

Systematic Review

Challenges encountered among community-delivered malaria volunteers in Greater Mekong Sub-region for malaria elimination: a systematic review

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ABSTRACT

In the Greater Mekong Sub-region (GMS) countries, community-delivered malaria volunteers (CDMV) have been serving a vital role in providing primary preventive and curative services of malaria in the uncovered areas, but they have encountered different challenges. The main purpose of this systematic review was to determine the CDMVs' challenges in malaria elimination settings of the GMS. A review team applied MEDLINE and PubMed, Google Scholar, and Myanmar Health Sciences Research Journal as major databases and Boolean operators as the focus search for selecting a final set of 46 English studies designed with qualitative and quantitative, and published in 2010 and after. The service qualities of CDMVs were affected by different challenges: motivational challenges (lack of incentive pay, supervision, shortage of malaria supply and inadequate training), community acceptance challenges (negative comments and less preference of community, unawareness of the CDMVs' roles, and inappropriate care of traditional healers), technical challenges (unsatisfactory knowledge and practices, complexities of reporting formats and applications), communication and transportation challenges (lack of electricity and Internet, inapplicability of transportation aids and poor road infrastructure), safety challenges (testing blood with unsafe technique), financial and logistic supply challenges (lack of supply for additional costs, and interruption of malaria 'supply') challenges in malaria management (difficulties in managing the patients with mixed malaria, invalid RDT results and severe patients). This review recommends that more research on the community malaria services should be invited and the malaria programmers from each GMS country should establish more perfect volunteer policies for eliminating the CDMVs' challenges.

Keywords: Challenges, Community-delivered malaria volunteers, Malaria elimination and GMS

INTRODUCTION

Malaria is a serious vector-borne disease caused by a digenetic parasite, *Plasmodium*. The invertebrate female Anopheles mosquitoes are the sole transmitting vectors and they can transmit the *Plasmodium* parasites to the human for being malaria through their blood meals. Until 2019, malaria has been causing 86 countries to endemic

and is risky for 50% of the worldwide population and therefore it still creates a global public health problem. Malaria is the most threatening public health concern and a great challenge to Myanmar, Cambodia, Vietnam, China's Yunnan Province, Thailand, and Lao PDR of the Greater Mekong Sub-region (GMS). The GMS has bagged the first spot among countries of South-East Asia region in the number of malaria patients and deaths in 2020.¹ In this

sub-region, about 50,000 malaria cases and 10 malaria deaths were found on 31 October 2020.² The malaria cases and deaths have still been accounted for and reported for the vast majority in border areas especially hard-to-reach areas where have a limited health workforce for quality primary care for malaria. Besides, almost all of the border areas, forest areas, forest fringes, and the areas where most of the migrant people are residing are malaria-endemic areas. Importantly, the people residing in some areas of the GMS are difficult to seek early medical advice relating to early diagnosis and prompt adequate treatment for malaria because of the shortage of trained healthcare providers; consequently, they are more likely to be at risk of getting malaria and its complications. Further, they have several challenges such as communication and transportation difficulties, limited access to healthcare workforce and infrastructure, over migrations, internal armed conflicts, and low income.³

As the statement of World Health Organization (WHO), the GMS importantly needs to interrupt the local transmission of malaria and continuously afford to prevent the re-establishment of malaria transmission. In this statement, the malaria elimination goals within GMS are targeted for China, Thailand, Cambodia, Lao PDR, Myanmar, and Viet Nam at the end of 2020, 2024, 2025, and 2030 respectively.² To achieve the WHO's malaria elimination plan within the GMS, improving access to quality primary care for malaria is an essential issue. For this to happen, training and equipping the CDMVs and providing them with technical support is an important and valuable strategy for early testing and diagnosing malaria suspected patients, for promptly treating the minor malaria cases, and for timely referring the danger malaria patients. Besides, the CDMVs are particularly essential because they are the key supporters to the malaria programmes in organizing the health literacy promotion activities, leading care group households, surveying the community-based activities, assessing the risk groups (pregnant women and children), managing the malaria patients, counselling about the malaria treatment, promoting the behaviour of using insecticide-treated nets, encouraging care-seeking behaviour, informing the outcome of the early referral, and so on.⁴

Since the CDMVs are the focal points of successful malaria elimination at the grassroots level, only training and equipping them could not be complete.⁵ Better understanding the challenges encountered among them

while implementing the malaria preventive and control activities and developing supportive planning for how to help to overcome their challenges will be more likely to get their full participation and quickly meet the successful malaria elimination.^{6,7} This review was capable of assessing the challenges relating to motivation, community acceptance, techniques, communication and transportation, safety, financial and logistic supply and malaria management and might offer a collective and comprehensive overview of the challenges encountered among CDMVs. Additionally, in searching the related topics in many databases including Cochrane Library, PubMed clinical queries, and PROSPERO, the researchers have not found a similar review yet.

METHODS

A systematic review was planned for providing robust answers to the predefined research question: “what will be challenging to CDMVs in their malaria elimination activities in GMS?” formulated with the criteria of FINER and PICOT.

Inclusion and exclusion criteria and rationale

Table 1 explains the inclusion criteria of the studies for this review and reasons why the studies were includable. This review excluded secondary efforts (review articles and meta-analyses) and evidence resulting from the data that has already been presented in the historical records, published academic papers, statistical databases, and government reports.

Searching strategy

The study used three online search engines namely MEDLINE and PubMed, Google and Google Scholar, and Myanmar Health Sciences Research Journal (MHSRJ), and also applied Boolean operators (or, and), double quotation marks, and parentheses for different search terms.

Key words for search

There were four keywords for searching such as: challenges, CDMVs, malaria elimination activities, and GMS. Moreover, the researchers ensured a search in the forms of the extensions of each keyword for complete research work (Table 2).

Table 1: Inclusion criteria and their rationales.

Identification	Inclusion criteria	Main rationale
Types of study	Primary studies with qualitative, quantitative, and mixed methods	To assemble the different specific information from the different types of studies in a synergistic way
Publication language	English only	To overcome interpretation error

Continued.

Identification	Inclusion criteria	Main rationale
Publication status	Full-text papers	To appraise the detailed description of the methodological domains and to pool the completed study results
Date of publication	Between 2010 and 2021	To count the challenges experienced after the recruitment of CDMVs in the malaria programme
Geographical location of study	Countries in Greater Mekong Sub-region	To support robust evidence for GMS's volunteer supports in their malaria elimination setting
Study population	CDMV's and ICMV who are responsible for not only communicable diseases including malaria, HIV, and TB but also non-communicable diseases	To develop more effective strategies on the CDMVs in the GMS' countries
Exposure	All malaria elimination activities	To provide a similar experience of the CDMVs on malaria elimination activities
Reported outcomes	Challenges on: motivation, community acceptance, technology, communication and transportation, aspects of safety, financial and logistics supply, and management of malaria patients	To support the malaria programmers more visible challenges of the CDMVs in the malaria elimination setting

Table 2: Key search terms and their explanations.

Key search terms	Explanations
Challenges	The researchers identified further significant words or characteristics of challenges relating to motivation, community acceptance, technology, communication and transportation, safety, financial and logistics supply, and malaria case management
Community-delivered malaria volunteers	Similar keywords were village health volunteers, integrated community-malaria volunteers, community health workers, malaria volunteers, village health workers, local health volunteers, village malaria volunteers, and community-based health workers
Malaria elimination activities	Examples of activities were case detection, active case detection, reactive case detection, testing, diagnosis, rapid diagnosis tests, treatment, Artemisinin-based combination therapy, directly observed treatment, case reporting, notification of case, surveillance, field data collection, a compilation of data, referral of complicated cases, pre-referral treatment, long-lasting insecticide nets distribution, health education, health promotion, monitoring of patients
Greater Mekong Sub-region, its countries and other defined areas	Further key words were Greater Mekong Subregion, GMS, Cambodia, the People's Republic of China (Yunnan Province), Laos People's Democratic Republic, Myanmar, Thailand, Viet Nam and their malaria-endemic areas, remote areas, hard to reach areas, rural or village areas, worksites, rubber plantation sites, corn plantation sites, and forest areas

Details of selection process

The systematic literature search was dependent on the three databases mentioned above and the initial step of identifying the running titles, abstracts, and reference lists provided 1899 citations. Of these, the 229 full-text papers relevant to the review were downloaded (128 full papers by the principal reviewer and 101 full papers by co-reviewer). The second step compared all papers downloaded by the principal reviewer with the papers selected by the co-reviewer and could count the 88 duplicated papers. After that, 141 were available in total for full-text analysis. In the third step, two reviewers minutely read and examined these 141 papers with the review's inclusion and exclusion criteria and identified them by three categories (includable, not includable, and maybe includable) in an excel sheet. If not or maybe includable, note the reasons. Ninety-five papers were

excluded because four papers were systematic reviews that analyzed the difficulties in researching malaria-endemic areas, thirty-four papers studied on the villagers and their health-seeking behaviours for malaria treatment, twenty-eight papers studied on the villagers and identified their participation statuses in malaria control, twenty-two papers studied associated factors of finding malaria treatment among migrant workers and seven papers studied on health workers and out of GMS. Finally, forty-six papers were consistent with the review's inclusion criteria and included in the review's analysis (Figure 1).

Assessment of the quality of the study

The researchers applied the critical appraisal skills program (CASP) tool for appraising both qualitative and quantitative types of research. The researchers decided to establish the quality scores such as 1 point completed for 1

mark, 2 points completed for 2 marks, and finally, 10 points completed for 10 marks of both qualitative and quantitative studies because the CASP checklist describes

10 major lists. The grading of quality scores was executed as between 1-4_ poor score, 5-7_ moderate score, and 8-10_ great score.

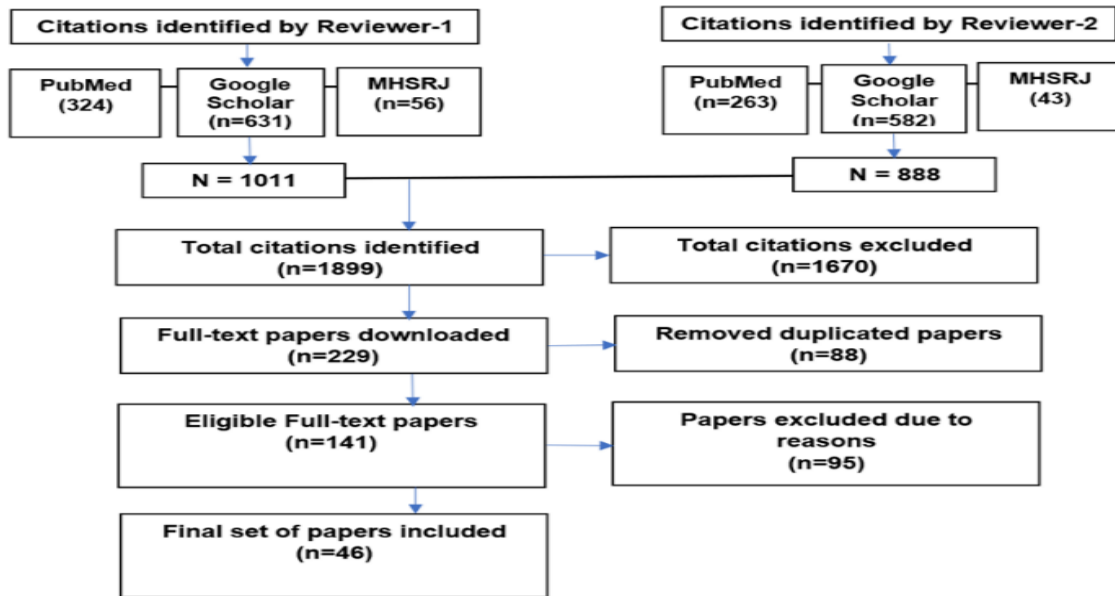


Figure 1: Flow chart of selection process.

Moreover, the researchers appraised the qualities of mixed-method research by using MMAT appraisal tool. MMAT tool generally includes five questions for the rating system, therefore the researchers assigned one point for 2 marks, two points for 4 marks, and five points for 10 marks. Regarding the scoring system, the research determined 4 marks and below as poor score, 6 marks as moderate score, and 8 marks and above as a great score.

Choice of synthesis methods

This systemic review applied narrative synthesis as a synthesis method and used a qualitative or descriptive approach. The first stage of the synthesis was a thematic analysis that the researchers searched the eligible papers,

counted and listed them with serial numbers, and organized outcomes as well as presented these outcomes in a tabular form. Then in the second stage, the researchers structured and presented the outcomes as the detailed review finding according to seven themes predefined.

RESULTS

Details of the included studies

Table 3 demonstrates the descriptive analysis of the included studies in terms of country of origin, focus fields, study designs, data collection methods and tools, data analysis tools, the status of quality appraisal, publication years, and sample size.

Table 3: Characteristics of the included studies.

Specifications	Frequency	Percentage
Country of origin		
Cambodia	12	26
The People's Republic of China	0	0
Laos	6	13
Myanmar	23	50
Thailand	3	6.5
Vietnam	2	4.5
Focus Fields		
Examining knowledge, skill, attitude, and determinants of service quality of CDMVs	19	41.3
Examining the community participation and engagements in malaria services	5	10.9
Evaluating the feasibility and viability of community surveillance system and reporting system	7	15.2
Determining associated factors of a mobile phone-based communication system	4	8.7

Continued.

Specifications	Frequency	Percentage
Determining motivation and challenges in using RDT test kits	3	6.5
Evaluating the monitoring system of volunteer services for malaria	2	4.3
Assessing the effectiveness of the malaria volunteer training	2	4.3
Determining the community acceptance to the CDMVs' services	2	4.3
Evaluating financial issues of the malaria volunteer programme	1	2.2
Determining the consequences of COVID-19 on malaria	1	2.2
Study designs		
Cross-sectional (quantitative)	16	34.7
Cross-sectional (mixed method)	12	26.1
Cross-sectional (qualitative)	8	17.4
Analytical cross-sectional (retrospective)	2	4.4
Before and after study (quantitative)	2	4.4
Cross-sectional (descriptive)	2	4.4
Retrospective cohort study (quantitative)	2	4.4
Cluster randomized controlled trial (quantitative)	1	2.1
Micro-costing approach, ecological study (quantitative)	1	2.1
Data collection methods and tools		
In-depth interview questionnaire	15	24.2
Structured questionnaire	13	20.9
Reviewing monthly reports and phone records	13	20.9
Focus group discussion	8	13.0
Semi-structured questionnaire	5	8.1
Observations	5	8.1
Survey questionnaire	2	3.2
Open-response interviews	1	1.6
Data analysis tools		
Descriptive analysis	20	31.7
Thematic analysis	20	31.7
Student's t-test (Stata, version 8)	7	11.0
Multiple linear regression	4	6.4
McNemar's test	4	6.4
Fisher's exact test (Stata, version 8)	3	4.8
Chi-square test for bivariate analysis	3	4.8
Multivariate analysis	1	1.6
Mantel-Haenszel Chi square test	1	1.6
Quality status		
Great score	25	54.3
Moderate score	21	45.7
Poor score	0	0
Publication year		
2010	3	6.5
2011	1	2.2
2012	3	6.5
2013	2	4.4
2014	4	8.7
2015	3	6.5
2016	7	15.2
2017	3	6.5
2018	7	15.2
2019	2	4.4
2020	1	2.2
2021	10	21.7

Challenges encountered by CDMVs

Motivational challenges

Regarding motivational challenges, less or insufficient incentive pay was a key challenge. The performance of the CDMVs' malaria services and willingness to volunteer work was often reduced due to lack of or insufficient incentive pay, less trust of the community in their testing, examination, and management services, and delay in supplying malaria commodities.⁸ Despite submitting the monthly reports via mobile-phone application, the lack of supplying pre-paid cards caused CDMVs demotivation.⁹⁻¹¹ A study by Sato et al pinpointed that there was a significant association between financial incentives and the performance of volunteers (AOR- 2.10, 95% CI- 1.19-3.71).¹²

Another important motivational challenge was lack of or irregular supportive supervision. The frequency of the supervisors' visits to CDMVs was very low, and the tracking systems about the situations of CDMVs were weak.¹³ The CDMVs have never been received any effective feedback on the reporting and malaria slides reported.^{9,10} Bad communication of health staff at upper levels on late referred patients affected the community trust upon the CDMVs.⁹ Many CDMVs experienced less recognition of MOHS, NGOs, and INGOs.¹⁴ A study by Sato et al also stated that a significant association was noted between regular supervision, recognition, and high motivation (95% CI-1.08-1.73, OR 1.37) and good performance of CDMVs (95% CI- 1.51-3.80, OR- 2.40).¹²

Another cause of demotivation was a shortage of malaria drugs, RDTs, insecticide-treated nets, and basic requirements such as fuels, transportation facilities, and bags. These supplies were frequently out of stock, which in turn led to delays in malaria treatment and negative feedback from the community.^{9,10} Less trustworthiness of the community influenced the CDMVs' ability to organize the community in mass group education and take the help of the community members.¹² Further challenges encountered by the CDMVs was inadequate training, insufficient modules, lack of certificate for malaria management, and inability to carry out extra health promotion activities apart from malaria when the community demands them as well as lack of career opportunity.^{9,15}

Community acceptance challenges

Among some communities, frequent travelling, participation in festivals for long holidays, cultural beliefs, job reasons such as fishing, vegetable gardens, social activities cause CDMVs difficulties in their service provisions and ineffectiveness in the use of insecticide-treated nets. No agreement for counselling about malaria with women who were in menstrual periods and stayed in huts also challenged them.¹⁶ The forest goers and migrants took the malaria treatments from the CDMVs with less

respect, for which the CDMVs were difficult to practice directly observed treatment.¹⁰ In some areas, the migrants and new seasonal workers were unaware of the CDMVs' activities.^{19,20} Many villagers often missed the follow-up care of the CDMVs because of their seasonality tasks.²¹ Some villagers tried to consult the traditional healers than the CDMVs when they demanded other illnesses rather than malaria.²² Some locals believed that private clinics provided superior malaria medications than CDMVs. Caregivers and forest goers were hesitant to consult with CDMVs because they believed CDMVs lacked professional abilities and formal medical training, as well as concerns about the quality of drugs and equipment.^{17,23} The critical challenges encountered by the CDMVs were the difficulty to overcome community self-medication for malaria, lack of respect and support from the community and unawareness of the community about their services.²⁰ Some communities were more familiar with untrained healthcare providers near them and they frequently self-diagnosed and self-prescribed on malaria.^{20,22} Some communities were more likely to use traditional or hammock nets instead of using insecticide nets.²⁴

Technical challenges

Importantly, unsatisfactory skills and knowledge on diagnosis with RDT and malaria drug prescription and requirement of promoting basic knowledge on malaria case management were challenging to the quality services of the CDMVs.²⁵ As CDMVs have limited knowledge of malaria and vector ecology characteristics of breeding sites, they often provide misinformation about malaria transmission, epidemiology, and vector ecology. Some CDMVs could be able to distribute insecticide nets only, and they could not share knowledge about how to protect malaria and reduce vector burden. Further, they were less competent in the active case identification, and unfamiliar with the application of malaria educational (information, education, and communication) materials.⁹

Completing various reporting forms caused the CDMVs to be challenged and poor literacy was one important barrier to completing reporting documents. The CDMVs were less understanding the contents of malaria records and reports, for which more time in completing the patient records and logbooks.^{13,26} Very young CDMVs have less ability to counsel the community to receive RDT testing, less ability to overcome the patients' fear of getting RDT test and low ability to initiate active community participation in the malaria prevention activities.^{18,27} Studies by Nyunt et al and Aung et al demonstrated that the low technical skills of CDMVs were due to insufficient training for the works of CDMVs.^{26,28} Another study reported that 80% of CDMVs from cross-border areas were lack of information from health supervisors and other media for their technical development.¹⁹ Some CDMVs have very low ability to use smartphones for their malaria services.²⁹ Some could not manage the in-stock of RDT and malaria drugs and therefore they experienced stock out and expired malaria drugs.³⁰

Communication and transportation challenges

Many areas where the CDMVs stayed and were assigned were a very long distance from health facilities and other developed areas. Frequently, much of their time was eaten up due to difficulties in road conditions and most of the CDMVs were unaffordable to transportation costs.²⁶ The residential areas of 80% of the CDMVs lost the connection services of radio, phones, and Internet and lacked electricity.¹⁹ Mobile phone network-based approaches were failed and many activities were delayed. Due to loss of communication, the CDMVs have difficulties informing the stock situations of RDT and malaria drugs and they frequently missed timely malaria treatment due to stock out of malaria-related medicines and medicinal equipment.¹⁹ Further, the CDMVs lost the appointment day for day-3 slides and the activities of direct observed treatment due to communication and transportation barriers. Moreover, more than 80% of the CDMVs who lived in the difficult-to-communicate and difficult-to-transport regions faced supply interruption, and more than 50% stocked out of RDTs for more than seven days and malaria medicines for a longer period.⁹

A study by Liverani et al described that transportation aids such as bicycles or motorcycles were not applicable in the areas where some of CDMVs were assigned.²³ The CDMVs in remote areas were difficult to join the monthly meeting, refer patients, travel to migrants' sites, and notify malaria cases within 24 hours.²⁹ Another important challenge encountered by the CDMVs was the difficulty of reaching illegal worksites and the difficulty of referring the malaria patients who lived in illegal areas.^{24,31}

Safety challenges

When working the blood testing for malaria in forests, huts, and other convenient sites, the CDMVs were weak in following proper safety procedures. Most of them were inconsistent with the safety of blood testing techniques and unskillful for infection control techniques.¹⁸ Frequently, they test the patients for malaria under poor lighting and do not wash their hands with soap and water. The CDMVs were very risky for COVID-19 and other serious infectious diseases because they did not wear masks and gloves when contacting the patients.³² Most of CDMVs were travelling and working under harmful and dangerous conditions, and they were self-responsible for security. Narrow and difficult roads, poor road infrastructure during the rainy season and difficult transportation, environmental problems including weather conditions, and the effects of armed conflicts were too risky to them.³¹

Financial and logistics supply challenges

Many studies mainly reported that lack of supply for phone bills, transportation costs, warrants, referral fees, additional special bonuses, and interruptive supply of malaria medicines and medicinal equipment were experienced.^{12,18,19,26} Despite the provision of some

financial incentives, the payments were insufficient.¹⁰ Despite providing mobile phones for mobile-based application approaches, payment cards were not supplied. The transportation costs supplied by the programme did not cover all the actual expenses and the budgets allocated for training development, refreshments, training aids, and daily allowance were not enough, therefore the CDMVs frequently use their pocket money in delivering advocacy meetings, social mobilization, and mass group health education activities.^{4,26} The CDMVs experienced a delay in malaria management, shared use of a course between two patients, insufficient treatment, dose and course reduction, use of expired RDT and malaria drugs²⁶ due to unresponsiveness of malaria supply chain system.^{10,18,19,26,30}

Challenges in managing malaria patients

The main challenge in managing malaria patients was unsatisfactory skills and knowledge on diagnosis with RDT and malaria drug prescription.²⁵ Due to insufficient knowledge and skill on malaria treatment, errors and inaccuracies of drug prescription for severe malaria cases were noted.³¹ A study reported that more than 2% of malaria patients were treated with the incorrect chloroquine treatment regimen. Besides, over 80% of CDMVs participated were unable to provide reliable management on patients' complaints, less competent in deciding the time for the referral and had very low capacity to operate emergency and critical malaria cases.¹⁶ Further, the CDMVs were less comprehensive on how to manage the malaria of pregnancies and children.³³ Moreover, some CDMVs were less able to distinguish *Plasmodium falciparum* and *vivax* on RDT results and weak in prescribing for *Plasmodium vivax* than *Plasmodium falciparum* malaria cases.¹⁸ Additionally, the CDMVs were unable to screen and diagnose glucose-6 phosphate deficiency (G6PD) and to provide symptomatic treatment.²⁰ Another challenge was poor RDT sensitivity and their invalid results.²⁴ Accordingly, the CDMVs faced less ability to manage invalid RDT results (19%), faint RDT brands (23%), misinterpretation of RDT results (30%), and difficulties in using RDT (20%).²⁶

DISCUSSION

The CDMVs are the volunteers who are trained to deal with malaria problems encountered by the rural community especially in the remote and malaria-endemic areas, to provide basic services of malaria case management, and to implement in close relationship with the malaria prevention and control services.⁴ Engaging primary care practices for malaria in the areas with the limited health workforce in GMS is an important barrier to timely eliminating malaria. The national healthcare systems in GMS could not create significant change for improved access to quality healthcare for malaria through the workforces of the healthcare professionals. Only recruitment of the CDMVs is the best systematic approach that enables to meet the malaria elimination goals set.

This review found the findings of lack of incentives payment such as transportation costs, mobile credits, and adequate honourable fees are the motivational challenges of CDMVs in GMS. A study conducted outside of GMS also found that insufficient transportation costs and payment to phone use were considered as demotivational factors and significantly impacted the CDMVs' performance.³⁴ This review found that the procedures of helping the CDMVs to progress their service quality and quantity were not found. This challenge is reliable with the revelation of a study conducted in Western Kenya. The Kenya study pinpointed that lack of recommendations and supportive feedback was one of the key challenges for the motivation of CDMVs.³⁵ This finding concluded that CDMVs were dissatisfied with the smaller number of training participation, and modules in training are not completely effective for their field implementation. The study conducted in Iran comparably reported that ineffective training decreased the CDMVs' productivity and increase performance gaps.³⁶ Importantly, this review pointed out that community support, trust, and appreciation were based on skills and knowledge of CDMVs in field implementation. Also, the revelation of this review could conclude that if the CDMVs receive effective capacity building training, regular feedback from supervisors, and honorarium (both financial and non-financial incentives), they will surely develop their skills and practice within the community and get trust and support from community members as well as consequently result in higher achievement in the malaria elimination setting.

The review revealed that traditions, cultural practices, and seasonality tasks of the community were sources of barriers for achieving CDMVs' malaria services. Some communities were not acknowledged of their activities and services. This information was in line with the findings of Aseyo et al discussed that for attaining the highest achievement of the malaria control programme, building community acceptance is at the heart and the power of the CDMVs influenced the real changes of community behaviours with strong connection and acceptance.³⁷ This review reveals that communities with a low level of malaria knowledge self-medicate themselves for malaria treatment and some are more likely to consult with private providers and traditional healers than CDMVs. Similar practices and challenges were consistently found in the study conducted in Guyana.³⁸ As CDMVs are frequently stocked out, community members did not receive prompt treatment, which in turn led to the untrustworthiness of the community on their services. These findings are consistent with results from the study conducted by Das et al.³⁹

In this review, the CDMVs without prior experiences of health services in community work had limited malaria knowledge and skills, inability to provide quality services such as incomplete and non-compliance of treatment, inability to use the IT-related applications and also even could not effectively manage stock and commodities. If compared with this revelation with another study by Ochieng et al, the similarity was noted because their study

expressed that CDMVs with a number of service-years in community service provisions already have adequate capacity building training and confidence in providing effective services to the community than unexperienced CDMVs.⁴⁰

Due to poor road infrastructures, transportation and communication availability in remote areas, CDMVs in the GMS region were difficult to obtain malaria medicines and commodities timely, unable to conduct monitoring, follow up of patients, and referral services, cost for transportation, late in submission of reports and could not also conduct a physical meeting with their supervisors. These challenges are uniformly reported in the study of Blanas et al.⁴¹ Another study conducted by Kweku et al also provided agreeable findings that non-availability of communication and electricity was one of the major barriers for CDMVs to report malaria cases timely to their supervisors.⁴²

CDMV's in GMS were stocked out of malaria test kits and antimalarial drugs for more than a week as findings of this review. As similarly reported by Sudoi et al, Kangwana et al, and Marita et al, their findings affirmed shortage of malaria drugs and RDTs were stocked out due to procurement failures and delayed process of the logistic system.⁴³⁻⁴⁵ Moreover, the finding of this review and a study by Banek et al.⁴⁶ consistently disclosed that the CDMVs was lack of support such as financial incentives including transportation costs, mobile credits, and referral fees.

The safety of both CDMVs and patients is critical in malaria elimination. This review showed that many CDMVs in GMS did not wear personal protective equipment in examining the patients and exercising blood tests for malaria patients. This finding was very similar to a study by Marita et al stated that the CDMVs did not take properly universal precautions, but different from other studies revealed that, after receiving adequate training, the CDMVs could undertake RDT testing safely, diagnose malaria accurately and practice the infection control procedures properly.^{45,47,48}

Moreover, in this review, the CDMVs could not effectively provide malaria services, especially in conflict-affected areas and remote settings due to security and safety reasons. This review recommends that the responsible programmers of malaria projects should continuously provide service quality audits, supportive supervision, personal protective equipment, and training for how to mitigate insecurity and unsafety issues.

As stated by MacDonald, the natures of tasks undertaken by the CDMVs for malaria prevention and control are potential to insecurity to them and therefore it is recommended that malaria programmers should analyze the different aspects of unsafe zones, prepare for relative safety measures and support the most appropriate technology and necessities to the CDMVs residing in unsafe regions.⁴⁹

Regarding challenges in malaria case management, many studies of the included studies consistently found that unfulfillment in basic training and knowing little knowledge about malaria, and practicing inadequate skills on malaria management were big challenges among CDMVs. This finding was not only for GMS and very common outside of GMS.^{46,50} Moreover, this review reported like a study by Harvey et al that the CDMVs could not address the issues that resulted from invalid RDT results, difficulties to refer the complicated and emergency malaria patients, and requirements for providing urgent management of malaria patients.⁴⁸ This review recommends that the malaria programmers should develop the knowledge management system of the CDMVs that can increase innovative and effective malaria prevention and control measures, be better communication among CDMVs or between the CDMVs and supervisors, improve all processes of prevention, control, management, and referral of malaria, and develop the quality of both CDMVs and malaria projects.

CONCLUSION

This systematic review provided a range of results on CDMVs' challenges. Particularly, this review finding may be important to argue the volunteers' challenges between theoretical and practical implications. Also, the review findings might help policy-makers in the malaria programme of each GMS country to establish more perfect volunteer policies for lessening the obstacles the CDMVs have been experiencing. Moreover, the review's results provide vital guidance for researchers and future research to focus on the insights of a specific challenge.

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