Systematic review of literature on roles of community health workers for malaria control and elimination in Asia and Africa

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Literature search strategy

Initial search: 13th September 2022

Pubmed (n=294)

(("Malaria"[Mesh] OR Malaria[tiab]) AND ("Community Health Workers"[Mesh] OR "village malaria worker"[tiab] OR "mobile malaria worker"[tiab] OR "community health volunteer"[tiab] OR "village health volunteer"[tiab] OR "community malaria worker"[tiab]) AND ("Asia, Southeastern"[Mesh] OR "Africa South of the Sahara"[Mesh]))

Adapted search strategy for Scopus: (n=9)

(TITLE-ABS-KEY(malaria) AND TITLE-ABS-KEY("Community Health Workers" OR "village malaria worker" OR "mobile malaria worker" OR "community health volunteer" OR "village health volunteer" OR "community malaria worker") AND TITLE ABS-KEY ("Greater Mekong subregion" OR Thailand OR Myanmar OR Cambodia OR Laos OR Vietnam OR China OR "Sub-Saharan Africa" OR Angola OR Benin OR Botswana OR "Burkina Faso" OR Burundi OR Cameroon OR "Cape Verde" OR "Central African Republic" OR Chad OR Comoros OR Congo OR "Côte d'Ivoire" OR Djibouti OR Equatorial Guinea OR Eritrea OR Ethiopia OR Gabon OR The Gambia OR Ghana OR Guinea OR Guinea-Bissau OR Kenya OR Lesotho OR Liberia OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Mozambique OR Namibia OR Niger OR Nigeria OR Réunion OR Rwanda OR "Sao Tome and Principe" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR "South Africa" OR Sudan OR Swaziland OR Tanzania OR Togo OR Uganda OR "Western Sahara" OR Zambia OR Zimbabwe))

Adapted search strategy for Web of science (n=187)

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Updated search: 7th July 2023

Pubmed (n=308)

(("Malaria"[Mesh] OR Malaria[tiab]) AND ("Community Health Workers"[Mesh] OR "village malaria worker"[tiab] OR "mobile malaria worker"[tiab] OR "community health volunteer"[tiab] OR "village health volunteer"[tiab] OR "community malaria worker"[tiab]) AND ("Asia, Southeastern"[Mesh] OR "Africa South of the Sahara"[Mesh]))

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Thematic synthesis from the systematic of literature review

Our review methods followed five steps: i) identifying the key research questions through an iterative review of literature and discussion among the experts in the field; ii) identifying the initial highly relevant studies (using systematic search) and based on the discussion that informed and refined our review framework; iii) adding literature review into the framework to substantiate/refute the framework; iv) synthesizing, and refining of the findings based on the additional literature, and v) discussion among experts and utilizing their feedback as a required steps in knowledge translation part of scoping review methodology.

Search strategy

The study followed a scoping literature review methodology that combined a systematic search of the literature and thematic synthesis of the findings as recommended for complex social interventions.(1-6) We performed a literature search in three major databases including PubMed, Scopus, and Web of Science. No restrictions were made on publication date, and only English language publications were included. Searches in PubMed used 'MESH-terms'. In all search strategies the countries within 'Sub-Saharan Africa' and 'Southeast Asia' were combined, using 'OR', and these terms were combined with 'Malaria' and 'Community health workers', using AND. CHWs are categorized into lay health workers, level 1 paraprofessionals and level 2 paraprofessionals based on the educational attainment, pre-service training, and remuneration.(7) Nonetheless, in this study, 'community health workers' may loosely represent all three kinds and its mixture may have been ascribed with varied roles and responsibilities. The search strategies and selection process are shown in **figure 1**. The last search was performed on 7th July 2023.

Screening and study selection

After removing duplicate files, three different screening phases were performed. The first screening was based only on the study title; followed by screening guided by title and abstract. For the last screening, the articles were selected based on scanning the full-text article. In the first phase, an article was considered eligible if the article included any reports on community health workers in southeast Asia or sub-Saharan Africa. In the second phase, abstracts were read to exclude studies that did not provide adequate descriptions of CHW networks and were thus not relevant for our study. In the third phase, after scanning the full text, studies that provided information on three or more aspects of our research question were considered eligible for inclusion. Studies describing CHWs treating additional diseases beyond malaria were also included.

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Data extraction

Data was extracted based on the prepared themes that were informed by the preliminary review of the literature and with input from the experts in the field. The review utilized a narrative synthesis of literature following a scoping review framework outlined by Arksey and O'Malley.(8, 9)

The variables were informed by the preliminary literature review and were selected based on the discussions with the experts on the field. Variables included data on author, title, publication year, country, study design, provided package, remuneration, role, diseases covered, training duration, coverage, location, duration of their work and supervision were, if reported, extracted. All the data were put in a table to show an overview of the results. Based on our pre-defined themes and emerging themes based on the data, the themes were revised and formed the basis of the review.

Theme I: Health system

Role

The role of a CHW in malaria management can be summarized as assessing the need for treatment, counselling patients and caretakers on the importance of completion of treatment, treating simple cases of malaria and referring severely ill patients to higher level health facilities.(10) Their general role is to improve health through increasing access to malaria services, even in the most remote of rural villages.(11) One essential observation is the inconsistency in defining the role of a CHW. The roles therefore may not represent the country in general but may represent the studies that were carried out.

In Ghana and Mozambique, CHWs performed home visits to 'identify fever cases and offer case management'. In Ethiopia, Mali, Malawi, and Niger, the CHWs performed additional work from health posts next to these home visits.(12) In Senegal, a study found that proactive deployment of CHWs (increased household visits) increased the detection and treatment of febrile patients in intervention villages compared to non-intervention villages.(13) CHWs' roles entailed providing diagnosis, and treatment for uncomplicated malaria, and referring patients beyond their level to the nearest health facility.(14) One study described the role of CHWs in a spectrum (or models) covering number of diseases and intensity of care they offered that mostly included diagnosing of febrile cases, community-based management of fever cases and referring to higher centres.(10) Models helped to categorize their roles and thus promoting the planned community case management in future. For instance, in Uganda and Mali CHWs assess sick patients, counsel caretakers on the

importance of completion of treatment, sell treatment and refer sick patients to the nearest health facilities.

In Burkina Faso and Ethiopia CHWs facilitate rather than provide treatment directly. They teach caretakers to treat their children, they refer the children if they do not improve after 48 hours. The CHWs were able to assess patients using a simple algorithm and supply colour-coded pre-package courses of antimalarials. CHWs in Kenya treat children with multiple diseases, sold the drugs to community members and used revenues from drug sales to buy more drugs to restock their kits in a revolving fund scheme.(10) Nonetheless, CHWs' quality of services was questioned in various studies. For instance, in Uganda, CHWs were treating children under five years, referred severely sick children and new-borns, made home visits, counselled caregivers on homecare, and maintained the records of community sensitization. However, only one in five CHWs were able to undertake these roles optimally as measured using a structured questionnaire.(15)

Contrastingly, a study that trained and devolved roles of CHWs for integrated community case management (iCCM) of febrile children found improved access to treatment and was acceptable in the community.(16) Another study from rural Uganda corroborated the findings that scaling up of iCCM-trained CHWs were key to the provision of affordable, high-quality treatment for sick children.(17) Affordability and economic benefits of setting up community management of malaria was emphasized by a study conducted in Nigeria as well.(18) A study from Madagascar showed proactive community management of malaria improved malaria control in moderate transmission settings which echoed with the iCCM strategies.(19) iCCM trained CHWs were found to be equally effective in management of malaria compared to other iCCM components.(20)

Treatment of malaria through the CHWs was acceptable to caregivers and communities; and were perceived to be accessible, diligent and effective in a study conducted in Burkina Faso, Nigeria and Uganda.(21) Despite the success of iCCM-trained CHWs in improving access and quality of services, challenges remained to be overcome by the health system that included resolving funding of CHW programs, training and supervision, supply-chain management and averting the regulatory challenges.(9) Limitations among CHWs were mostly attributed to the complexity of the guidelines, and inadequate clinical supervision.(22) Many studies show that trained CHWs were able to improve the access to diagnosis and treatment, with significant shortening of clinical duration and reduction in number of severe cases.(23, 24) A recent study from Zambia showed community case management to be effective in reducing the malaria morbidity and mortality. An increase of one malaria service point per 1000 population was associated with 19% reduction in severe malaria and 23% reduction in malaria deaths among under five children.(25)

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In Guinea-Bissau, Burkina Faso, and Uganda CHWs diagnosed and treated the covered diseases and referred patients with severe illnesses to health facilities.(26) While in Sierra Leone, CHWs just recognized severe symptoms and danger signs to refer these cases to health facilities. In Liberia, CHWs visited households monthly and performed active case-finding in order to identify cases of illness in their community.(26) In CAR, CHWs were reported to ensure communities have access to malaria treatment.(27) In Senegal, although CHWs were preferred means of services for malaria in the community, there were significant shortcomings, particularly the CHWs lacked means of transport to reach patients, make referral for treatment and did not have the competence to offer complete package of health services.(28)

A systematic review identified that tailoring and adapting programmes to suit the governance processes as the important determinant of successful execution of integrated community-based case management (malaria, diarrhoea, and pneumonia) by CHWs.(29) A multi-country study from six Sub-Saharan Africa showed that IMCI (Integrated Management of Childhood Illnesses: pneumonia, diarrhoea and malaria) by CHWs significantly increased the coverage and quality of services (e.g. reduced mortality).(30) A longitudinal study from Uganda also showed a significant decrease in childhood mortality when CHWs offered services and further attested their capacity to identify very sick children with danger signs and make appropriate referral.(31) A study in Nigeria also evaluated the intervention (paid community malaria services provided by CHW) which showed that access and acceptability of treatment were improved but not the capacity to afford the services, particularly inequities were rendered among low socio-economic families.(32)

In Myanmar, CHWs are the point of first contact, they provide treatment, distribute long-lasting insecticidal nets and mosquito repellent, perform community mobilization for malaria elimination activities, contribute to fieldwork for malaria microstratification, and report malaria cases to their supervisor or other staff within 24 hours of diagnosis.(33) Nonetheless, there were limitations regarding CHWs' performance on malaria control activities. For instance, less than half of the CHWs could optimally execute the malaria control activities that included providing health education, distributing LLINs, and observing how LLINs were used.(34) Also, the current roles offered to CHWs in Myanmar were contested particularly because they were only aligned to suit the vertical programs but were not based on the epidemiological burden in the community and the evidence on effectiveness of integration.(35) In Lao People's Democratic Republic (PDR), CHWs contributed to more than a quarter of malaria case diagnosis and treatment.(36) In Cambodia, CHWs provide diagnosis, treatment, keep records, maintain stocks, attend monthly meetings, refer patients based on the need and assist in various malaria control activities.(37) Nonetheless, research has

highlighted the limitation of VMWs' roles as they are focused in managing clinical cases of malaria only, overlooking preventive measures including vector control strategies.(38)

A systematic review on adding roles to CHWs for iCCM (pneumonia, malaria, diarrhoea and sepsis) found the increase in coverage but could not ascertain the quality of coverage.(26) A multi-country study however, showed improved quality of services when CHWs were provided training and supervision on malaria diagnosis and treatment.(39) Multiple studies have echoed on improving of CHWs' quality of services when they have a supportive health system, specifically when they are provided regular, interactive and practical training, clear guidelines, and supportive supervision.(40)

Although CHWs in both regions are tasked to serve primary health care in the rural regions, the differences were clear in terms of malaria management. In SEA, CHWs had specific malaria related roles compared to SSA where CHWs had more integrated roles.(9)

Remuneration

Generally, CHWs are 'nonpaid volunteers', with minimal health literacy, selected by their respective communities.(26) Providing care for, most of the time, a large community can be daunting. To keep these CHWs motivated for doing their work, remuneration or other kinds of compensations are sometimes being used.(9, 40) These can differ from free meals during work to transportation costs being compensated, small monthly payments, or nothing at all. For instance, in Nigeria, CHWs were provided gifts (during festivities) and allowance during the meetings, in addition to reimbursement were made against the costs for calling and following up patients.(23)

In Ghana, Sierra Leone, Senegal, and Uganda CHWs were not paid for their work. Although CHWs were considered to operate purely as volunteer in Uganda, national guidelines recommended provision of allowances, a minimum stipend of 4 USD in a month. In some countries, like Senegal, Liberia, and Uganda they were receiving meals and/or transport costs as an additional compensation.(11, 12, 14, 26, 28) In Ethiopia, Mali, Malawi, Mozambique, Niger, Senegal, Liberia and CAR their remuneration differed anywhere between 5 and 110 US$/month.(12, 13, 26, 27, 41) Burkina Faso has a system in place that allows CHWs to get compensated for their work as they can sell drugs to community members, of which they can keep the returns, to provide a small financial motivation for their work.(23, 26) Similar strategy was applied in Nigeria where CHWs were paid based on the revenues generated from the sale of drugs by CHW to a malaria patient in a month.(18)

CHWs in Lao PDR receive 19 US$ monthly as remuneration. In Myanmar, this amount was 1.49 US$ per month,(33, 36) nonetheless, in most settings, social recognition, community support and their roles in contributing to community was also stated as a major incentive.(28, 34, 37) Village health volunteers in Malaysia received occasional financial support from villagers based on their needs and

involvement.(42) A previous systematic review also found the heterogeneity in provision of incentives, nonetheless, the incentives were minimal if at all provided.(40) Lack of incentives including other resources(20) such as raincoats, boots, transport means to CHWs have been identified as major challenges in community case management of malaria.(9, 21, 43)

Training and supervision

In Ethiopia, Malawi, and Niger supervision was done by health centre staff, without detailing whether this was only guidance, quality control or training.(12) Although supervision and training have been widely reported as the core elements to promote CHWs' performance, much less is reported on the content, duration and context of the training and supervision.(9, 15, 24, 34, 35, 37, 41, 43-45) Nonetheless, studies have shown the improvement in CHWs' performance after the training.(28) Refresher training (on the job training) was found to be important for them to remind CHWs to keep up their knowledge and practice in Myanmar.(34)

In Senegal, a study piloted a proactive model to train and supervise CHWs to visit households, and manage fever cases, which led to increase in detection and treatment of cases in intervention villages.(13) Training and supervision were organized in a package that included workshops conducted by The district health management teams (DHMT) every quarter of the year to share the guidelines of the strategy followed by monthly training and supervision by health post chief nurses (HPCN) and weekly by community supervisors.(13) Another study from Senegal reported supervision was done by the DMT without a further description of DMT.(14) After their stay in the health centre, CHWs were assigned for field training to the health post covering their village for up to a month. At the health post, the CHWs improved their skills and knowledge in malaria, diarrhoea and acute respiratory infection diagnosis, treatment and prompt referral under nurses' supervision.(14)

A multi-country study from sub-Saharan Africa region reported a peer-supervision that entailed conducting a home visit to each CHW under their catchment area each month. The peer supervision was found to increase the pneumonia treatment more regularly with consequent increase in quality of screening.(30) In Mali, CHWs received 35 days literacy training, followed by a week of kit management. In Thailand, CHWs were trained for two days and received periodic refresher training. In Bangladesh, female CHWs received 21 days of training and monthly one day refresher training.(10) In Guinea-Bissau and Burkina Faso supervision was conducted by trained community health nurses.(26) In Uganda, supervision was carried out by health facility workers based at different organisations and facilities. CHWs who met their supervisor once in the previous month were more likely to score above 50% in their clinical skills/performance assessment compared with

those who did not.(11) Another study reports supervision consisted of home visits and quarterly meetings conducted by Health facilities, malaria consortium staff, as well as their peer supervisors.

The supervision in Sierra Leone took place on a monthly basis and included reviews of CHW reports and direct observation of CHWs during visits. There was no reporting on who conducted the supervision of the CHWs.(26) Most CHWs self-reported that they received preservice training but there was large variation in refresher training.(46) In CAR, trained staff employed by the NGO, supervised each CHW two times per month, enabling quality control and stock replenishment.(27) A study evaluated the impact of training to CHWs in Burkina Faso, Nigeria and Uganda. The training was 3-5 days long and were followed by refresher training and was found to have the excellent performance after the training based on the mixed methods evaluation.(39) A systematic literature review on CHWs role in malaria found a recurrent theme that sufficient supportive supervision was a major facilitating factor in studies of health worker performance at all levels of the health system.(40) The review also reinforced the importance of maintaining the quality of community case management.

In Nigeria, the supervisors and the project manager regularly monitored the CHWs. In addition, the project team made regular visits to the villages to monitor the project. The CHWs and the project team met every week for the first two months, then every two weeks for the third month and then monthly for the final two months of the project.(18)

In Burkina Faso, Uganda and Nigeria, CHWs were trained by the health staff and the training included diagnosis, and recognition of uncomplicated and severe illness with danger signs, counting respiratory rate, diagnosis using RDTs and treatment dosage by age.(23) CHWs' competence in performing RDTs and administering medication were improved by training, refresher skills, opportunities to improve and facilitate interactions between CHWs and formal healthcare workers.(21)

A study in Kenya evaluated impacts of initial training (3 weeks) to CHWs, followed by refresher training and regular supervision. Although the training, refresher sessions and supervision were deemed adequate, some CHWs found difficulty managing sick children and it may be due to the complexity of the guideline, implying the critical value of having short and simple guidelines.(22) Strengthening supervision in combination with modifying training courses may be effective in improving the VMWs' quality.(38)

In Thailand the supervision was conducted by the malaria program.(10) In Laos, malaria training and supervision was conducted through a cascade training technique, where central level trainers train

provinces and district malaria staff who in turn train staff at hospitals, health centre and finally CHWs.(36) In Lao PDR provincial and district staff were unable to perform CHW supervision due to coordination and resource gaps. That is why instead, they provided monthly CHWs meetings at health centres for CHWs to report submissions, replenish their stocks, and receive mentorship and payment.(36)

Duration of CHW training

Since CHWs are members of the community with little to no education, it is necessary that every CHW receives proper training to be able to recognise and treat the covered diseases. Multiple types of training were reported such as basic training, iCCM training, classroom/literacy training and practical training. Few studies reported a specific type of training, for instance in Myanmar, training was conducted by Myanmar Medical Association in 2011 to raise CHWs' capability on diagnosis, early treatment for uncomplicated cases, and referral for severe or complicated cases, although the duration of training was not reported.(34) iCCM training is generally of four days that covers management of childhood pneumonia, diarrhoea and malaria and has been in operation since its inception in 2004 by a joint effort of WHO, and UNICEF.(29)

Some studies just referred to 'training' without any specifications. The duration of the training differed from country to country. During the comparison of the training durations, no distinction has been made by the type of training. Few studies reported about additional training course (three days) offered to lay health workers to evaluate their training and the outcome.(28) VMWs in Cambodia received an original two-days training in 2009, in addition to refresher training in 2011 and monthly meetings.(37, 38) The results show a wide variation in total training durations, especially in Africa but also in Asia, there were no benchmarks or standard guidelines to specify the training duration of a CHW.

Duration of basic training for CHWs varied, for example, from a year in Ethiopia, five days in Ghana, 40 days in Mali, three months in Malawi and four months in Mozambique.(12) The variation was reported even for an iCCM which was deemed to be a standard three-diseases management among children. iCCM training lasted for six days in Ethiopia and Mali, three days in Ghana, 15 days in Mali, and 23 days in Mozambique.(12) In Senegal, in addition to their basic training for CHW and iCCM, study related training for household management of pneumonia, diarrhoea and malaria were offered for five days followed by 15 days of practical training at the health posts.(13)

Although variations in training duration were reported, another study conducted in six sub-saharan nations that included Rwanda, South Sudan, Sierra Leone, Uganda, Ethiopia and Ivory Coast the

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training on iCCM for CHWs lasted between five to seven days.(30) In Bangladesh, a NGO led CHWs received 21 days of initial training followed by refresher training once monthly and they managed ten disease that included diarrhoea, dysentery, goitre, scabies, anaemia, ringworm, intestinal worms, cold, fever and stomatitis.(10)

In Mali, government together with the stakeholder developed a training package that included 35 days of literacy training followed by a week on drug kit management.(10) In Pakistan, CHWs training lasted for three months, and one week a month for at least a year and performed a range of activities such as managing pneumonia, fever, malaria, and diarrhoea.

Ghana, Senegal, Uganda, Sierra Leone, Kenya, and CAR all had a total training duration of less than a month. Mali, Malawi, and Mozambique reported having a training duration between one and six months.(12) Ethiopia and Niger both had a total CHW training of more than six months.(12) A Cochrane review of iCCM in low- and middle-income countries also echoed the heterogeneity of training durations, but mostly averaged around 5-6 days.(26) In Sierra Leone, CHWs were provided a standardized 10-day preservice training that entailed a package of community based primary health care (PHC) services which included prevention, promotion and curative services, surveillance activities, through household visits.(46)

In Nigeria, training lasted for three days and included 28 CHWs in a session. In Uganda, training lasted for five days with three days of theory and two days of practice.(39) A study piloted a short training on malaria in Uganda, Nigeria and Burkina Faso and significantly improved the coverage, diagnosis and treatment. Training was for 5 days in Uganda and 3 days in Nigeria (with an additional 2 days for severe malaria) and 3 days in Burkina Faso.(23) Health extension workers (HEWs) received training for a year after their minimum of ten years of school education.(24) In Kenya, CHWs were offered training for three weeks followed by a weeklong refresher training in a cohort of 8-10 CHWs.(22)

In Senegal, CHWs received three days of classroom teaching at the district health centre, followed by an additional 15 days of training in the health post in their catchment area.(14) In Central African Republic, CHWs were trained by nurses and physicians over five days to implement basic health interventions in their homes, including prevention and treatment against infectious diseases. A three-day refresher training tool was repeated every six months.(27) In Uganda, CHWs whose initial training lasted 2–3 days were more likely to have scores above 50% compared with those whose training lasted more than 3 days, implying the shorter training duration were better retained.(11)

In Asia, Thailand and Nepal had a training duration of two and seven days, respectively. In Myanmar, they reported having a training period of six months.

Some studies piloted the training programs and evaluated their impact. For instance, in a study from Senegal, NMCP and partners piloted the integration of management of diarrhoea and pneumonia for children under five years, and the training was offered to CHW that lasted for three years.(13) In Burkina Faso, Nigeria and Uganda, a study provided 3-5 days of the training and later assessed its effectiveness after a year and found that the overall performance was 98%.(39) A previous systematic review exploring role and contribution of CHWs in malaria found training and supervision to be an important elements to enhance their performance but did not explore on the duration of the training or duration of CHWs' work.(40)

Provided package

For an effective diagnosis and treatment of malaria: the WHO recommends microscopy or a rapid diagnostic test (RDT) for diagnosis and highly potent artemisinin-based combination therapy (ACT), for mild malaria and severe cases of malaria should be treated with injectable artesunate.(47) The provided package used by community health workers was assessed by all included studies.

Studies from Uganda, Burkina Faso, Liberia, and Sierra Leone showed that ACT was used for the treatment of malaria followed by the diagnosis by RDT.(26) Guinea-Bissau started their treatment with chloroquine, which eventually changed in 2009, when ACT was introduced there.(26) Uganda initially started with a pre-packaged combination of chloroquine and sulfadoxine-pyrimethamine, until 2004 when they choose ACT as their new first-line drug.(10, 16) Studies from Ethiopia, Ghana, Mali, Malawi, Mozambique, and Niger reported that RDTs were used for diagnosing.(12)

In Liberia and Guinea-Bissau, fever was treated presumptively, without the use of RDTs. In Liberia this presumptive treatment was caused by the WHO "no touch" protocol during the Ebola epidemic, as it later was reinstated. In Sierra Leone, malaria was diagnosed symptomatically.(26) In Central African Republic (CAR) and Senegal, multiple studies noted that in these countries, RDTs and ACT were used with an additional provision of long-lasting, insecticidal bed nets (LLINs) for their community.(13, 14, 27)

Myanmar has an identical approach as CAR and Senegal, utilizing ACT and RDTs with LLINs as additional prevention. Lao PDR and Thailand both used RDTs and ACT but with an additional differentiation of *P. vivax* and *P. falciparum* using microscopy.(33, 36)

According to these results, the African region uses a more varied combination of methods for the treatment and diagnosis of malaria. Treatments in Africa vary from ACT to chloroquine and sulfadoxine-pyrimethamine; and diagnosis can differ from RDTs to malaria being diagnosed symptomatically. For instance, in Uganda antimalarials were provided based on the symptomatic

diagnosis when RDTs were not available.(20) While in Asia, all the included studies reported having ACT as treatment and RDT as a major diagnostic, and some with additional provision of microscopy.

Theme II: Community Health Workers

Diseases covered by CHWs

CHWs have been tasked to provide health services to multiple other disease in addition to malaria in general. CHWs who managed more than one disease were also reported to perform well in terms of clinical management.(11) Many studies reported the combination of malaria, pneumonia and diarrhoea as a mix of diseases undertaken by CHWs. Few studies explained these three diseases under the heading of iCCM (integrated community case management of childhood illnesses).(12, 15, 16, 26, 29, 30, 44, 46, 48) Nonetheless a lot of studies in this review reported malaria as the main disease managed by CHWs.(13, 18, 28, 32, 37) A systematic review explored intervention models for the management of children with signs of pneumonia or malaria by community health workers.(10)

An evaluation study in Kenya showed that CHWs managing multiple diseases were able to treat 90.5% of malaria adequately but were often making mistakes when assessing symptoms, classifying illnesses, and prescribing correct doses of medications. The main problem for CHWs were due to complexity of the guidelines, thus reducing the message of guidelines for diseases were proposed to reduce the errors made by CHWs.(22) CHWs contributed to malaria case detection and surveillance, diagnosing and treating 27% of malaria cases in Lao PDR and 55% Honduras in 2019. Ethiopia, Ghana, Mali, Malawi, Mozambique, Niger, Senegal, Uganda, Guinea-Bissau, and Sierra Leone all covered multiple illnesses including Malaria, Diarrhoea, and pneumonia.(12, 13, 26) In Burkina Faso and Ethiopia, CHWs only treated Malaria.(10) CHWs in Kenya and Burkina Faso also covered dehydration.(10, 26) Liberia has a more complete package where they also covered Ebola. In CAR, the covered illnesses were malaria, rehydration, diarrhoea, malnutrition, and covered services like deworming and folic acid supplements for pregnant women.(27) In Uganda, CHWs with dual (malaria and pneumonia management) responsibilities and single (malaria management only) responsibility performed equally well when assessing their level of knowledge, identifying the disease and providing correct prescriptions.(20) Between 2008 and 2011 there was a seven-fold increase in the number of lay health workers (LHW) providing health services. LHW's work varied seasonally, 24.3% of all patients prescribed with an ACT had a negative RDT or were never tested with an RDT, and less than half of patients with absolute indications for referral (severe symptoms, age under two months and pregnancy) were referred.(14)

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In Myanmar, the roles of malaria volunteers were expanded to include the management of dengue, lymphatic filariasis, tuberculosis, HIV/AIDs and leprosy. The expanded role was not however based on the evidence but was rather to fit into the vertical governance system.(35) CHWs in Nepal and Lao PDR had a wider coverage compared to Africa. In Nepal, CHWs covered pneumonia, malaria, diarrhoea, nutrition, vitamin A deficiencies, and immunization components.(10) In Lao PDR, CHWs covered Malaria, childhood diarrhoea, pneumonia, TB, and dengue, as well as services like maternal and child health support.(36) In Thailand, they covered only Malaria just as in Burkina Faso and Ethiopia.(10) A study from Uganda showed that more than two diseases (e.g. pneumonia and diarrhoea in addition to malaria) and higher coverage of households were negatively associated with their quality of services and were positively associated when they had regular interaction with the supervisors.(11) A study from Cambodia showed that VMWs were proficient in managing malaria using RDT and antimalarials but their activities related to prevention and vector control was inadequate suggesting the need for a regular supervision and training.(38)

Duration of the work experience

There was a heterogeneity of work duration of CHWs, although only very few studies reported the duration of their service. In addition, the reported work experiences are study specific and may not represent the actual duration (average duration) of work experience in a country. Globally, over last 30-35 years, village-based volunteers have been contributing to malaria diagnosis and treatment. VMW project was led by CNM in 2004. In Cambodia as well, roles and responsibilities of VMWs to cover malaria zone were expanded in between 2014 to 2016 to cover from 400 to 1123 villages.(37) A cross-sectional study in Myanmar found the average duration of their experience as CHWs was two years.(34, 49) One study reported on the functional duration of CHWs. In Lao PDR 91% of all CHWs reported having more than a year of experience, with 43% reporting ten or more years of service.(36)

Apart from the duration of training, most studies did not report on the duration of their services.(23) A study conducted in Sierra Leone showed that CHWs took pride and satisfaction from their work and duration in being able to be of help to the population in need.(43) In Kenya, CHWs were working for an average of 1-4 years after the initial training and regular supervision. Maintaining competency among CHWs were attributed not just to the duration of their work but the amount of exposure to patients and their practice.(22) In Laos, most (91%) CHWs reported having more than a year of experience, and 43% (of those 91%) had ten or more years of experience.(36) VMWs had served a mean duration of more than three years in Cambodia.(38)

Theme III: Communities

Coverage

The population coverage by CHWs were heterogenous and incomplete because of the inherent reporting bias and lack of accurate estimate of service-coverage by CHWs. In Uganda, based on the population estimate of a district and the number of CHWs, one CHW was providing health services to around 900 people, which was around 25-30 households/CHW.(15) Although there is consensus on expanding the network of village malaria workers (VMWs) in Cambodia, number of VMWs are still in short supply to cover the population requiring services for malaria diagnosis and treatment.(37) Within Africa, the coverage per CHW was 377 patients in Ethiopia (2007–2010), 360 patients in Mali (2007-2011), 632 patients in Malawi (2007-2008), 735 patients in Mozambique (2007-2010), and 576 patients in Niger (2007-2008). In Ghana, a CHW covered only 72 patients (2007 to 2010).(12) A study in Senegal showed that the number of patients seeking care from CHWs increased when CHWs were deployed to proactively visit households for home-based management of malaria. There was a 104% increase in the number of RDTs performed and a 77% increase in the number of positive tests and patients treated with ACTs.(13)

Some studies only offered details of the geographical coverage (or the population size) but not the number of CHWs who provided health services.(44) A study in Senegal reports that in 2008 six CHWs covered an estimated population of 3,471 or 779 patients per CHW. In 2011 this was increased to 19,505 patients per 43 CHWs, making it 453 patients per CHW.(14) In Kenya the coverage was ten households per CHW from 1997 to 2001.(10) In CAR the average coverage from April 2009 to 2014 was 80 patients per CHW. In Liberia 229 CHWs were trained, and each served 161 patients from March 2015 to June 2016.(27) In Uganda the coverage was 22 patients per month per CHW. In the following countries the coverage was given in ratio; in Guinea-Bissau a ratio of 20-50 households per CHW, in Sierra Leone a total of 2129 CHWs were trained, all with a ratio of 50 households per CHW.(26)

Coverage by CHWs was also affected by the distance between the community members and CHWs. For instance, households located 1–3 km from a CHW were 81% less likely to utilize CHW services compared to those households residing within 1 km of a CHW.(16) A study in Niger estimated the number of additional CHWs needed to optimize the geographical accessibility of the population beyond the reach of the existing community health post network. An addition of 7741 additional CHWs was found to increase the geographical coverage from 41.5% to 82.9%.(48) The per cent of the population within 30min walking to the nearest CHW increased from 16.1% to 80.4% between 2000 and 2015. Nonetheless, most of this increase occurred in areas within 3 km of a health facility

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where nearly two-thirds (64.5%) of CHWs were deployed. Hard to reach areas were still deprived of the CHW services.(46) A study in Nigeria showed that CHWs offered a paid service to 40,000 people in 12 scattered villages which increased access, and services but did not redress the inequities in health services, meaning some of the poor households could not benefit from the health services.(32)

Availability of RDTs with CHWs for malaria was also reported to be indicator of access to diagnosis and treatment. RDTs were stocked by CHWs in three countries: Cambodia (97%), Madagascar (54%) and Uganda (70%).(45) In Uganda, around 20% of children with malaria, diarrhoea and pneumonia (MDP) first attended CHW. The CHW was more likely to provide cheapest and appropriate treatment compared to any other provider or to those not seeking care for children with MDP.(17)

In Myanmar, 140 villages were served by 140 volunteers in a period of 6 months.(33) Myanmar has around 60,000 villages and only a quarter of these villages (n=15000) are serviced by integrated community malaria volunteers.(35) A multi-country observation study that included a total of 15932 children, showed increased access, and shortened clinical episode duration when treatment offered by trained CHWs.(23) In Ethiopia, based on the records showing treatment provided by CHWs, around 92% (n=368) of patients received appropriate drugs (dose and duration).(24) Among nearly 200,000 people who consulted a CHW in Central African Republic between 2009 and 2014, 81% were found to be positive for malaria parasites by RDT and 98.9% of these positive cases were appropriately treated with artemisinin-based combination therapy (ACT). The appropriate treatment coverage to population was high despite political crisis.(27) A systematic review showed that 96-100% of RDT tests were correctly interpreted by CHWs who were trained properly. And more than 90% of patients with positive RDTs were provided with anti-malarial therapy by CHWs.(41) An Ugandan study found that serving high volumes of population without adequate training were likely to compromise the quality-performance of CHWs.(11) In Cambodia, almost all VMWs were able to conduct diagnosis with RDTs and prescribe anti-malarials to those who had positive RDT result. While only a few of them were able to explain about compliance and follow-up patients, much less had knowledge on malaria prevention and vector control.(38)

Location

For the location, we examined where the CHWs were stationed to see whether there was a major difference between the two regions. Remarkably, only few studies reported where the CHWs were stationed. Only few studies reported where CHWs provided services such as health posts, specific community or in their own village. In Myanmar, community-based case management of malaria was established in 2001 in which village health volunteers (VHVs) were trained to implement the home

management of malaria. In 2011, Myanmar Medical Association-Malaria (MMA-Malaria) augmented the existing program by providing more training to raise the capability to diagnose, treat and refer based on the severity of malaria cases. The program covered 420 VHVs in remote areas of 14 townships under the supervision of MMA-Malaria.(34) Consistent with Myanmar, in Uganda, CHWs are the major workforce reaching out to rural population for health services related to childhood malaria, pneumonia, and diarrhoea.(11) Community based study with CHWs were found to enhance the early case identification and management in rural areas of Kenya; and was found to be feasible and effective at reaching the poorest households.(50) Another study from Uganda reported that each CHW took care of about 25-30 households and were responsible for delivery of minimum health care package that includes preventive services such as childhood immunization, health promotion and education as well as treatment and control of common infectious diseases such as malaria, HIV/AIDS and TB.(15) In terms of where CHWs were located, distance was a major factor in delivery and uptake of services. 86% of households were within a kilometre from a CHW's home who received more services compared to 26% who were within a km from the health centre.(16)

There were two groups of human resources available at the village level in Senegal that included community health workers (CHWs) who worked in a village with a functional health hut, and Community Medicine Distributors (CMDs) who worked in villages without health huts. Unlike CHWs, the CMDs were trained only to manage uncomplicated malaria and were not permitted by the ministry of health to manage any other condition.(28) In one study in Senegal, CHWs were tasked to visit all households in their village weekly during transmission season to detect and manage febrile patients at the household. The study showed increase in testing by 104%, RDT positivity and treatment of malaria by 77%.(13)

In Cambodia, since 2004, VMWs have been providing malaria diagnosis through the use of rapid diagnostic tests and free of charge artemisinin-based combination therapy in villages more than 5 km away from the closest health facility.(37) CHWs programs in sub-Saharan Africa also varied, for instance CHWs carried out their work from health posts in Ethiopia, Malawi, Mali and Niger while in Ghana and Mozambique, CHWs conducted home visits.(12) In Niger, the percent of the population within 60-minute walking to the nearest community health post with a CHW increased from 0.0% to 17.5% between 2000 and 2013.(48) In Sierra Leone, nearest CHW with preservice training increased from 16.1% to 80.4% between 2000 and 2015. Based on the multi-country study in sub-Saharan Africa, CHWs in three countries were found to have RDTs with them in Cambodia (97%), Madagascar (54%) and Uganda (70%).(45) In Burkina Faso, Nigeria and Uganda, CHWs were trained and tasked to serve population in rural malaria endemic regions.(39)

In Myanmar, CHWs are part of the health services in rural and hard to reach areas.(35) CHWs were also based in rural areas of Burkina Faso, Nigeria and Uganda and worked alongside traditional healers, faith homes, drug shops/drug hawkers, and dispensaries. CHWs managed most patients and referred very sick patients to the higher level of care, nonetheless the study reported that CHWs were either not available (Uganda) or barely utilized (Burkina Faso and Nigeria) prior to the study.(23) In Ethiopia, CHWs were referred to as 'Health Extension Workers/HEWs' who were trained for one year and were deployed at health posts.(24) CHWs were also known as 'Community Medicine Distributors (CMDs)' in Uganda and were treating children aged less than five years in remote communities.(20) In Kenya, pilot project, CHWs were remotely based to undertake integrated management of childhood illnesses.(22) In Lao PDR, CHWs were the major workforce in rural communities undertaking most of the malaria related work.(36)

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