was poor: 14 out of the 15 studies had a high risk of bias. Sources of bias included reporting bias, recall bias, selection bias, and observation bias. There were no randomized controlled trials [RCTs]. Due to the high risk of bias, the chances of overestimating or underestimating the effectiveness of rural CHWs in improving health outcomes during the COVID-19 pandemic were high. Furthermore, the causal link between rural CHW interventions and rural CHW effectiveness in improving COVID-19 and non-COVID-19 related health outcomes was weakened by the lack of comparative components in study designs. Only 4 out of 15 studies had comparative components in their research designs: the first study, a cost effectiveness analysis, compared different combinations of five COVID-19 public health interventions including health-care testing alone, diagnostic testing at health care centers; contact tracing in households with cases; isolation centers for cases not requiring hospital admission; mass symptom screening with testing of symptomatic individuals by CHWs; and quarantine centers for household contacts who test negative [35]. The second study compared COVID-19 seropositivity rates across different time points [39]. And the remaining two studies compared pre- and post-intervention mental health outcome measures and CHW knowledge [42, 45].

Phases of CHW interventions according to the MRC complex intervention evaluation framework

We found that most studies addressing the effectiveness of rural CHWs in improving health outcomes during the COVID-19 pandemic were in feasibility and pilot phases of the MRC framework. Specifically, two studies were in the design and modeling phases [35, 41]. Seven studies were in feasibility and pilot phases [36, 38, 39, 40, 42, 43,45, 46-48]. Three studies

described well established CHW programs that were used to respond to the COVID-19 pandemic [37, 44, 49].

Discussion

During pandemics and other shocks, rural CHWs face greater challenges because rural health systems are under-resourced compared to urban health systems. Therefore, a focused examination of their effectiveness during the COVID-19 pandemic is important. To our knowledge, this is the first review to examine the effectiveness of rural CHWs during the COVID-19 pandemic.

During the COVID-19 pandemic, rural CHW interventions were carried out in multiple regions, particularly in LMICs where health systems were experiencing critical gaps in resources. From the regional distribution of studies, we can infer that health systems with greater gaps in human resources were more likely to implement rural CHW interventions during the COVID-19 pandemic. This was to maximize prevention and delay the influx of a high number of severe COVID-19 cases that would rapidly overwhelm their health systems. The possibility that health systems would be rapidly overwhelmed was a significant concern in LMICs, particularly in SSA [50-52]. As a result, relative differences in approaches emerged early during the COVID-19 response depending on resources that were available. In HICs, there was a heavier focus on hospital care that was more readily available; and the management of severe COVID-19 cases frequently involved mechanical ventilation [53]. In contrast, in LMICs, there was an emphasis on community-based approaches. In rural Vietnam, Tran et al described the benefits of deploying village health workers to strengthen community surveillance efforts by expanding the population coverage in a setting with low COVID-19 testing capacity [54]. In Kenya, where 70% of the population is rural, home-based care of COVID-19 patients was rolled out in July 2020 [four months after the pandemic was declared]; and some rural counties, such as Siaya county built the capacity of CHWs to maximize COVID-19 prevention and optimize its case management at the community level [55, 56]. In future pandemic preparedness and response

strategies, integrated approaches with interventions implemented at community and health facility levels could be synergistic and are worth considering.

We observed differences in interventions and health outcomes reflecting differences in CHW roles across different settings during the COVID-19 pandemic. CHWs promoted COVID-19 prevention measures; they participated in the early detection and management of COVID-19 cases, and they sustained linkages to key essential health services during the COVID-19 pandemic with improved COVID-19 and non-COVID-19 health outcomes as previously described [Figure 4]. Other studies have found improved disease specific health outcomes following rural CHW interventions. For instance, in the case of dengue fever, an emerging pandemic, a study from Vietnam showed a dengue control efficacy rate of 99.7% following a rural CHW intervention [57]. Furthermore, in a Nicaraguan and Mexican randomized controlled trial, there was a 29.5% reduction in dengue infections in CHW intervention clusters [58].

During a pandemic, providing essential and comprehensive health services for a range of conditions is also important to prevent increased mortality from unrelated causes. A systematic review of 81 studies from 20 countries found that the utilization of diagnostic services, routine vaccinations, and surgical services decreased by a third during the COVID-19 pandemic [22]. Furthermore, more recent evidence shows significant reductions in the use of maternal and child health [MCH] services during the COVID-19 pandemic [22-26]. Similar observations were made during the Ebola outbreak in Guinea, Sierra Leone, and Liberia where there were sharp reductions in the use of MCH services [59]. However, with CHW training and support, the use of MCH services rebounded [59]. These results align with our findings of improved non COVID-19 related health outcomes following rural CHW interventions [Figure 4]. By strengthening links to routine and comprehensive health services during pandemics, rural CHWs can mitigate significant reductions in the use of essential and

414 comprehensive health services during pandemics. These findings support the inclusion of
415 rural CHWs in pandemic preparedness and response strategies.
416
417 Stakeholder perspectives are particularly useful because they provide information on key
418 gaps that should be addressed during future pandemic response efforts. Stakeholder
419 perspectives varied across studies; however key insights that emerged across regions were
420 that: CHWs remained committed to delivering COVID-19 and non-COVID-19 related health
421 services despite increasing workloads and fear of contracting COVID-19. This is consistent
422 with the findings of a study from Rwanda [60]. Another overarching theme was the need for
423 more rural CHW training. This finding aligns with a recent WHO systematic review that found
424 that training was critical to CHW effectiveness [7]. In countries where access to vaccines
425 was delayed - vaccine supply was also a significant concern [4]. In addition, we found
426 limited qualitative data on attitudes, perceptions and experiences of CHWs represents a gap
427 in the current evidence that should be addressed in future studies. Further understanding of
428 CHW attitudes, perceptions, and experiences would provide important insights for future
429 CHW interventions during pandemics.
430
431 The methodological limitations in research designs led to a high risk of bias from multiple
432 sources. The early COVID-19 response was an emergency and rapid action was favored to
433 save as many lives as possible. Because of these initial priorities, designing, piloting,
434 implementing, reporting and evaluating interventions with well-designed impact assessments
435 was challenging [61]. Moreover, during the initial phase of the COVID-19 pandemic,
436 vaccines were not available, and the risk of contracting and potentially dying from COVID-19
437 was significant; this made clinical and research activities very challenging.
438
439 Our systematic review has several strengths. First, it focuses on rural CHWs who are more
440 likely to experience lack of resources and support [62]. Second, our review demonstrates
441 that it was feasible and effective to train rural CHWs during the COVID-19 pandemic. In

addition, we show that deploying trained and supported rural CHWs appeared to lead to improved COVID-19 and non-COVID-19 health outcomes across regions, a finding which is consistent with the potentially critical role rural CHWs can play during pandemics. In addition, in contrast to other studies, our review examined phases of evaluation of CHW interventions that showed that most studies were in feasibility and pilot phases; highlighting a need for more consistent and sustained investments in building evidence around effective community based interventions during pandemics.

There may however be evidence we did not capture in our search, for example because some reports are in the gray literature that were not captured by our search. Calculating a composite effect measure across different interventions was not possible because of the heterogeneity in study designs, interventions, and outcome measures. The majority of included studies had a high risk of bias and the lack of comparative components in study designs meant that conclusions were not definitive. Our findings are specific to the COVID-19 pandemic and may not fully apply to other pandemics.

For policy makers with significant rural populations and limited resources, engaging rural CHWs is a potential solution for strengthening pandemic preparedness and response efforts using a cadre of health workers already in place. Our review provides some evidence that CHWs were able to effectively care for COVID-19 patients, and they also maintained linkages to essential and comprehensive health services during the COVID-19 pandemic.

Different response strategies to the COVID-19 pandemic emerged as the pandemic progressed; well-resourced health systems emphasized hospital care - and resource constrained health systems tended to emphasize community-based approaches. Future policy action in pandemic preparedness and response should consider an integrated approach with interventions to strengthen both hospital care and community-based health care to maximize the potential number of lives that can be saved.

Stakeholder perspectives, although limited, provided key insights on current gaps in CHW interventions that need to be addressed including more CHW training and more CHW support with PPE, and other essential supplies. Better designed studies, that limit sources of bias and confounding factors, are needed to further explore the effectiveness of rural CHWs in improving health outcomes during pandemics. Randomized controlled trials [RCT] [most likely cluster RCTs] would be the gold standard but are difficult to undertake in emergency situations. Guidance on the evaluation of complex interventions should shape future research.

Furthermore, there is a need for cost-effectiveness data on rural CHW interventions during pandemics to help policy makers make decisions on what interventions would be most effective when resources are limited. Additionally, we found a lack of mortality data in studies published to date. Mortality data would provide more compelling evidence on the effectiveness of rural CHWs in improving health outcomes during pandemics but will be increasingly difficult for COVID-19 as death rates have fallen. Lastly, more qualitative data would be useful to gain a better understanding of stakeholder perspectives to guide future action in pandemic preparedness and response.

Conclusions

The current evidence suggests that rural CHWs may be effective in improving access to health services and health outcomes during the COVID-19 pandemic in rural LMICs but the quality of studies included in this evidence synthesis is poor. Given the threat of future pandemics, and the need to strengthen rural health system responses, there is a need for better designed studies to generate high quality evidence on the effectiveness and cost-effectiveness of rural CHWs in improving health outcomes during pandemics.

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Author contributions:

NK, MR, MM, KO, and AH contributed to the conceptualization, methodology, writing, reviewing and editing of the manuscript. In addition NK and MM reviewed articles for inclusion in the systematic review.

Disclosure statement

The findings and conclusions in this systematic review are those of the authors.

Ethics and consent

Because this study retrieved and synthesized data from already published studies, ethics approval was not required.

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Paper context:

Rural health systems face greater challenges in terms of having an adequate number of health care workers, infrastructure, and equipment which limit their capacity to respond to pandemics including the COVID-19 pandemic. Rural CHWs play an important role in improving health outcomes. Our systematic review findings suggest that rural CHWs improved health outcomes during the COVID-19 pandemic, and they are a potential critical resource to be leveraged to strengthen rural pandemic preparedness and response efforts.

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